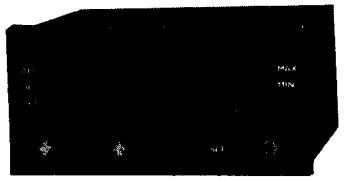
User's Guide



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e-mail: nl@omega.com

Czech Republic:
ul. Rude armady 1868, 733 01 Karvina-Hranice,
Czech Republic
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e-mail: czech@omega.com

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Toll Free in France: 0800-4-06342
e-mail: france@omega.com

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Toll Free in Germany: 0130 11 21 66
e-mail: germany@omega.com

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Leicestershire, LE9 6TU, England
Tel: 44 (1455) 285520
FAX: 44 (1455) 283912
- P.O. Box 7, Omega Drive, Irlam,
Manchester, M44 5EX, England
Tel: 44 (161) 777-6611
FAX: 44 (161) 777-6622

Toll Free in England: 0800-488-488
e-mail: uk@omega.com

Table of Contents

Figures & Tables

Product Description 1.1

1.1.1 GENERAL

This instrument is a microprocessor based 1/8 DIN digital process indicator with the flexibility to accommodate T/C, RTD and DC inputs.

Features include alarm 1 (user selectable latching or non-latching) relay, time exceeded display, and maximum/minimum tracking of excursions of the process variable.

The instrument can operate from a 90-264V AC, 50/60Hz power supply, or an optional 24V AC/DC power supply.

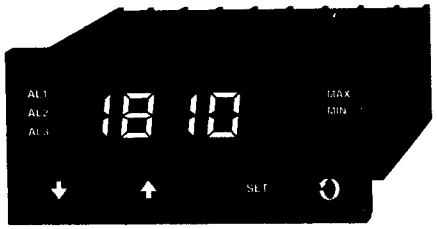
1.1.2 DISPLAYS

Each instrument is provided with dual displays and status indicators as shown in Figure 1-1. The four-digit display displays the value of the process variable and the single display displays units (°C, °F or Units).

1.1.3 ALARMS

Alarm indication is standard on all instruments. Up to three alarm outputs are possible. Alarm type may be set as Process Direct or Reverse (high or low). Alarm status is indicated by LED.

FIGURE 1-1
Keys and Indicators



Installation and Wiring 2.1

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

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

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

Recommended panel opening size is illustrated in Figure 2-1. After the opening is properly cut, insert the instrument into the panel opening. Ensure that the panel gasket is not distorted and that the instrument is positioned squarely against the panel. Slide the mounting clamp into place on the instrument (see Figure 2-3, page 8) and push it forward until it is firmly in contact with the rear face of the mounting panel.

FIGURE 2-1
Panel Cut-Out Dimensions

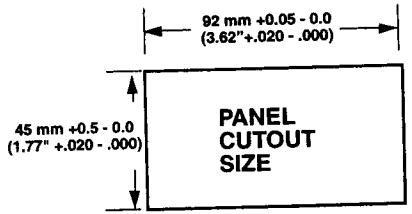


FIGURE 2-2
Main Dimensions

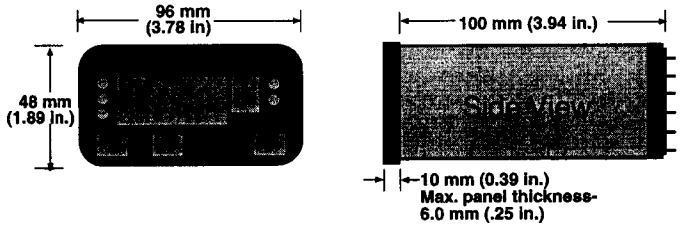
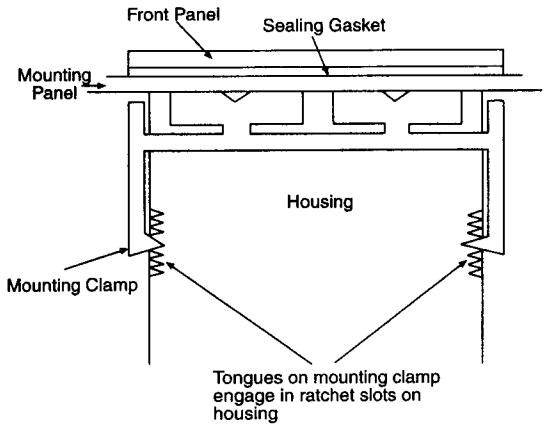


FIGURE 2-3
Panel Mounting the Controller



Preparation for Wiring 2.2

2.2.1 WIRING GUIDELINES

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

2.2.1.1 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.

2.2.1.2 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.

2.2.1.3 WIRE ISOLATION

Three 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
- AC power

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

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

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

2.2.1.4 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.

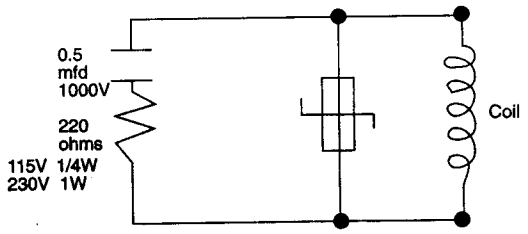
2.2.1.5 NOISE SUPPRESSION AT THE SOURCE

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.

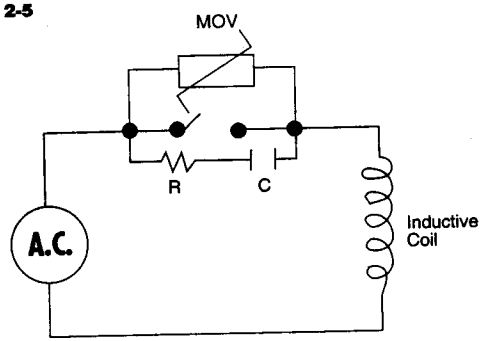
FIGURE 2-4



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, page 12.

FIGURE 2-5



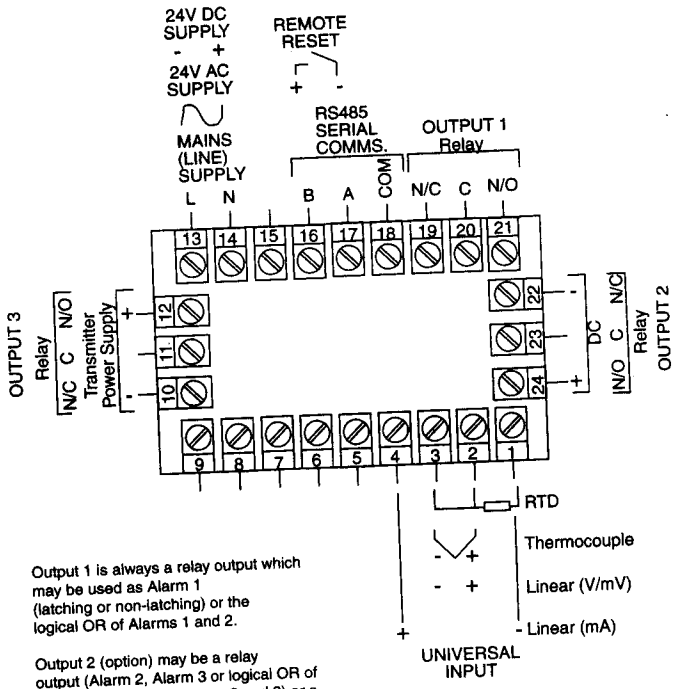
2.2.2 SENSOR PLACEMENT (Thermocouple or RTD)

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
Wiring Label



Output 1 is always a relay output which may be used as Alarm 1 (latching or non-latching) or the logical OR of Alarms 1 and 2.

Output 2 (option) may be a relay output (Alarm 2, Alarm 3 or logical OR of Alarms 1 and 2, 1 and 3, or 2 and 3) or a DC output (recorder output).

Output 3 (option) may be a relay output (Alarm 2, Alarm 3 or logical OR of Alarms 1 and 2, 1 and 3, or 2 and 3) or a transmitter power supply output.

Input Connections 2.3

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 provides 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 1A fuse, as shown below.

FIGURE 2-7

Main Supply

The instrument will operate on 90-264V AC 50/60Hz 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.

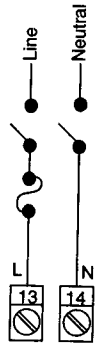


FIGURE 2-7A
24V AC/DC Supply Connections
The supply connections for the 24V AC/DC version are shown below. Power should be connected via a two-pole isolating switch and a 315mA slow-blow fuse (anti-surge Type T).

The nominal 24V supply may be in the following ranges:

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

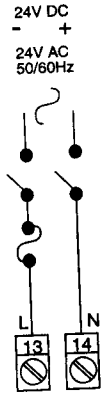
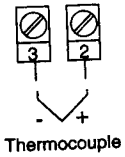


FIGURE 2-8
Thermocouple (T/C) Input
Make thermocouple connections as illustrated below. Connect the positive leg of the thermocouple to terminal 2 and the negative leg to terminal 3.



Thermocouple

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 1 and the other leg to terminal 2 as shown below. A jumper wire supplied by the customer must be installed between terminals 2 and 3. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Appendix C).

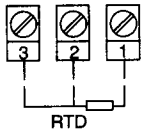


FIGURE 2-10
Volt, mV Input
Make volt and millivolt connections as shown below. Terminal 2 is positive and terminal 3 is negative. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Appendix C).

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

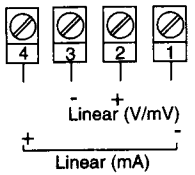


FIGURE 2-11
Remote Reset
Make connection as shown below.

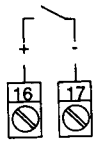
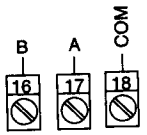


FIGURE 2-12
Remote Digital Communications - RS485
Make digital communication connections as illustrated below.



Output Connections 2.4

FIGURE 2-13
Relay Output 1
Connections are made to Output 1 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

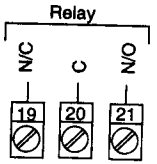


FIGURE 2-14
Relay Output 2
Connections are made to Output 2 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

FIGURE 2-15
mADC Output 2
Make connections for DC Output 2 as illustrated below.

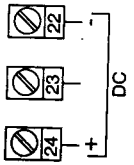


FIGURE 2-16
Relay Output 3
Connections are made to Output 3 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

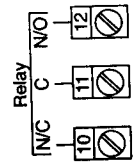
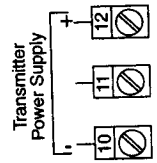


FIGURE 2-17
Transmitter Power Supply (TPS)
Connections are made to Output 3 TPS as illustrated below.



Operation 3.1

3.1.1 POWER UP PROCEDURE

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

During power up, a self-test procedure is initiated during which all LED segments in the front panel display appear and all LED indicators are ON. When the self-test procedure is complete, the instrument reverts to normal operation.

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

3.1.2 KEYPAD OPERATION

SCROLL KEY
This key is used to:
1. Select a parameter to be viewed or adjusted.
2. Display enabled modes of operation.
3. Display a mode parameter value.
4. Advance display from a parameter value to the next parameter code.
5. With the DOWN key to view the current Hardware Definition Code setting.

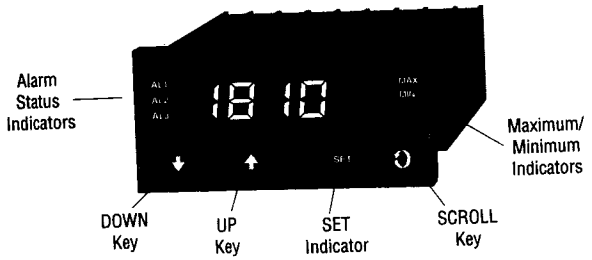
UP KEY
This key is used to:
1. Increase the displayed parameter value.
2. With the DOWN key to enter Enable mode.
3. Used to confirm a change in the Program mode.

DOWN KEY
This key is used to:
1. Decrease the displayed parameter value.
2. With the UP key to enter the Enable mode.
3. With the SCROLL key to view the current Hardware Definition Code setting.

3.1.3 OPERATION

The Operator Mode is the normal mode of the Indicator, once it has been set up and programmed as required. The front panel displays, indicators and keys are shown in Figure 3-1, below.

FIGURE 3-1



3.1.4 FOUR DIGIT DISPLAY

In Operator Mode, this normally displays the process variable value. Using the SCROLL key, the operator may view, in a sequence according to the Operator Mode Display Strategy parameter in Set Up Mode.

3.1.4.1

Current maximum value attained by process variable (since the maximum value was last reset) - **MAX** indicator ON when this is displayed. Also saves the Sensor Break and Over-Range conditions.

3.1.4.2

Current minimum value attained by process variable (since the minimum value was last reset) - **MIN** indicator ON when this is displayed. Also saves the Sensor Break and Under-Range conditions.

3.1.4.3
Time elapsed in the Alarm 1 active condition (units display shows E). The display is in the format mm.ss (mm = minutes, ss = seconds) or mmm.s (mmm = minutes, s = seconds (tens)). If elapsed time is greater than 999 minutes 59 seconds, display will show: cHHɔ

Note: This does not include time when Alarm 1 is latched but alarm condition is cleared.

3.1.4.4
Alarm 1 value (units display shows 1 or, if only Alarm 1 present, A).

3.1.4.5
Alarm 2 value, if equipped and programmed (units display shows 2).

3.1.4.6
Alarm 3 value, if equipped and programmed (units display shows 3).

3.1.4.7
SEt - parameter prompt for Set-Up mode.

3.1.4.8
Prog - parameter prompt for Program mode.

3.1.4.9
Process variable value.

Further depressions of the SCROLL key will repeat this display sequence.

3.1.5 ALARM STATUS INDICATORS

The Alarm Status indicators show the current state of the alarm(s):

AL1	Flashes when Alarm 1 is active (with latching alarm, ON when Alarm 1 is latched but alarm condition has cleared)
AL2	Flashes when Alarm 2 is active
AL3	Flashes when Alarm 3 is active

For descriptions of the operation of the various types of alarms available, see Set-Up Mode, page 29.

3.1.6 RESETTING THE MAXIMUM VALUE/MINIMUM VALUE OR TIME ELAPSED VALUE

To reset the maximum value, minimum value (to the process variable value at the instant of resetting) or time elapsed value (to zero):

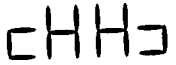
1. Select the display of the maximum value, minimum value or time elapsed value (as appropriate - see above).
2. Depress the UP key or DOWN key for five seconds.

The resetting the value is indicated by the four-digit display showing:

for two seconds before reverting to the maximum value or minimum value display.

3.1.7 OVER-RANGE / UNDER-RANGE DISPLAYS

If the process variable attains a value higher than the input scale maximum limit (over-range) or lower than the input scale minimum limit (under-range), the upper display will show:



for the over-range condition and:

for the under-range condition.

3.1.8 SENSOR BREAK INDICATION

If a break is detected in the sensor circuit, the four-digit display will show:

The reaction of the alarms to a detected sensor break is dependent upon the input type.

3.1.9 COLD JUNCTION COMPENSATION DISABLED

If a thermocouple input is fitted, the Cold Junction Compensation should be enabled. If it is disabled, whenever the process variable is displayed, the unit display will be as shown: — — —

3.1.10 RESETTING THE LATCHED ALARM

If Output 1 is configured to be a latched alarm output (see Output 1 Use parameter in Table 3-2), once it becomes active it will remain active (even if the alarm condition itself is cleared) until reset either from the front panel or via the Remote Reset hardware option (Appendix C). To reset the latched alarm from the front panel:

1. Ensure that the normal Operating Mode display (ie.e process variable) is shown.
2. Press either the UP key or the DOWN key for at least five seconds.

The four-digit display will then show:

— — — —

for two seconds, indicating that the latched alarm has been reset. The latched Alarm 1 can be reset only if the original alarm condition has been cleared; this reset has no effect while the alarm condition prevails.

3.1.11 VIEWING THE HARDWARE DEFINITION DISPLAYS

The operator may view the current Hardware Definition Code setting in the four-digit display by simultaneously depressing the DOWN and SCROLL keys. A return may be made to the normal Operator Mode display by simultaneously depressing the DOWN and SCROLL key.

Note: An automatic return is made to the normal Operator Mode display after 30 seconds.

To view the Hardware Option setting, press the SCROLL key while the Hardware Definition code is displayed.

Configuration 3.2

All configurable parameters are provided in Tables 3-1 through 3-3 on the following pages. These tables illustrate the display sequence, parameter adjustment and factory setting for each step.

If a mode is not enabled it will be skipped over by the routine.

3.2.1 ENABLE MODE

The Enable mode provides a means of enabling or disabling access to the Program and Set-Up modes. If a mode has been disabled, then that mode will not be displayed or available to the user in the Operator mode. See Table 3-1 (below) for the Enable Mode procedure.

3.2.2 PROGRAM MODE

The Program mode is used to configure or re-configure the instrument. The input and output selections are made in the Program mode. All possible parameters are illustrated in Table 3-2 (page 26). Only those parameters that are applicable to the hardware options chosen will be displayed.

3.2.3 SET-UP MODE

The Set-Up mode is used to adjust the alarm settings, display strategy, and retransmit scaling needed for proper operation of the instrument. See Table 3-3 (page 29) for Set-Up mode. Only those parameters that are applicable will be displayed.

TABLE 3-1 ENABLE MODE

To enter the Enable mode, press and hold the UP and DOWN keys. After about 10 seconds, "EnAb" will be displayed. Release the keys, the display should show "both". Pressing the UP or DOWN key will display the Enable mode codes in the following sequence:

EPro - - ESEt - - nonE - - both

With the Enable code status desired, use the SCROLL key to enter.

To exit the Enable mode, press the DOWN key with the "out?" prompt displayed.

(Continued on next page)

DISPLAY CODE	DESCRIPTION
EPro	Enables Program; Disables Set Up
ESEt	Enables Set Up; Disables Program
nonE	Disables Program and Set Up
both	Enables Program and Set Up

Factory Setting: "both"

TABLE 3-2 PROGRAM MODE

To enter the Program mode, press and release the SCROLL key until "Prog" is displayed. Press the DOWN key and the instrument will then enter Program Mode and the SET indicator will flash. The user will then be presented with the first of a sequence of parameter displays; in each instance, the parameter will be identified by a single-character legend in the units display and the setting of that parameter will be shown in the four-digit display. The user may then step through the parameters using the SCROLL key. The setting may be adjusted using the UP/DOWN keys. As soon as the value/setting is changed, the four-digit display will flash, indicating that the new value/setting has yet to be confirmed (this flashing is inhibited during actual adjustment). When the value/setting is as required, it may be confirmed by:

(a) pressing the SCROLL key, whereupon the four-digit display will show:

(b) pressing the UP key.

The four-digit display will then show a static (non-flashing) display of the new parameter setting. Depression of any key other then the UP key at the SurE? display will cause the original parameter setting to be retained. The sequence of parameter displays is shown in Table 3-2.

Note: Changes to the value/setting of certain Program Mode parameters (e.g. input range, output use and type) will cause the Set Up Mode parameters to be automatically set to their default values the next time Set Up Mode is entered.

To exit the Program mode, with "out?" in the display, press the DOWN key.

PARAMETER	LEGEND	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
Input Range	r	Defined by Input Code (See App D)		1420
Alarm 1 Type	AL1 On	P_Hi	Process High Alarm	P_Hi
		P_Lo	Process Low Alarm	
Alarm 2 Type	AL2 On	nonE	Not in use	nonE
		P_Hi	Process High Alarm	
		P_Lo	Process Low Alarm	
Alarm 3 Type	AL3 On	nonE	Not in use	nonE
		P_Hi	Process High Alarm	
		P_Lo	Process Low Alarm	
Output 1 Use	1	A1nd	Alarm 1, non-latching direct-acting	A1nd
		A1nr	Alarm 1, non-latching reverse-acting	
		A1Ld	Alarm 1, latching, direct-acting	
		A1Lr	Alarm 1, latching, reverse-acting	
		012d	Logical OR of Alarm 1 and Alarm 2, direct-acting	
		012r	Logical OR of Alarm 1 and Alarm 2, reverse-acting	
Output 2 Use[1]	2	A2_d	Alarm 2, direct-acting[5]	A2_d
		A2_r	Alarm 2, reverse-acting[5]	
		A3_d	Alarm 3, direct-acting[5]	
		A3_r	Alarm 3, reverse-acting[5]	
		012d	Logical OR of Alarm 1 and Alarm 2, direct-acting[5]	
		012r	Logical OR of Alarm 1 and Alarm 2, reverse-acting[5]	
		013d	Logical OR of Alarm 1 and Alarm 3, direct-acting[5]	
		013r	Logical OR of Alarm 1 and Alarm 3, reverse-acting[5]	

PARAMETER	LEGEND	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
		023d	Logical OR of Alarm 2 and Alarm 3, direct-acting[5]	
		023r	Logical OR of Alarm 2 and Alarm 3, reverse-acting[5]	
		rEcP	Recorder Output (PV)[6]	
Output 3 Use[2]	3	A2_d	Alarm 2, direct-acting[7]	A3_d
		A2_r	Alarm 2, reverse-acting[7]	
		A3_d	Alarm 3, direct-acting[7]	
		A3_r	Alarm 3, reverse-acting[7]	
		012d	Logical OR of Alarm 1 and Alarm 2, direct-acting[7]	
		012r	Logical OR of Alarm 1 and Alarm 2, reverse-acting[7]	
		013d	Logical OR of Alarm 1 and Alarm 3, direct-acting[7]	
		013r	Logical OR of Alarm 1 and Alarm 3, reverse-acting[7]	
		023d	Logical OR of Alarm 2 and Alarm 3, direct-acting[7]	
		023r	Logical OR of Alarm 2 and Alarm 3, reverse-acting[7]	
		tPSU	Transmitter Power Supply[8]	
Communications Baud Rate[3]	b		1200, 2400, 4800, or 9600 Baud	4800
Communications Address[3]	A		1-32	1
Communications	P	WES	West ASCII	WES
		Mbo	ModBus, odd parity	
		MbE	ModBus, even parity	
		Mbn	ModBus, no parity	
Cold Junction Compensation Enable/Disable[4]	J	EnAb	Enabled	EnAb
		diSA	Disabled	

Notes for Table 3-2

1. Only appears in display sequence if Output 2 is fitted/configured in the Hardware Definition Code (i.e. Digit 3 is non-zero).
2. Only appears in display sequence if Output 3 is fitted/configured in the Hardware Definition Code (i.e. Digit 4 is non-zero).
3. Only appears in display sequence if Hardware Option parameter is set to r485.
4. Only appears in display sequence if thermocouple input is fitted/configured i.e. Digit 1 of Hardware Definition Code is set to 2 .
5. Only if Output 2 is configured as a relay output.
6. Only if Output 2 is configured as a DC linear output
7. Only if Output 3 is configured as a relay output.
8. Only if Output 3 is configured as a transmitter power supply output.

* If a thermocouple input is fitted and the CJC is disabled, in Operator Mode whenever the process variable is displayed, the unit will show: ‾ _ .

TABLE 3-3 SET-UP MODE

To enter the Set-Up Mode, depress and release the SCROLL key until "SEt" is displayed. Press the DOWN key and the instrument will enter Set Up Mode and the SET indicator will come ON, the instrument still displaying the process variable value.

Note: If the four-digit displays shows:

■ ■ ■

(i.e. all decimal point positions illuminated), this indicates that one or more of the critical Program Mode parameters - typically input range - have been altered in value/setting and, as a consequence, all Set Up Mode parameters have been automatically set to their default values/settings. To clear this display, simply alter the value/setting of any Set Up Mode parameter (see below).

The parameters available for view/adjustment in Set Up Mode are summarized in Table 3-3. When Set Up Mode is active, the units display (normally °F, °C, or blank) will show the single-character legend for the selected parameter and the value for that parameter will be shown in the four-digit display. The user may step through the Set Up Mode parameters by depressing the SCROLL key. The value/setting may be altered using the UP/DOWN keys.

PARAMETER	LEGEND	ADJUSTMENT RANGE	FACTORY SETTING
Alarm 1 Value[1]	1 or A	Range Min. to Range Max.	Range Max (Proc. High) Range Min (Proc. Low)
Alarm 1 Hysteresis	—	1 LSD to 10% of span expressed as display units	1 LSD
Alarm 2 Value[2]	2	Range Min. to Range Max.	Range Max (Proc. High) Range Min (Proc. Low)
Alarm 2 Hysteresis[2]	=	1 LSD to 10% of span expressed as display units	1 LSD
Alarm 3 Value[3]	3	Range Min. to Range Max.	Range Max (Proc High) Range Min (Proc Low)
Alarm 3 Hysteresis[3]	≡	1 LSD to 10% of span expressed as display units	1 LSD
Process Variable Offset	O	± input span of instrument	0
Digital Filter Time Const.	t	0.0 secs. (OFF) to 100.0 secs. in 0.5 sec. increments	2.0 secs.
Linear Input Decimal Point Position[4]	P	0 (XXXX), 1 (XXX.X), 2 (XX.XX) or 3 (X.XXX)	1
Linear Input Scale Range Minimum[4]	L	-1999 to 9999	0000

PARAMETER	LEGEND	ADJUSTMENT RANGE	FACTORY SETTING
Linear Input Scale Range Maximum[4]	h	-1999 to 9999	1000
Recorder Output Scale Minimum	d	-1999 to 9999	Range Min.
Recorder Output Scale Maximum	u	-1999 to 9999	Range Max
Operator Mode Display Strategy[5]	S	0, 1, 2, 3, or 4	0

Notes for Table 3-3

1. The legend for this parameter will be A if only Alarm 1 is fitted/ configured or 1 if other alarms are fitted/configured.
2. These parameters appear in the display sequence only if Alarm 2 is fitted/configured.
3. These parameters appear in the display sequence only if Alarm 3 is fitted/configured.
4. Only applicable if a DC Linear input is fitted.
5. Defines the parameters displayed in sequence in Operator Mode.

Parameter Settings				
0	1	2	3	4
PV value Max. PV value Min. PV value Elapsed Time Set Up Program	PV value Max. PV value Min. PV value Set Up Program	PV value Alarm 1 value Alarm 2 value* Alarm 3 value* Set Up Program	PV value Max. PV value Min. PV value Alarm 1 value Alarm 2 value* Alarm 3 value* Set Up Progarm	PV value Max. PV value Min. PV value Elapsed Time Alarm 1 value Alarm 2 value* Alarm 3 value* Set Up Program
* if configured/fitted				

3.2.5 ALARM 1 VALUE 1 or A

If Alarm 1 is selected to be a Process High alarm, this defines the process variable value at or above which Alarm 1 will be active; the default value will be Input Range Maximum. If Alarm 1 is selected to be a Process Low alarm, this defines the process variable value at or below which Alarm 1 will be active; the default value will be Input Range Minimum. Its value may be adjusted between Input Range Maximum and Input Range Minimum. Alarm operation is illustrated in Figure 3-2.

3.2.6 ALARM 1 HYSTERESIS -

This parameter applies a hysteresis band on the "safe" side of the Alarm 1 value. The effect of the hysteresis value on alarm operation is shown in Figure 3-3. Default is 1.

3.2.7 ALARM 2 VALUE 2

If Alarm 2 is selected to be a Process High alarm, this defines the process variable value at or above which Alarm 2 will be active; the default value will be Input Range Maximum. If Alarm 2 is selected to be a Process Low alarm, this defines the process variable value at or below which Alarm 2 will be active; the default value will be Input Range Minimum. Its value may be adjusted between Input Range Maximum and Input Range Minimum. Alarm operation is illustrated in Figure 3-2.

3.2.8 ALARM 2 HYSTERESIS =

This parameter applies a hysteresis band on the "safe" side of the Alarm 2 value. The effect of the hysteresis value on alarm operation is shown in Figure 3-3. Default is 1.

3.2.9 ALARM 3 VALUE 3

If Alarm 3 is selected to be a Process High alarm, this defines the process variable value at or above which Alarm 3 will be active; the default value will be Input Range Maximum. If Alarm 3 is selected to be a Process Low alarm, this defines the process variable at or below which Alarm 3 will be active; the default value will be Input Range Minimum. Its value may be adjusted between Input Range Maximum and Input Range Minimum. Alarm operation is illustrated in Figure 3-2.

3.2.10 ALARM 3 HYSTERESIS

This parameter applies a hysteresis band on the "safe" side of the Alarm 3 value. The effect of the hysteresis value on alarm operation is shown in Figure 3-3. Default is 1.

3.2.11 PROCESS VARIABLE OFFSET

This parameter is used to modify the actual process variable value (measured at the input terminals) in the following manner:

Offset PV value = Actual PV value + Process Variable Offset value.

The offset process variable value is used for all PV-dependent functions (display, alarm, recorder output).

Note: This parameter value should be chosen with care. Any adjustment to this parameter is, in effect, a calibration adjustment. Injudicious application of values to the 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).

The default is 0.

3.2.12 INPUT FILTER TIME CONSTANT

The input is equipped with a digital filter which is used to filter out any extraneous impulses on the process variable. This filtered PV is used for all PV-dependent functions (alarms, etc). The time constant for this filter may be adjusted in the range 0.0 seconds (filter OFF) to 100.0 seconds in 0.5 second increments. The default setting is 2.0 seconds.

CAUTION: If this parameter is set to an excessively high value, the indication quality may be significantly impaired. The value chosen should be sufficiently large to attenuate stray noise on the process variable signal but no larger.

3.2.13 LINEAR INPUT SCALE RANGE MINIMUM L

This parameter, applicable only if a linear input is fitted, defines the scaled input value when the process variable input hardware is at its minimum value. It is adjustable between -1999 and 9999 (with decimal point as defined by Linear Input Decimal Point Position). The default value is 0. This parameter can be set to a value greater than (but not equal to) Linear Input Scale Range Maximum, in which case the sense of the input is reversed.

3.2.14 LINEAR INPUT SCALE RANGE MAXIMUM h

This parameter, applicable only if a linear input is fitted, defines the scaled input value when the process variable input hardware is at its maximum value. It is adjustable between -1999 to 9999 (with decimal point as defined by Linear Input Decimal Point Position). The default value is 1000. This parameter can be set to a value less than (but not equal to) Linear Input Scale Range Minimum, in which case the sense of the input is reversed.

3.2.15 RECORDER OUTPUT SCALE MINIMUM d

This parameter defines the value of the process variable at which the Recorder Output reaches its minimum value; for example, for a 0-5V Recorder Output, this value corresponds to 0 V. It may be adjusted within the range -1999 to 9999. The decimal point position for the Recorder Output is always the same as that for the process variable input range. The default value is Input Range Minimum. This parameter is not applicable if the Recorder Output option is not fitted.

> Note: If this parameter is set to a value greater than that for the Recorder Output Scale Maximum, the relationship between the process variable value and the Recorder Output is reversed.

3.2.16 RECORDER OUTPUT SCALE MAXIMUM U

This parameter defines the value of process variable at which the Recorder Output reaches its maximum value; for example, for a 0-5V Recorder Output, this value corresponds to 5V. It may be adjusted within the range -1999 to 9999. The decimal point position for the Recorder Output is always the same as that for the process variable input range. The default value is Input Range Maximum. This parameter is not applicable if the Recorder Output option is not fitted.

Note: If this parameter is set to a value less than that for the Recorder Output Scale Minimum, the relationship between the process variable value and the Recorder Output is reversed.

3.2.17 OPERATOR MODE DISPLAY STRATEGY 5

This defines the sequence of parameter displays available in Operator Mode (see notes on Table 3-3). Default is 0.

3.2.18 EXIT FROM SET UP MODE

To leave Set Up Mode, with "out?" in the display, press the UP key, whereupon the SET indicator will go OFF and the instrument will return to Operator Mode.

Note: An automatic return to Operator mode will be executed if there is no key activity in Set Up Mode for one minute.

FIGURE 3-2 ALARM OPERATION

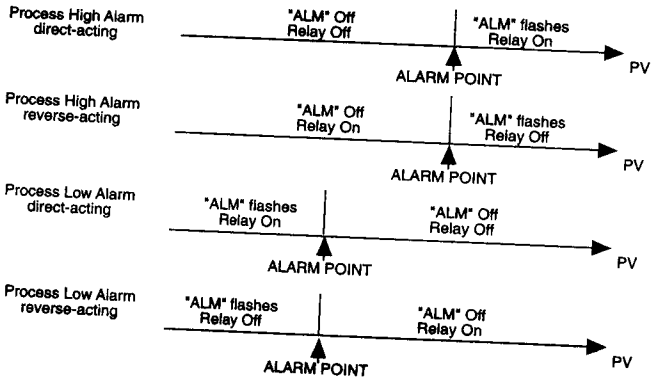
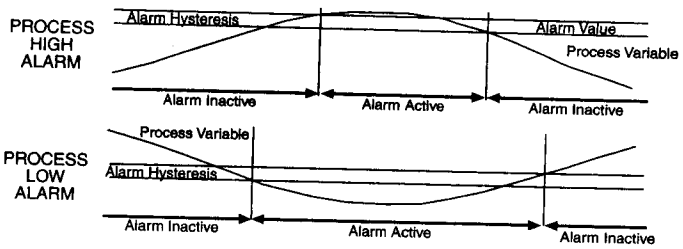


FIGURE 3-3 ALARM HYSTERESIS OPERATION



Appendix A
Board Layout - Jumper Positioning

FIGURE A-1 PCB POSITIONS

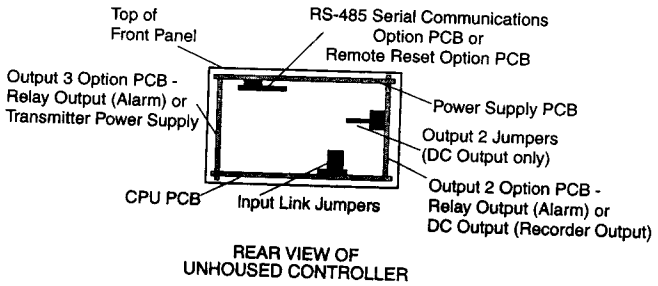


FIGURE A-2 OUTPUT 2, OUTPUT 3 REMOVAL

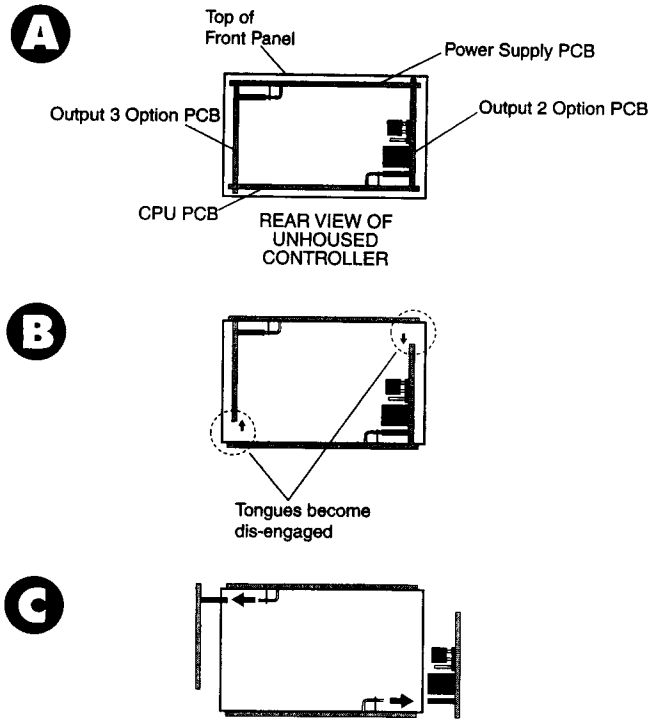
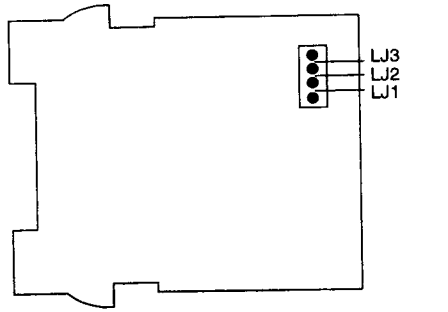
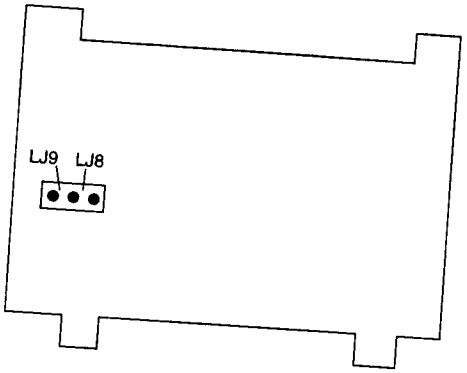


FIGURE A-3 CPU PWA - SELECTION OF INPUT TYPE



Input Type	LJ1, LJ2, LJ3 Jumper Position
RTD, DC (mV)	None (parked)
TC	LJ3
DC (mA)	LJ2
DC (V)	LJ1

FIGURE A-4 DC OUTPUT 2 OPTION



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

Appendix B
Installing the Engineering Unit Label

The instrument is equipped with a label carrier (see Figure B-1, page 42) to which a self-adhesive engineering unit label may be attached if required.

If the instrument is configured with a linear input and engineering units are to be displayed on the front panel, the required unit label (see sheet of peel-off labels supplied with instrument) may be installed as follows:

1. Remove the instrument from its housing.

2. For the CPU PCB and Power Supply PCB simultaneously, gently bend one retaining arm (see Figure B-2, View A, page 43) to free one side of each PCB; swing the PCBs clear of the front panel and care fully move them away from the front panel (the CPU PCB will still be connected to the front panel/Display PCB by a ribbon cable - do not stress this ribbon cable).

3. Remove the label carrier from it aperture on the Display PCB (see Figure B-2, View B, page 43).

4. Remove the required engineering unit label from the peel-off sheet and affix label to the front face of the label carrier (see Figure B-2, View C, page 43), using the ledge on the front face of the carrier for alignment.

5. Replace the label carrier in its aperture on the Display PCB.

6. Replace the CPU PCB and Power Supply PCB in position at the rear of the front panel.

7. Replace the instrument in its housing.

Note: Spare label carriers and engineering labels sheets are available.

FIGURE B-1 LOCATION OF LABEL CARRIER

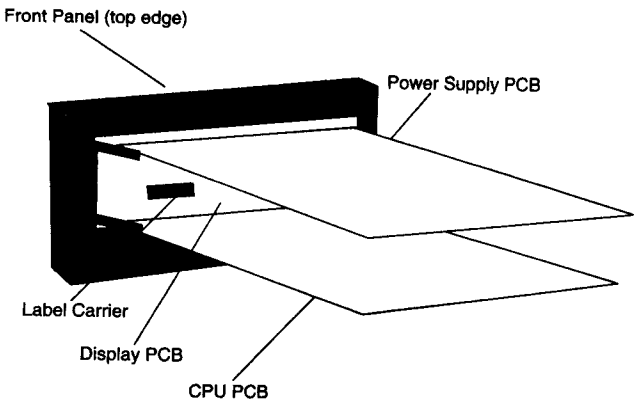
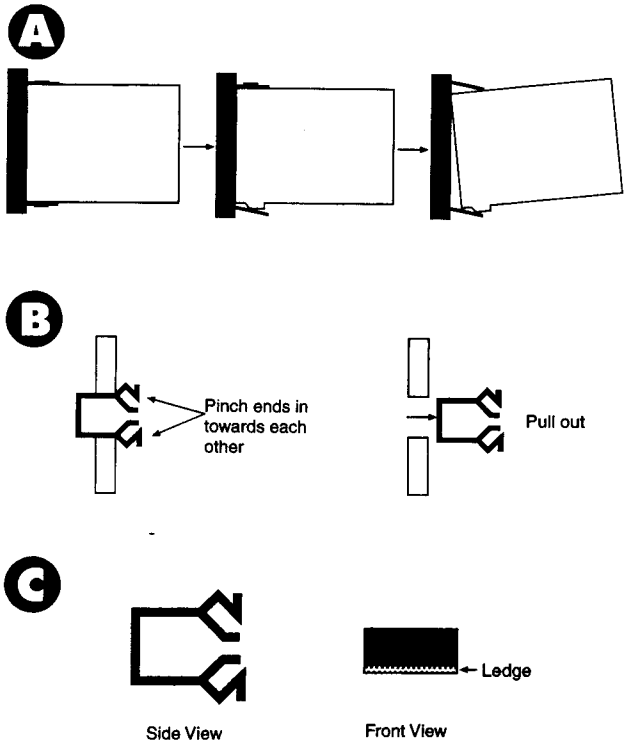


FIGURE B-2 INSTALLING THE ENGINEERING UNIT LABEL



Appendix C
Hardware Definition Code

This parameter is used to represent the hardware fitted (input type, Output 1 type, Output 2 type and Output 3 type); this must be compatible with the hardware actually fitted. Access to the Hardware Definition Code is gained by pressing the SCROLL and DOWN ARROW keys simultaneously while the instrument is in Program Mode. The code is used as follows:

the first (left-most) digit is input type:
- 1= RTD/Linear DC (mV)
- 2= Thermocouple†
- 3= Linear DC (mA)
- 4= Linear DC (V)

the second digit (Output 1) is always
- 1= Relay Output

the third digit is Output 2 type:
- 0= Not fitted†
- 1= Relay
- 3= DC (0-10V)
- 4= DC (0-20mA)
- 5= DC (0-5V)
- 7= DC (4-20mA)

the fourth digit is Output 3 type:
- 0= Not fitted†
- 1= Relay
- 8= Transmitter Power Supply

† Default setting

The maximum setting available for this code is 4178. For example, the code for an instrument with a thermocouple input, relay Output 1, relay Output 2 and relay Output 3 would be 2111.

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's software depends upon this code to ensure correct operation.

HARDWARE OPTION

There are two hardware options available - RS-485 Serial Communications and Remote Latching Alarm Reset. These options are mutually exclusive. Access is gained to the Hardware Option parameter by pressing the SCROLL key while the Hardware Definition Code is displayed in Program Mode.

RS-485 Serial Communicatons Option

If this option is selected, the display will show "r485". For this option, the protocol used is defined by the Communications Protocol parameter.

Remote Latching Alarm Reset Option

If this option is selected, the display will show "rrES". This option has the same effect as resetting the latching alarm 1 from the front panel. A contact closure will reset the alarm. The latched Alarm 1 can be reset only if the original alarm condition has been cleared; this reset has no effect while the alarm condition prevails.

Appendix D
Input Range Codes

The 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°C	1934
T	-328 - 503°F	1526	B	100 - 1824°C	1938
T	0.0 - 260.6°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.

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 jumpers LJ1, LJ2, or LJ3 needs to be changed.

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 E
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:	Isolated from all outputs at 240V AC

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. 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. Alarms operate as if the process variable has gone over-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. Alarms operate as if the process variable has gone under-range.

Remote Reset Input

Type:	Voltage-free or TTL compatible
Reset Caused By:	Open-close transition (external switch/relay contacts) or "1" - "0" transition (TTL logic signal).
Maximum Input Delay (open-closed or "1"-"0")	1 second
Minimum Input Delay (closed-open or "0"-"1")	1 second

External switch/relay contacts:

Max. Contact Resistance: (Closure)	50 ohm
Min. Contact Resistance: (Open)	5000 ohm

External TTL Logic Signal:

Max. Voltage (TTL) for "0":	0.8V
Min. Voltage (TTL) for "0":	-0.6V
Min. Voltage (TTL) for "1":	2.0V
Max. Voltage (TTL) for "1":	24.0V

OUTPUT SPECIFICATIONS

Output 1

General

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

Output 2

General

Types Available:	Relay and DC Linear (retransmission only)

Relay

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

DC

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, 0-5V, 1-5V, and 2-10V.
	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 JU movement.

Output 3

General

Types Available:	Relay and Transmitter Power Supply

Relay

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

Transmitter Power Supply

Output:	20-28V DC (24V DC nominal)
Minimum Load Impedance:	910 ohm (22mA @ 20V DC)

Alarms

Maximum Number:	Three
Maximum # of Outputs:	All three outputs can be alarms
Combination Alarms:	Logical OR of alarms to an individual hardware output is available

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 thermocouple 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 50/60 Hz
Series Mode Rejection:	>500% of span (at 50/60Hz) causes negligible effect

DC Linear Inputs

Measurement Accuracy:	± 0.05% of span ±1 digit

Thermocouple Inputs

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

RTD Inputs

Measurement Accuracy:	± 0.25% of span ± 1 LSD
Linearization Accuracy:	Better than ± 0.2°C any point, any 0.1°C range (± 0.05°C typical) Better than ± 0.05°C any point, any 1°C range

DC Output 2

Accuracy: (Recorder Output)	mA:	0-20mA ± 0.25% of span (20mA) @ 250 ohm 4-20mA ± 0.25% of span (16mA) @ 250 ohm
	V:	0-10V ± 0.25% of span (10V) @ 2K ohm 0-5V ± 0.25% of span (5V) @ 2K ohm

OPERATING CONDITIONS

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

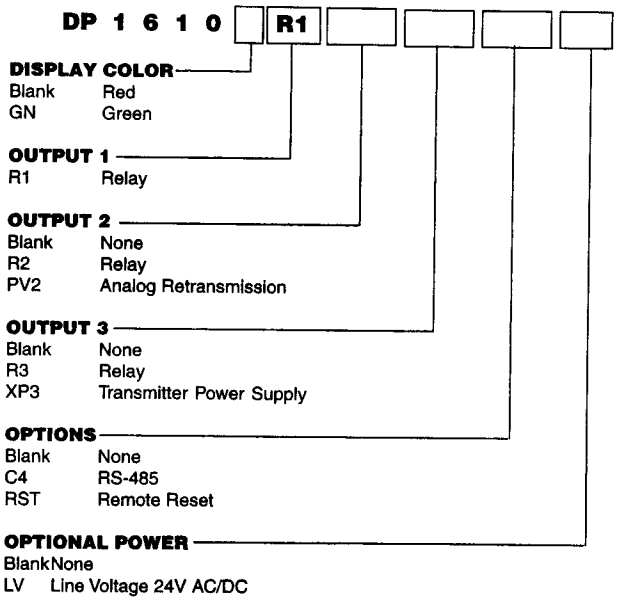
Performance Under Operating Conditions

Temperature Stability:	0.01% of span/°C change in ambient temperature
Cold Junction Comp.: (thermcouple only)	Better than ± 1°C
Supply Voltage Influence:	Negligible
Relative Humidity Influence:	Negligible
Sensor Resist. Influence:	Thermocouple 100 ohm: <0.1% of span error Thermocouple 1000: <0.5% of span error RTD Pt100 50 ohm/lead: <0.5% of span error

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

PHYSICAL	
Dimensions:	Front Panel 48mm x 96mm (1.89" x 3.78") 100mm (3.94") deep
Mounting:	Plug-in with panel mounting fixing strap
Panel Cut-Out:	45mm x 92mm (1.77" x 3.62")
Terminals:	Screw Type
Weight:	0.48kg (1.06 lb) maximum
Display Character Height:	0.39"

Appendix F
Order Matrix



Appendix G
Software Reference Sheet

HDW DEF	
OPTION	

Program Mode	Legend	Your Setting
Input Range	"r"	
Alarm 1 Type		
Alarm 2 Type		
Alarm 3 Type		
Output 1 Use	"1"	
Output 2 Use	"2"	
Output 3 Use	"3"	
Comms Baud Rate	"b"	
Comms Address	"A"	
Comms Protocol	"P"	
Cold Junction Comp	"J"	

Enable Mode (circle one)			
EPro	ESEt	nonE	both

Set-Up Mode	Legend	Your Setting
Alarm 1 Value	"1" or "A"	
Alarm 1 Hysteresis	"-"	
Alarm 2 Value	"2"	
Alarm 2 Hysteresis	"="	
Alarm 3 Value	"3"	
Alarm 3 Hysteresis	"≡"	
Process Variable Offset	"o"	
Digital Filter Time Const	"t"	
Linear Decimal Position	"P"	
Linear Range Minimum	"L"	
Linear Range Maximum	"h"	
Record Out Minimum	"d"	
Record Out Maximum	"u"	
Operator Display Strategy	"S"	

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 Warranty adds an additional one (1) month grace period to the normal **three (3) years product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, 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 being 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, EXPRESSED 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.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

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. P.O. 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. P.O. number to cover the COST of the repair,
2. Model and serial number of 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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Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gauges
- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- 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

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