Dynapar, Veeder Root, and Eagle Signal Brands:

Sales, Repair, and Application Support:
1675 Delany Rd.
Gurnee, IL. 60031
847-662-4150 Sales/Order Entry Fax
847-782-5277 Applications Support Fax
800-873-8731 Sales/Order Entry
800-234-8731 Applications Support

NorthStar Brand:

Sales, Repair, and Application Support:
1675 Delany Rd.
Gurnee, IL. 60031
847-782-5288 Sales/Order Entry Fax
847-782-5277 Applications Support Fax
800-326-6216 Sales/Order Entry
800-326-6216 Applications Support

Partlow, West, Rustrak, and LFE Brands:

Sales, Repair, and Application Support:
1675 Delany Rd.
Gurnee, IL. 60031
847-662-4150 Sales/Order Entry Fax
847-782-5277 Applications Support Fax
800-873-8731 Sales/Order Entry
800-866-6659 Applications Support

Please disregard all phone numbers and addresses in this manual. The phone numbers and address on this page are the correct phone number and addresses to use for sales, repair, and application support.

WEST MODEL 3010
DIGITAL INDICATOR
Installation & Operating Instructions

CAUTION: REFER TO MANUAL

THE INTERNATIONAL HAZARD SYMBOL IS INSCRIBED ADJACENT TO THE REAR CONNECTION TERMINALS. IT IS IMPORTANT TO READ THE MANUAL BEFORE INSTALLING OR COMMISSIONING THE UNIT.

WEST INSTRUMENTS LIMITED
The Hyde, Brighton,
East Sussex
BN2 4JU
England.
Tel: +44 (0) 1273 606271
Fax: +44 (0) 1273 609990

Veeder-Root SARL
8 Place de la Loire
Silic 422
94583 Rungis CEDEX
France.
Tel: 33 (1) 46-87-09-81
Fax: 33 (1) 46-86-80-04

WEST INSTRUMENTS
Unternehmensbereich
der Veeder-Root GmbH
Zum Bahndamm 40
61200 Wolfersheim
West Germany
Tel: (06036) 97 07-0
Fax: (06036) 97 07-15

PARTLOW-WEST COMPANY
Two Campion Road
New Hartford, NY
13413
U.S.A.
Tel: (315) 797-2222
Fax: (315) 797-0403

4.3.3 Alarm 1 Deadband ( ) 4-2
4.3.4 Alarm 2 Value ( ) 4-2
4.3.5 Process Variable Offset ( ) 4-3
4.3.6 Range Decimal Point ( ) 4-3
4.3.7 Range Minimum ( ) 4-3
4.3.8 Range Maximum ( ) 4-3
4.3.9 Recorder Range Minimum ( ) 4-3
4.3.10 Recorder Range Maximum ( ) 4-3
4.3.11 Filter Time Constant ( ) 4-3
4.4 Alarms 4-4
4.5 Leaving Set-Up Mode 4-4

SECTION 5 OPERATION VIA AN RS485-COMPATIBLE SERIAL COMMUNICATIONS LINK 5-1
5.1 RS485 Connections 5-1
5.2 Activating the Communications Link 5-1
5.3 RS485 Channel Selection 5-1
5.4 RS485 Operation 5-1
5.4.1 Character Transmission 5-1
5.4.2 Line Turn-Round 5-1
5.4.3 Communications Protocol 5-3
5.4.4 Data Format 5-5
5.4.5 Resetting Maximum Hold/Minimum Hold 5-5

SECTION 6 CONFIGURATION MODE 6-1
6.1 Entering Configuration Mode 6-1
6.2 Configuration Mode Functions 6-2
6.2.1 Input Range Selection 6-2
6.2.2 Alarm 1 Type 6-3
6.2.3 Alarm 2 Type 6-4
6.3 Changing Input Type 6-5
6.4 Exiting from Configuration Mode 6-6

SECTION 7 INTERNAL LINKS AND SWITCHES 7-1
7.1 Dismantling the Indicator 7-1
7.1.1 Withdrawing the Indicator from its Housing 7-1
7.1.2 Separating the PCBs (If an Options Board is Fitted) 7-1
7.2 Selecting Thermocouple Break Protection and DC Input Range 7-3
7.3 Alarm 2 Output Options Board (Type 450) 7-4
7.4 RS485 Communications Options Board (Type 481) 7-4
7.5 Recorder Output Options Board (Type 496) 7-5

7.6 Changing the Mains (Line) Supply Voltage 7-5
7.7 Assembling the Indicator 7-5
7.7.1 Fitting the Options Board to the CPU Board (if required) 7-5
7.7.2 Fitting the Board(s) to the Front Panel Assembly 7-6
7.7.3 Fitting the Indicator into its Housing 7-6

APPENDIX A SPECIFICATION FOR 3010 DIGITAL INDICATOR A-1

APPENDIX B PRODUCT CODES B-1

Tables

Table 2-1 Thermocouple Cable Colour Codes 2-5
Table 4-1 Parameter Display Sequence 4-1
Table 5-1 RS485 Channel Selection 5-2
Table 5-2 Set-Up Parameters 5-5
Table 5-3 {data} Format/Decimal Point Position 5-6
Table 7-1 Input Type/Break Protection Selection 7-3
Table 7-2 Recorder Output Range Selection 7-5

Illustrations

Figure 1-1 3010 Front Panel 1-1
Figure 2-1 Panel Cut-Out Dimensions 2-1
Figure 2-2 Panel-mounting the Indicator 2-2
Figure 2-3 Location of Locking Screw 2-3
Figure 2-4 Rear Terminal Connections 2-4
Figure 2-5 Mains (Line) Supply Connections 2-4
Figure 2-6 Thermocouple Input Connections 2-5
Figure 2-7 Three-wire RTD Input Connections 2-5
Figure 2-8 DC Linear Input Connections 2-6
Figure 2-9 Alarm 1 Output Connections 2-6
Figure 2-10 Alarm 2 Output Connections 2-6
Figure 2-11 Recorder Output Connections 2-6
Figure 2-12 RS485 Connections 2-6
Figure 2-13 Input Transducer Power Supply Connections 2-7
Figure 3-1 Front Panel Display - Normal Mode 3-1
Figure 3-2 "Process Variable Out of Range" Displays 3-1
Figure 4-1 Operation of Alarms 4-5
Figure 5-1 Options Board Type 481 - RS485 Switches 5-2
Figure 6-1 Switch Selection of Input Type 6-5

Illustrations (Continued)

Figure 6-2 Cold Junction Compensation Sensor 6-6
Figure 7-1 Detaching the PCBs from the Front Panel 7-2
Figure 7-2 Separating the Two PCBs 7-2
Figure 7-3 CPU Board Link Jumpers 7-3
Figure 7-4 Options Board 450 - Link Jumpers 7-4
Figure 7-5 Options Board 481 - Link Jumpers 7-4
Figure 7-6 Options Board 496 - Link Jumpers 7-5

SECTION 1
INTRODUCTION

The WEST 3010 Digital Indicator is a full-range high-visibility indicator which can accommodate inputs from thermocouple, resistance temperature detector (RTD) or DC linear sources. Its range of output options and the optional RS485 serial communications ability make the 3010 a highly flexible and cost-effective means of process measurement.

The Indicator operates in any one of three modes: User Mode (indicating the current process variable value and the presence of any alarm condition - see Section 3), Set Up Mode (in which the operating parameters of the Indicator may be adjusted - see Section 4) and Configuration Mode (in which the operator may define input range and alarm type(s) and usage - see Section 6).

The salient features of the 3010 Digital Indicator are:

- High-visibility four-digit LED display
- Linear input ranges scaleable from the front panel
- One alarm relay included as standard
- Alarm 1 adjustable deadband
- Scaleable analogue output for external recorder or re-transmission
- Input transducer power supply option
- Optional second alarm output
- Maximum Hold and Minimum Hold features for process variable value
- Programmable digital filter
- RS485 serial communications output for computer interfacing
- 1/8 DIN case - only 153mm deep
- Process Variable Offset control

1.1 FRONT PANEL

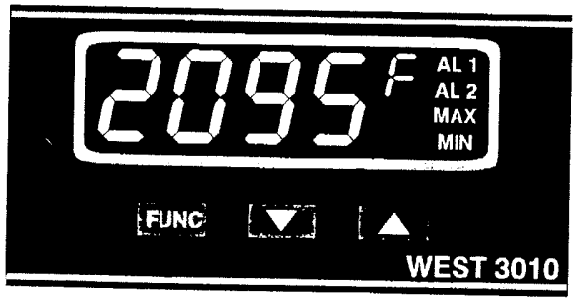


Figure 1-1 3010 Front Panel

The 3010 Front Panel (see Figure 1-1) contains a four-digit red LED display (equipped with a fifth smaller segement which indicates the unit of measurement), two discrete LED indicators (for the alarm outputs) and three control keys. The four-digit display range is from -1999 to 9999. The control keys and discrete LED indicators have the following functions:

1.1.1 Control Keys

In User Mode, whilst the process variable value is displayed, used to select display of Maximum Hold and Minimum Hold parameter values. In Set-Up Mode, used to select the parameter for display/adjustment. In Configuration Mode, used to select parameters and to confirm selection of each parameter setting.

Raise key. In Set-Up Mode, used to increment the displayed parameter value; one momentary depression of this key will increment the least significant digit by 1; if this key is held depressed for longer than one second, the least significant digit is incremented at the rate of 25 per second; if this key is held for longer than ten seconds, the second least significant digit is incremented at the rate of 25 per second. In Configuration Mode, used to select parameter setting. Also used, in conjunction with the Lower key, to enter Configuration Mode.

Lower key. In Set-Up Mode, used to decrement the displayed parameter value; one momentary depression of this key will decrement the least significant digit by 1; if this key is held depressed for longer than one second, the least significant digit is decremented at the rate of 25 per second; if this key is held for longer than ten seconds, the second least significant digit is decremented at the rate of 25 per second. In Configuration Mode, used to select parameter setting. Also used, in conjunction with the Raise key, to enter Configuration Mode.

NOTE

The Raise and Lower keys are used in User Mode to "reset" the Maximum Hold and Minimum Hold parameters (see Section 3) and to select Set-Up Mode (see Section 4).

1.1.2 Indicators

This indicator flashes when Alarm 1 is active.

This indicator is operative only if the optional Alarm 2 is fitted and flashes when Alarm 2 is active.

This indicator is ON whilst the Maximum Hold parameter is being viewed in User Mode. In any other circumstances, this indicator is not visible.

This indicator is ON whilst the Minimum Hold parameter is being viewed in User Mode. In any other circumstances, this indicator is not visible.

1.2 OPTIONS AND VARIANTS

Full details of the options and variants offered with the 3010 Digital Indicator may be found in Appendix B of this manual.

SECTION 2
INSTALLATION

2.1 UNPACKING PROCEDURE

1. Remove the Indicator from its packing. The indicator is supplied with a mounting clamp and two screws.

NOTE

Retain the packing for future use, should it be necessary to transport the indicator to another site or to return it to the supplier for repair.

2. Examine the delivered items to check for damage or deficiency. If any is found, notify the carrier immediately. Check that the product code shown on the product code label (affixed to the top face of the Indicator housing) corresponds to the Indicator ordered.

2.2 PANEL-MOUNTING THE INDICATOR

2.2.1 Pre-requisites

The panel on which the Indicator is to be mounted must be rigid and may be up to 6.0mm (0.25 inches) thick. The cut-out required is as shown in Figure 2-1. Several Indicators may be mounted one above another in a continuous vertical cut-out of height:

(48n - 4)mm or (1.89n - 0.16) inches

where n is the number of Indicators to be installed in the cut-out.

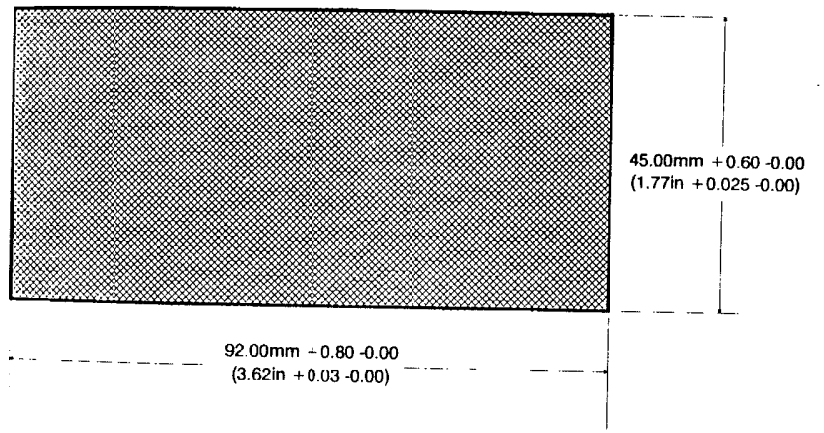


Figure 2-1 Panel Cut-Out Dimensions

The Indicator is 150mm deep, measured from the rear face of the front panel. The front panel is 48.00mm (1.89 inches) high and 96.00mm (3.80 inches) wide; when panel-mounted, it projects out 6.00mm (0.25 inches) from the mounting panel.

2.2.2 Panel-Mounting Procedure

1. Insert the rear of the Indicator housing through the cut-out (from the front of the mounting panel) and hold the Indicator lightly in position against the mounting panel.

2. Slide the mounting clamp into place on the Indicator (see Figure 2-2) and push it forwards until it touches the rear face of the mounting panel. Teeth on the arms which project to the rear of the clamp will engage with the ratchets moulded into the side surfaces of the Indicator housing.

3. Gently tighten the screws in the clamp until the front panel is fitted snugly in the cut-out in the mounting panel.

CAUTION

Do not over-tighten the screws; this will distort the mounting clamp.

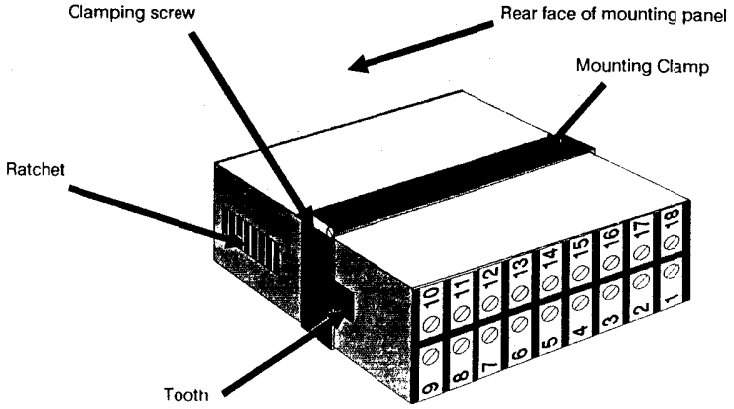


Figure 2-2 Panel-mounting the Indicator

2.3 REMOVAL OF THE INDICATOR FROM ITS HOUSING

The Indicator may be removed from its housing (for servicing purposes or to replace sub-assemblies), leaving the housing and rear terminal connections attached to the mounting panel.

CAUTION

The mains (line) supply must be disconnected from the Indicator before any attempt is made to remove the Indicator from its housing. The Indicator contains a lithium battery and devices which are sensitive to electrostatic discharge. During handling of the Indicator, care should be taken to minimise the risk of electrostatic discharge or short-circuiting the battery, i.e.:

- Do not place the unhoused Indicator on a conducting surface.
- Touch only the edges of the PCBs in the Indicator. Ensure that fingers do not come into contact with any of the components or tracks on the PCBs.
- Before handling the unhoused Indicator, touch a nearby ground connection (e.g. a metal bench frame or rack).
- If possible, wear an earth wrist strap whilst handling the unhoused Indicator.

To remove the Indicator from its housing:

1. With a flat-bladed screwdriver of appropriate size (5mm or 3/16-inch), rotate the locking screw (see Figure 2-3) anticlockwise until the locking screw thread is completely dis-engaged. This will partially move the Indicator out of its housing and will dis-engage the connections at the rear of the Indicator (inside the housing).

2. Carefully pull the Indicator forward clear of the housing.

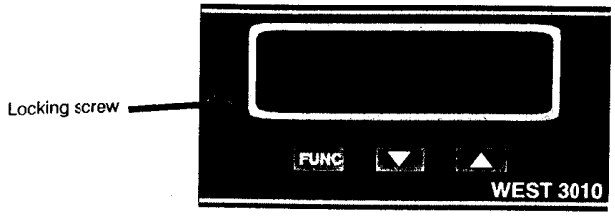


Figure 2-3 Location of Locking Screw

2.4 REPLACEMENT OF THE INDICATOR IN ITS HOUSING

1. Carefully slide the Indicator, rear end first, into its housing, ensuring that the Indicator PCB(S) locate against the outside of the board guides moulded into the sides of the housing.

2. Push the Indicator firmly into place such that sound connection is made between the Indicator PCBs' edge connector and the rear connection within the housing.

3. Engage the thread of the locking screw and tighten the locking screw until the Indicator is securely in position in the housing.

2.5 CONNECTIONS AND WIRING

The following connections for outputs and inputs are provided at the rear of the Indicator housing (with some configurations, some of the connections may not be present):

- Mains (line) input
- Thermocouple, RTD or DC linear input
- Alarm 1 output
- Alarm 2 output (optional)
- RS485 serial communications input/output (optional)*
- Recorder output (optional)*
- Transmitter Power Supply output**

* These options are mutually exclusive.
** Not available if Recorder Output Option is fitted

The connections to the rear terminals are shown in Figure 2-4.

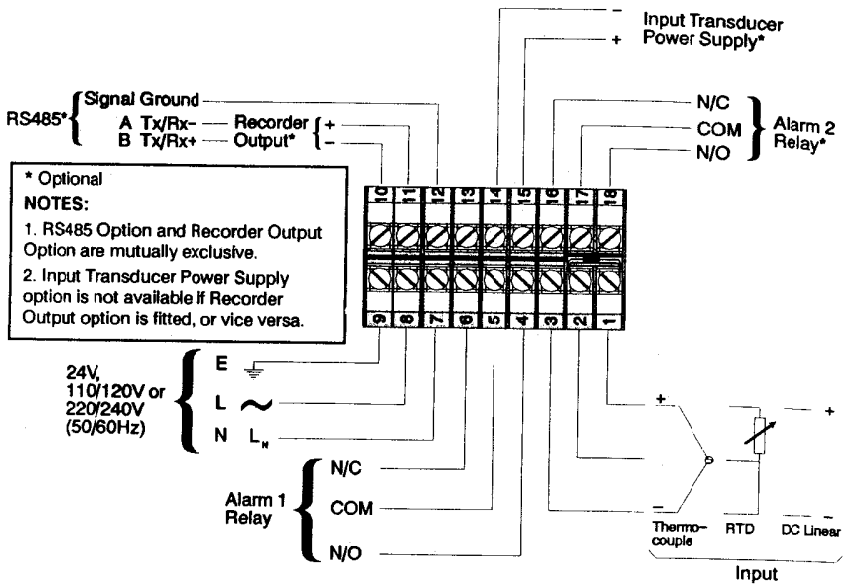


Figure 2-4 Rear Terminal Connections

2.5.1 Mains (Line) Input

The Indicator is supplied to operate on 24V AC, 100 - 132V AC or 193 - 264V AC supplies (50/60Hz). Check that the installation mains (line) voltage corresponds to that indicated on the Indicator's product code label before connecting power to the Indicator.

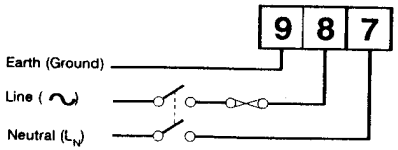


Figure 2-5 Mains (Line) Supply Connections

CAUTION

This equipment is designed for installation in an enclosure which provides adequate protection against electric shock. Local requirements regarding electrical installation should be rigidly observed. Ground terminals must be connected separately and must not be made common with the neutral connection. Consideration should be given to the prevention of access by unauthorised personnel to the power terminations. The Ground terminal (Terminal 9) should be connected to a protective ground conductor before any other connections are made and should remain connected at all times. Power should be connected via a two-pole isolating switch and a 1A (193 - 264V supply), 2A (100 - 132V supply) or 5A (24V supply) fuse, as shown in Figure 2-5.

2.5.2 Thermocouple Input

Thermocouple input connections are shown in Figure 2-6. The correct type of thermocouple extension leadwire or compensating cable must be used for the entire distance between the Indicator and the thermocouple, ensuring that the correct polarity is observed throughout. Joints in the cable should be avoided, if possible. All Indicators supplied with a thermocouple input have a cold junction compensation sensor connected across Terminals 1 and 2. This sensor should not normally be removed.

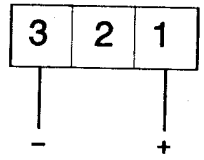


Figure 2-6 Thermocouple Input Connections

NOTE

Do not run thermocouple cables adjacent to power-carrying conductors. If the wiring is run in a conduit, use a separate conduit for the thermocouple wiring. If the thermocouple is grounded, this must be done at one point only. If the thermocouple extension lead is shielded, the shield must be grounded at one point only.

The colour codes used on the thermocouple extension leads are shown in Table 2-1.

Table 2-1 Thermocouple Cable Colour Codes

Thermocouple Type	Cable Material	British (BS)	American (ASTM)	German (DIN)	German (IEC)	French (NFE)
T	Copper Constantan	+ White – Blue * Blue	+ Blue – Red * Blue	+ Red – Brown * Brown	+ Brown – White * Brown	+ Yellow – Blue * Blue
J	Iron/Constantan	+ Yellow – Blue * Black	+ White – Red * Black	+ Red – Blue * Blue	+ Black – White * Black	+ Yellow – Black * Black
K	Nickel Chromium Nickel Aluminium	+ Brown – Blue * Red	+ Yellow – Red * Yellow	+ Red – Green * Green	+ Green – White * Green	+ Yellow – Purple * Yellow
R S	13% Copper 10% Copper Nickel	+ White – Blue * Green	+ Black – Red * Green	+ Red – White * White	+ Orange – White * Orange	+ Yellow – Green * Green
B	Platinum/Rhodium		+ Grey – Red * Grey	+ Red – Grey * Grey		

* Colour of overall sheath

2.5.3 Three-wire Resistance Temperature Detector (RTD) Input

RTD connections are shown in Figure 2-7, with the compensating lead connected to Terminal 3. For two-wire RTD inputs, Terminals 2 and 3 should be linked. The extension leads should be of copper and the resistance of the wires connecting the resistance element should not exceed 5 ohms per lead (the leads should be of equal length).

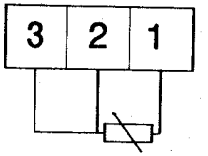


Figure 2-7 Three-wire RTD Input Connections

2.5.4 DC Linear Inputs

Any one of a range of DC linear inputs can be accommodated on the Indicator (see Appendix B). Connections for DC linear inputs are as shown in Figure 2-8.

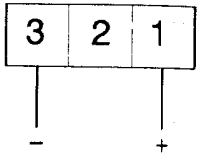


Figure 2-8 DC Linear Input Connections

2.5.5 Alarm Outputs

The relay connections for alarm outputs are shown in Figures 2-9 (for the standard Alarm 1 Output) and Figure 2-10 (for the optional Alarm 2 Output). Details of the operation of the various types of alarm may be found in Subsection 4.4 of this manual.

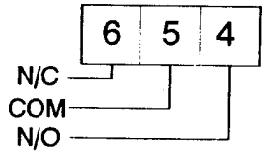


Figure 2-9 Alarm 1 Output Connections

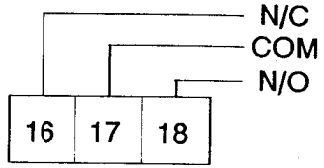


Figure 2-10 Alarm 2 Output Connections

2.5.6 Recorder Output (Product Codes X12, X18, X19 and X20)

NOTE

This Option is not available if the RS485 Serial Communications Option (Product Code X06) is fitted.

The connections for the recorder output are as shown in Figure 2-11.

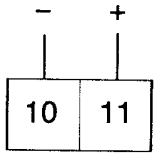


Figure 2-11 Recorder Output Connections

2.5.7 RS485-compatible Serial Communications Link (Product Code X06)

Indicators fitted with the RS485 Communications Option use Terminals 10, 11 and 12 as shown in Figure 2-12.

NOTE

This Option is not available if the Recorder Output Option (Product Code X12, X18, X19 or X20) is fitted.

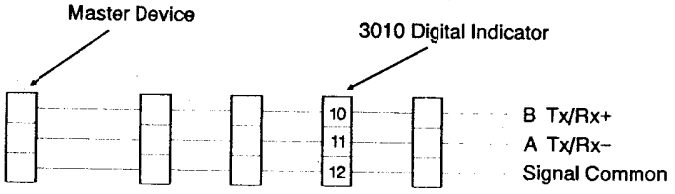


Figure 2-12 RS485 Connections

2.5.8 Input Transducer Power Supply (X08)

The output from this power supply is a two-terminal isolated voltage in the range 20V DC - 28V DC (nominal 24V DC). The minimum load impedance is 910Ω. The connections are as shown in Figure 2-13.

NOTES

1. This option is available with any combination of alarms and the RS485 Serial Communications option.
2. This option and the Recorder Output options (X12, X18, X19 or X20) are mutually exclusive.

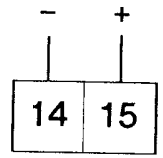


Figure 2-13 Input Transducer Power Supply Connections

SECTION 3
OPERATING INSTRUCTIONS

The WEST 3010 Digital Indicator requires no operator actions in order to perform its normal functions. The FUNC key may be used to select display of the Maximum Hold and Minimum Hold parameters (the **MAX** or **MIN** indicator will be ON, as appropriate) and the Raise/Lower keys may be used to "reset" the Maximum Hold and Minimum Hold parameters (see later) or to select Set-Up Mode (see Section 4). The display is used to indicate the current process variable value (see Figure 3-1) or (when requested by the operator) the most-recent historic values of the Maximum Hold/Minimum Hold parameters since the last "reset".

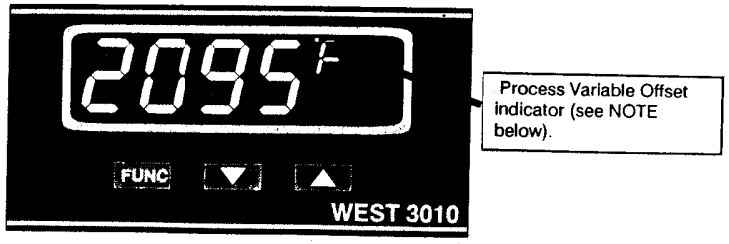


Figure 3-1 Front Panel Display - Normal Mode

NOTE

If the Process Variable Offset parameter (see Section 4) is set to a non-zero value, the Process Variable Offset indicator in the "Units" display is ON, indicating that the displayed Process Variable value is not the actual Proces Variable Value measured at the input to the Indicator.

The Process Variable Offset parameter should be used with caution; imprudent setting of the value of this parameter could cause the Indicator to show process variable values which bear little relationship to the actual process variable value.

If either the Actual Process Variable (as measured at the input terminals) or the Used Process Variable (Actual Process Variable + Process Variable Offset) is out of range, the display will show one of the "Out of Range" displays shown in Figure 3-2.

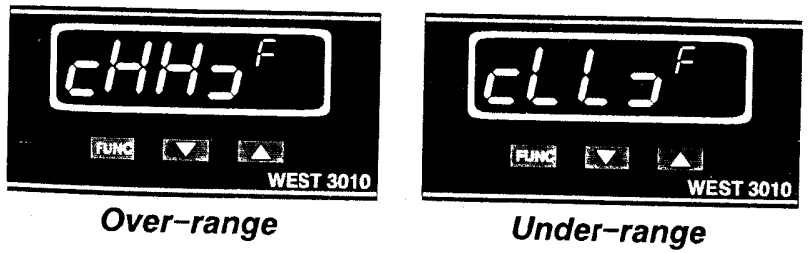


Figure 3-2 "Process Variable Out of Range" Displays

The Maximum Hold and Minimum Hold facilities in the Indicator enable the operator to view the maximum/minimum values of the process variable encountered since these facilities were last reset. To view the current maximum and minimum process variable values:

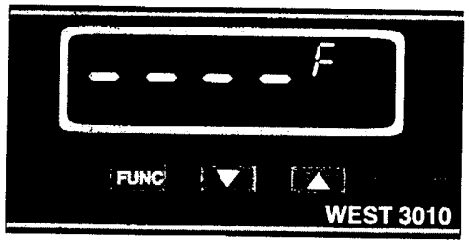
1. Whilst the Indicator is displaying the process variable value in User Mode, depress the **FUNC** key. The display will then show the current Maximum Hold value and the **MAX** indicator will come ON.

2. Whilst the Maximum Hold value is displayed, depress the **FUNC** key. The display will then show the Minimum Hold value, the **MAX** indicator will go OFF and the **MIN** indicator will come ON.

3. Whilst the Minimum Hold value is displayed, depression of the **FUNC** key will cause a return to the normal display of the process variable value, whereupon the **MIN** indicator will go OFF.

The Maximum Hold and Minimum Hold facilities may be reset to the current process variable value as follows:

1. With the Maximum Hold/Minimum Hold value displayed (as required), depress and hold down the Raise key or Lower key until (after a delay of approximately five seconds) the display shows the centre segments of the main display illuminated i.e.:



2. This display will appear for two seconds, after which the reset value of the Maximum Hold/Minimum Hold parameter (as appropriate) will be displayed.

Resetting the Maximum Hold or Minimum Hold parameter will cause that parameter to assume initially a value equal to the process variable value at the time of reset. The parameter(s) will then resume normal operation.

NOTE

When the Indicator is powered-down, the values of the Hold Maximum and Hold Minimum parameters at the instant of switch-off are retained and will be effective at the next power-up unless they are reset as described above.

SECTION 4
SETTING-UP PROCEDURES

4.1 ENTERING SET-UP MODE

With the Indicator in its normal operating mode (i.e. with the display showing the current value of the Process Variable), depress and hold down the raise and Lower keys simultaneously for at least three seconds, at the end of which the keys should be released. The Indicator is then in Set-Up Mode.

4.2 DISPLAY AND (IF REQUIRED) ADJUSTMENT OF A PARAMETER

Upon entry into Set-Up Mode, the display will show the Process Variable current value (as in the normal operating mode). This cannot be adjusted, since it is a "Read Only" function. Depression of the **FUNC** key will cause the display to show the first in a sequence of parameter displays. The sequence is shown in Table 4-1.

Table 4-1 Parameter Display Sequence

Parameter	Parameter Identifier	Adjustment Range
Process Variable	Units - C, F or (for linear) blank	None - "Read Only" display
Alarm 1 Value (see NOTE below)	A or 1	Range Minimum - Range Maximum
Alarm 1 Deadband	b	1 lsd 25% of span
Alarm 2 Value*	2	Range Minimum - Range Maximum
Process Variable Offset	o	± Span (limit = −1999 to +9999)
Range Point (DC Linear inputs only)	P	0, 1, 2 or 3
Range Minimum (adjustable on DC Linear inputs only)	L	−1999 to (Range Maximum − 1)
Range Maximum (adjustable on DC Linear inputs only)	h	(Range Minimum + 1) to 9999
Recorder O/P Range Minimum*	d	-1999 to 9999
Recorder O/P Range Maximum*	u	-1999 to 9999
Filter Time Constant	t	0 - 100 seconds in 0.1s increments

* Only displayed if appropriate option is fitted.

NOTE: Alarm 1 Value parameter identifier is as follows: A — One Alarm fitted; 1 — Two Alarms fitted

The "Units" display will show a character which identifies the parameter and the main display will show the current setting/value of that parameter. Each depression of the **FUNC** key causes the display to step to the next parameter in the sequence. The value/setting of the displayed parameter may be adjusted using the Raise (to increment) and Lower (to decrement) keys.

The display will flash if the operator attempts to:

(a) adjust a parameter to a value outside the range of adjustment

(b) adjust a parameter to a value beyond the limit set by another parameter (e.g. Process Variable Offset adjustment is limited by Range Maximum and Range Minimum)

(c) adjust a "Read Only" parameter (e.g. Process Variable)

In each of the above instances, the attempted adjustment will not be implemented.

4.3 PARAMETER DEFINITIONS

4.3.1 Process Variable (C, F or Blank)

This is a "Read Only" display and the value shown is the actual process variable value modified (if applicable) by the Process Variable Offset value (process variable indicator will be ON) i.e.:

Displayed Process Variable = Actual Process Variable + Process Variable Offset

4.3.2 Alarm 1 Value ( or )

This is the value at which the Process Variable will cause Alarm 1 to become active. This parameter is always displayed in the Set Up sequence because Alarm 1 is fitted as standard. Alarm 1 type may be defined from the front panel in Configuration Mode (see Subsection 6.2.2). Process High direct-acting Alarm 1 is standard

4.3.3 Alarm 1 Deadband ()

This parameter allows the operator to set the deadband for Alarm 1 as required. It may be adjusted in the range 1 least-significant-digit to 25% of the Indicator's span (although the value will be displayed in the same units as the process variable). The deadband is always formed on the non-active side of the alarm level to ensure that the alarm always becomes active at the set alarm value. For example, if Alarm 1 were a Process High alarm with the alarm level set to 100.0°C and deadband set to 10.0°C, Alarm 1 would become active when the process variable reaches a value of 100.05°C or greater; Alarm 1 would not become inactive until the process variable fell to 89.95°C or less.

NOTE

If the Alarm 1 Deadband parameter were being used for simple ON/OFF reverse-acting control, the effective set point value would be (Alarm 1 Value - ½ Alarm 1 Deadband Value) for a Process High reverse-acting alarm and (Alarm 1 Value + ½ Alarm 1 Deadband Value) for a Process Low direct-acting alarm.

4.3.4 Alarm 2 Value ()

This is the value at which the Process Variable causes Alarm 2 to become active. Alarm 2 can be configured as a "Process High" alarm or a "Process Low" alarm. Alarm 2 type may be defined from the front panel in Configuration Mode (see Subsection 6.2.3). This parameter is included in the Set-Up sequence only if Alarm 2 is fitted.

4.3.5 Process Variable Offset ()

This parameter is used to modify the actual Process Variable value (measured at the Indicator's input terminals) in the following manner:

Displayed Process Variable = Actual Process Variable + Process Variable Offset

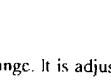
Displayed Process Variable is limited by Range Maximum and Range Minimum (see below). Displayed Process Variable is used for both display and alarm purposes. The Recorder Output (if fitted) is also modified in a similar manner by this parameter value.

NOTE

This parameter value should be selected with care. Any adjustment to this parameter is, in effect, a calibration adjustment. Injudicious application of values to this parameter could lead to the display process variable value bearing no meaningful relationship to the actual process variable value.

4.3.6 Range Decimal Point ()

This parameter determines the decimal point position for a linear input range. If the input is non-linear, this parameter does not appear in the Set-Up sequence. Available settings are 0, 1, 2 or 3 (indicating how many digits will appear to the right of the decimal point.

4.3.7 Range Minimum ()

This defines the minimum limit for the input range. It is adjustable only for a linear input. It is a "Read Only" function for a non linear input.

4.3.8 Range Maximum ( )

This defines the maximum limit for the input range. It is adjustable only for a linear input. It is a "Read Only" function for a non-linear input.

4.3.9 Recorder Range Minimum ()

This defines the minimum scale value for the recorder output and may be adjusted in the range -1999 to 9999. The decimal point position always corresponds to that for the process variable input range. If the Recorder Range Minimum is adjusted to be greater than the Recorder Range Maximum, the relationship between the process variable value and the recorder output value is reversed. Example: for a 0 - 5V recorder output, this value corresponds to 0V output.

4.3.10 Recorder Range Maximum ()

This defines the maximum scale value for the recorder output and may be adjusted in the range -1999 to 9999. The decimal point position always corresponds to that for the process variable input range. If the Recorder Range Maximum is adjusted to be less than the Recorder Range Minimum, the relationship between the process variable value and the recorder output value is reversed. Example: for a 0 - 5V recorder output, this value corresponds to 5V output.

4.3.11 Filter Time Constant ( )

The Indicator is equipped with a programmable filter, the time constant of which is defined by the value of this parameter. It is adjustable from 0.1 seconds to 100 seconds in 0.1-second increments. The default value of this time constant is 2 seconds.

4.4 ALARMS

Four possible alarm configurations are available for Alarm 1 and (if fitted) Alarm 2:

For Alarm 1:

Product Code	Alarm Type
C0048	Process High Alarm (relay) - direct-acting
C0049	Process High Alarm (relay) - reverse-acting
C0078	Process Low Alarm (relay) - direct-acting
C0077	Process Low Alarm (relay) - reverse-acting

For Alarm 2:

Product Code	Alarm Type
C00--48	Process High Alarm (relay) - direct-acting
C00--49	Process High Alarm (relay) reverse-acting
C00 -78	Process Low Alarm (relay) - direct-acting
C00--77	Process Low Alarm (relay) - reverse-acting

Alarm Type is defined in Configuration Mode (see Section 6) The operation of the various types of alarm is shown in Figure 4-1.

4.5 LEAVING SET-UP MODE

To return to the normal operating mode, select the display of the Process Variable in Set-Up Mode and simultaneously hold down the Raise and Lower keys for at least three seconds, at the end of which the Indicator will return to the normal operating mode.

NOTE

If, whilst in Set Up Mode, no key is operated for one minute, the Indicator will automatically return to the normal operating mode.

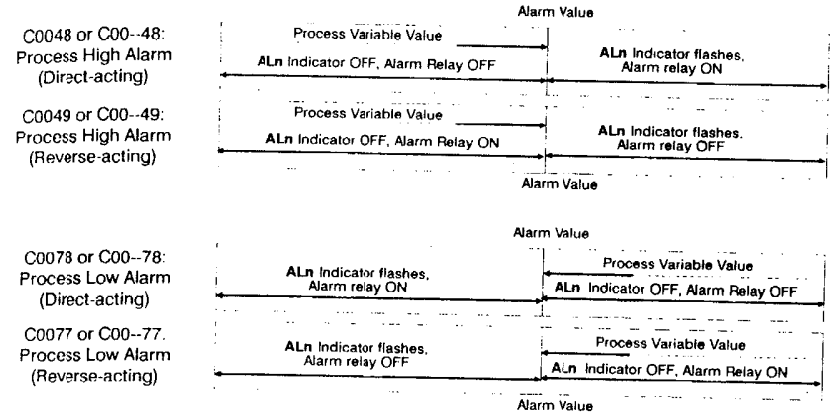


Figure 4-1 Operation of Alarms

SECTION 5
OPERATION VIA AN RS485-COMPATIBLE SERIAL COMMUNICATIONS LINK

NOTE

The Communications Option is not available on Indicators fitted with the Recorder Output Option.

The WEST 3010 Indicator may be fitted with the facility for communication with a master device (e.g. a computer or terminal) via an RS485-compatible serial link (Product Code X06).

5.1 RS485 CONNECTIONS

Indicators which are equipped with the RS485 Option use Terminals 10, 11 and 12, as described in Section 2, for this purpose. Communication is at 4800 Baud and the cable used should be suitable for data transfer at that frequency over the required distance. The transmitters and receivers in the 3010 Digital Indicator conform to recommendations contained in EIA Standard RS485. Up to 32 Indicators may be connected in parallel with one master device.

5.2 ACTIVATING THE COMMUNICATIONS LINK

The Options Board (Type 481) which provides the RS485 facility is shown in Figure 5-1, which shows the locations of the on-board DIL switches and link jumpers. To activate the communications link, switch S6 must be ON; with S6 ON, the Indicator parameters may be adjusted by the master device via the communications link. When switch S6 is OFF, the Indicator will not adjust or change any of its parameters in response to commands received via the link. With switch S6 in either state, the Indicator will return requested information in response to a ----? type message (see Subsection 5.4.3) from the master device.

5.3 RS485 CHANNEL SELECTION

Each 3010 Indicator connected to a master device is assigned a unique channel address which enables the master device to communicate with each slave Indicator individually. The channel address is defined by the settings of switches S1 - S5, thus providing up to 32 possible channel addresses for each master device. The channel addresses are defined in Table 5-1.

5.4 RS485 OPERATION

5.4.1 Character Transmission

Data characters transmitted comprise one start bit, seven data bits, one parity bit (even) and a stop bit. The link is asynchronous and operates at a transfer rate of 4800 Baud.

5.4.2 Line Turn-Round

RS485 circuits are a multi-drop half duplex system. When a device is transmitting, it drives the transmission lines to the appropriate levels; when it is not transmitting, its outputs are set to a high impedance in order that another device in the system can transmit. It is important that a transmitter releases the transmission lines before another device starts transmission. This imposes the following restraints on a computer system communicating with the Indicator(s):

(a) The transmitter must release the transmission lines within 6 milliseconds of the end of the last character of a message being transmitted. Note that delays due to buffers such as those used in universal asynchronous receivers/transmitters (UARTs) within the computer must be taken into account.

(b) The transmitter must not start transmission until at least 6 milliseconds have elapsed since reception of the last character of a message.

All WEST instruments which have an RS485 communications facility adhere to this standard; thus, provided that the master device conforms similarly to the standard, there should be no line contention problems.

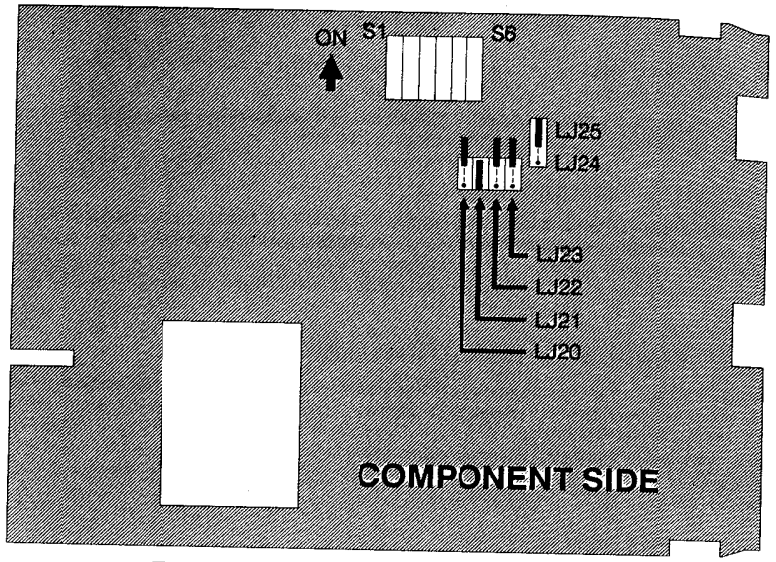


Figure 5-1 Options Board Type 481 - RS485 Switches

Table 5-1 RS485 Channel Selection

Channel No.	Switch S5	S4	S3	S2	S1
1	-	-	-	-	X
2	-	-	-	X	-
3	-	-	-	X	X
4	-	-	X	-	-
5	-	-	X	-	X
6	-	-	X	X	-
7	-	-	X	X	X
8	-	X	-	-	-
9	-	X	-	-	X
10	-	X	-	X	-
11	-	X	-	X	X
12	-	X	X	-	-
13	-	X	X	-	X
14	-	X	X	X	-
15	-	X	X	X	X
16	X	-	-	-	-

Channel No.	Switch S5	S4	S3	S2	S1
17	X	-	-	-	X
18	X	-	-	X	-
19	X	-	-	X	X
20	X	-	X	-	-
21	X	-	X	-	X
22	X	-	X	X	-
23	X	-	X	X	X
24	X	X	-	-	-
25	X	X	-	-	X
26	X	X	-	X	-
27	X	X	-	X	X
28	X	X	X	-	-
29	X	X	X	-	X
30	X	X	X	X	-
31	X	X	X	X	X
32	-	-	-	-	-

X = ON
- = OFF

5.4.3 Communications Protocol

All communication is initiated by the master device. The master sends a command or query to the addressed slave and the slave replies with an acknowledgement of the command or a reply to the query. All messages, in either direction, comprise:

(a) a Start of Message character
(b) one or two address characters (definirg the slave)
(c) a parameter/data string, and
(d) an End of Message character

Messages from the master may be one of four types:

Type 1:	L{N}??*
Type 2:	L{N}{P}{C}* or R{N}{P}{C}*
Type 3:	L{N}{P}#{data}* or R{N}{P}#{data}*
Type 4:	L{N}{P}I* or R{N}{P}I*

where all characters are in ASCII code and:

L	is the Start of Message character (Hex 4C)
{N}	is the slave Indicator address in the range 1 - 32; addresses 1 - 9 may be represented as a single digit (e.g. 7) or in two-digit form with a leading zero (e.g. 07).
{P}	is the parameter to be interrogated or adjusted (Hex 41 - 5D) - see Table 5-2.
{C}	is the command - see below.
#	indicates that {data} is to follow (Hex23).
{data}	is a string of numeric data in ASCII code (see Table 5-3).
*	is the End of Message character (Hex 2A).

No spaces are permitted in messages.

Type 1 Message

L{N}??*

This message is used by the master device to determine whether a slave Indicator is active. The reply from the addressed Indicator, if it is active, is:

L{N}?A*

An inactive Indicator will give no reply.

Type 2 Message

L{N}{P}{C}*

This type of message is used by the master device to interrogate or modify a parameter in the addressed Indicator. {P} is the parameter as defined in Table 5-2 and {C} is the command, which may be one of the following:

+ (Hex 2B)	increment the value of the parameter defined by {P}
D (Hex 2D)	decrement the value of the parameter defined by {P}
? (Hex 3F)	determine the current value of the parameter defined by {P}

The reply from the addressed Indicator is of the form:

L{N}{P}{data}A*

where {data} is the five ASCII-coded digits whose meaning is shown in Table 5-3. The data is the value requested in the query or the new value after modification. If the value specified is not valid, because it is outside the permitted value range of that parameter or because the parameter is not adjustable, the Indicator replies with a negative acknowledgement:

L{N}{P}{data}N*

The {data} string in the replay is the current (unchanged) value of the specified parameter.

If the process variable is interrogated when the process variable is outside the range of the Indicator, the replay is:

L{N}{P}??0A*	if over-range
or	
L{N}{P}??5A*	if under-range

A parameter identifier character] in the message from the master device indicates that a "combo scan" is required; this provides a facility for interrogating the values of the process variable and status in a single message from the master device. The reply to such a command would be in the form:

L{N}]xxaaaaabbbbbccccceeeeeA*

where xx = 20 (indicating the number of data digits to follow). The data digits are expressed as shown in Table 5-3 and are:

aaaaa	= 00000
bbbbb	is the current value of the Used Process Variable (Actual Process variable + Process Variable Offset)
ccccc	= 00000
eeeee	is the status of the Indicator as described in Table 5-2.

Type 3 Message

L{N}{P}#{data}*

This message type is used by the master to set a parameter to the value specified in {data}. The command is not immediately implemented by the slave; the slave will receive this command and will then wait for a Type 4 message. Upon receipt of a Type 3 message, if the {data} content and the specified parameter are valid, the slave Indicator responds with:

L{N}{P}{data}I*

indicating that the Indicator is ready to implement the command. If the parameter character {P} is not alphabetic, the comand is ignored. If the parameter specified is invalid or is not modifiable or if the desired value is outside the permitted range for that parameter, the Indicator replies with a negative acknowledgement:

L{N}{P}{data}N*

Type 4 Message

L{N}{P}I*

This is sent by the master to the addressed Indicator following a successful Type3 message transmission and replay to/from the same Indicator. Provided that the {data} content and the parameter specified in the preceding Type 3 message are still valid, the Indicator will then set the parameter to the desired value and will replay with:

L{N}{P}{data}A*

where {data} is the new value of the parameter. If the new value or the specified parameter is invalid, the Indicator will reply with a negative acknowledgement:

L{N}{P}{data}N*

where {data} is the current (unaltered) value of the parameter.

If the immediately-preceding message was not a Type 3 message, the Type 4 message is ignored.

A leaflet giving further details of software requirements and suggestions for programs to be implemented on the master is available on request from your nearest WEST division.

5.4.4 Data Format

The {data} field contains five ASCII-coded decimal digits. The first four digits form a decimal number whose sign and magnitude are defined by the fifth digit, as shown in Table 5-3.

5.4.5 Resetting Maximum Hold/Minimum Hold

The Maximum Hold or Minimum Hold parameter may be reset via the RS485 link by either of the following methods:

1. Send a **L {N} {P} + *** or **L {N} {P} – *** Type 2 message from the master device; this attempt to write a new value to either parameter will cause that parameter to be reset.

2. Send a **L {N} {P} # {data) *** Type 3 message followed by a **L {N} {P} I *** Type 4 message to attempt to set either parameter to a new value; this will cause that parameter to be reset.

In either of the above methods, {P} = A (for Maximum Hold parameter) or T (for Minimum Hold parameter).

NOTE

Either parameter can be interrogated over the RS485 link by sending a **L {N} {P} ? *** Type 2 message; the parameter value will not be altered.

Table 5-2 Set-Up Parameters

Parameter Identifier	Parameter	Modifiable?
A	Maximum Hold value	Yes - to reset
B	Not used	-
C	Alarm 1 Value	Yes
D	Not used	-
E	Alarm 2 Value[1]	Yes, if Alarm 2 fitted
F	Not used	-
G	Range Maximum[2]	Yes, if DC Linear Input fitted
H	Range Minimum[2]	Yes, if DC Linear Input fitted
I	Not used	-
J	Process Variable Offset	Yes
K	Not used	-
L	Indicator Status[3]	No
M	Used Process Variable[4]	No (except by modifying Process Variable Offset)
N - P	Not used	-
Q	Range Decimal Point[2]	Yes, if DC Linear Input fitted
R	Not used	-
S	Alarm 1 Deadband	Yes
T	Minimum Hold	Yes - to reset
U & V	Not used	-
W	Filter Time Constant	Yes
X - Z	Not used	-
]	Combo Scan	No
^	Not used	-

NOTES:

1. This parameter is operative only if Alarm 2 is fitted.
2. These parameters are operative only if a DC Linear input is fitted.
3. The value of the Indicator Status is transmitted as four decimal digits followed by 0. The four-digit number must be converted into binary form in which:
   - Bit 0 Indicates Alarm 1 State (1 = safe, 0 = unsafe)
   - Bit 1 Indicates Alarm 2 State (1 = safe, 0 = unsafe or alarm not fitted)
   - Bit 2 Not used
   - Bit 3 Set to 1 if any programmable parameter has been changed, by means other than the communications link, since the last time access was gained to the status word.
   - Bit 4 Indicates whether modification of parameters via the RS485 link is enabled (1 = enabled, 0 = disabled)

   Bits 5, 6 and 7 are not used.
4. Used Process Variable = Actual Process Variable + Process Variable Offset

Table 5-3 {data} Format/Decimal Point Position

First Four Digits	Fifth Digit
+abcd	0
+abc.d	1
+ab.cd	2
+a.bcd	3
+a.b.c.d.	4*
−abcd	5
−abc.d	6
−ab.cd	7
−a.bcd	8
−a.b.c.d.	9*

* These values indicate that default parameter values are being used.

SECTION 6
CONFIGURATION MODE

In this mode, the operator may perform the following functions:

- Select input range
- Select alarm type(s)

All parameters defined in this mode are stored in a high-integrity EEPROM.

6.1 ENTERING CONFIGURATION MODE

Configuration Mode may be selected as follows:

1. If the Controller is powered up, power-down.
2. Power Up and, during the power-up and self-test routine, depress and hold the Raise and Lower keys simultaneously.

Upon completion of the self-test routine, the Controller will enter Configuration Mode and will initially display the *currently-configured* input range. For example, the "units" display will show:

indicating that input range codes are being displayed, and the main display will show (typically):

This is one of the displays for Input Range Selection (see Subsection 6.2.1). Release the Raise and Lower keys.

With the main display static (i.e. not flashing), each depression of the FUNC key will now cause the displays to step through the sequence of Configuration Mode functions:

- Input Range selection
- Alarm 1 type selection
- Alarm 2 type selection

These functions are accessed in a cyclic manner i.e. depression of the FUNC key when the last function in the sequence is selected will cause the Input Range Selection displays to appear again.

6.2 CONFIGURATION MODE FUNCTIONS

6.2.1 Input Range Selection

When this function is selected, initially the "units" display will show:

and the main display will be of the form:

which is the numeric part of a T---- product code. This will be for a Thermocouple/DC Linear input, or an RTD input - dependent upon the setting of the switch S1 on the CPU Board (see Subsection 7.2 and Table 7-1). The input ranges available are:

Thermocouple*/DC Linear Input**

Type	Range	Code
R	0 to 1650°C	T1127
R	32 to 3002°F	T1128
S	0 to 1650°C	T1227
S	32 to 3002°F	T1228
J	0 to 205°C	T1415
J	32 to 401°F	T1416
J	0 to 450°C	T1417
J	32 to 842°F	T1418
J	0 to 760°C	T1419
J	32 to 1400°F	T1420
T	-200 to -260°C	T1525
T	-328 to -500°F	T1526
T	0 to 260°C	T1541
T	32 to 500°F	T1542
K	0 to 760°C	T1719
K	32 to 1400°F	T1720
K	0 to 1371°C	T1723
K	32 to 2500°F	T1724
L	0 to 205°C	T1815
L	0 to 450°C	T1817
L	0 to 760°C	T1819
B	212 to 3308°F	T1934
B	100 to 1820°C	T1938
DC	0 - 20mA	T3413
DC	4 - 20mA	T3414
DC	0.2 - 1V	T4415
DC	1 - 5V	T4434
DC	0 - 50mV	T4443
DC	0 - 1V	T4444
DC	0 - 5V	T4445
DC	10 - 50mV	T4499

RTD Input **

Range	Code
0 to 500°C	T2221
32 to 1112°F	T2222
32 to 572°F	T2229
-101.0 to +100.0°C	T2230
-150.0 to +212.0°F	T2231
0 to 300°C	T2251
0.0 to 100.0°C	T2295
32.0 to 212.0°F	T2296
200 to +205°C	T2297
-328 to +401°F	T2298
-101.0 to +300.0°C	T7201
-150 to +572°F	T7202

* For break protection selection, see Table 7-1.

** For CPU Board switch settings, see Table 7-1.

The operator may select the required input product code as follows:

1. Use the Raise/Lower keys to step through (on the main display) the input product codes available in numerical order of product code and in a cyclic manner. As soon as the main display is changed, it will flash (indicating that the code shown has not been confirmed for selection).

2. When the desired product code is displayed, depress the **FUNC** key to confirm selection. The main display will cease to flash.

NOTE

If the main display flashes for more than ten seconds without any key activity, it will revert to its original (static) display.

Whilst this function's *static* (i.e. not flashing) displays are shown, depression of the **FUNC** key will cause selection of the Alarm 1 Type function.

6.2.2 Alarm 1 Type

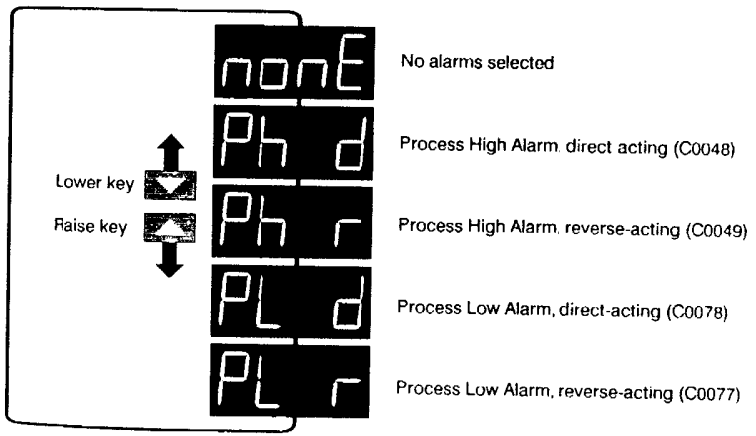
Selection of this function will cause the "units" display to show:

If one alarm fitted *If two alarms fitted*

indicating that Alarm 1 Type parameters are displayed, and the main (static) display to be of the form:

The alarm type may be selected as follows:

1. Use the Raise/Lower keys to step through, in a cyclic manner, the following sequence on the main display:



As soon as the main display is changed, it will flash (indicating that the displayed alarm type has not been confirmed for selection).

2. When the desired alarm type is displayed, confirm the selection by depressing the **FUNC** key, whereupon the main display will become static.

NOTE

If the main display flashes for more than ten seconds without any key activity, it will revert to its original (static) display.

Whilst this function's *static* (i.e. not flashing) displays are shown, depression of the **FUNC** key will cause selection of the Alarm 2 Type function. The default setting is Process High Alarm, direct-acting.

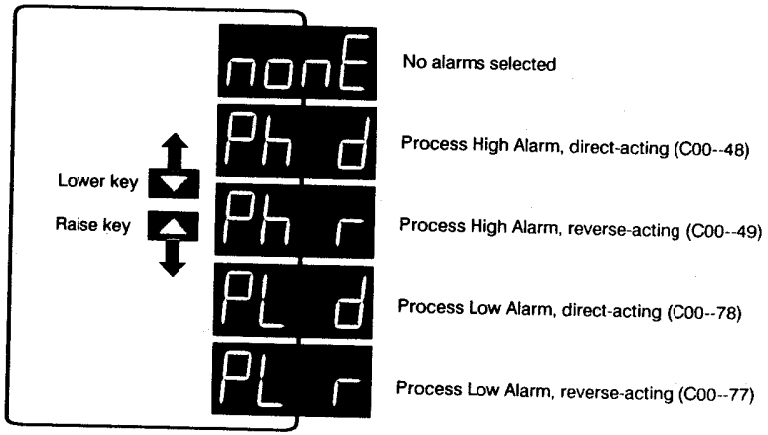
6.2.3 Alarm 2 Type

Selection of this function will cause the "units" display to show:

indicating that Alarm 2 Type parameters are being displayed, and the main (static) display will be of the form:

The Alarm 2 Type may be selected as follows:

1. Use the Raise/Lower keys to step through, in a cyclic manner, the following sequence on the main display:



As soon as the main display is changed, it will start to flash (indicating that the displayed alarm type has not been confirmed for selection).

2. When the desired alarm type is displayed, confirm the selection by depressing the **FUNC** key, whereupon the main display will become static.

NOTE

If the main display flashes for more than ten seconds without any key activity, it will revert to its original (static) display.

Whilst this function's *static* (i.e. not flashing) displays are shown, depression of the **FUNC** key will cause selection of the Input Range function. The default setting for Alarm 2 is **None**.

6.3 CHANGING INPUT TYPE

If it is required to change the type of input (Thermocouple/DC Linear to RTD or vice versa), this may be achieved by altering the setting of switch S1 on the CPU Board; this switch is accessible through one of the ventilation slots on the underside of the Controller (see Figure 6-1); the setting may be changed using a thin-bladed screwdriver. The required input range may then be selected as described in Subsection 6.2.1. When changing between thermocouple, RTD and DC input, it may be necessary to alter switch settings on the CPU Board - see Table 7-1.

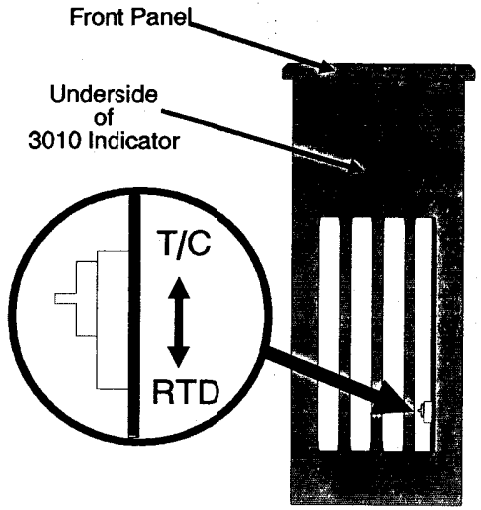


Figure 6-1 Switch Selection of Input Type

WARNING

Before any adjustments are made, all external wiring to the Controller's terminals must be disconnected.

NOTE

If the input is changed from Thermocouple to RTD, the Cold Junction Compensation sensor between Terminals 1 and 2 (at the rear of the Controller - see Figure 6-2) must be removed. If the input is being changed from RTD to Thermocouple, a Cold Junction Compensation sensor (Part No. 26173) must be fitted in this position.

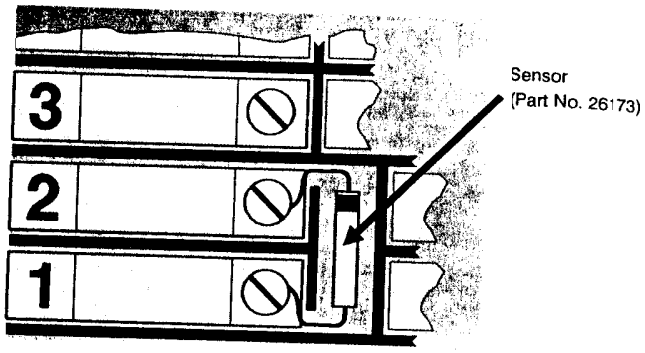


Figure 6-2 Cold Junction Compensation Sensor

6.4 EXITING FROM CONFIGURATION MODE

An exit may be made from Configuration Mode using any one of the follwing three methods:

(a) Temporarily remove power from the Controller.

(b) Depress and hold down the Raise and Lower keys simultaneously for a quarter of a second; after this time delay an exit is made from Configuration Mode and the normal Process Variable User Mode display is restored.

(c) No key activity for two minutes will cause an automatic exit from Configuration Mode, restoring the normal Process Variable User Mode display.

SECTION 7
INTERNAL LINKS/SWITCHES

The Indicator has options and variants which require changes to link jumpers and switches on the CPU Board and, if fitted, the Options Board. In order to gain access to these link jumpers/switches, it is necessary to dismantle the Indicator.

7.1 DISMANTLING THE INDICATOR

NOTES

1. Before starting the dismantling procedure, ensure that the mains (line) supply has been disconnected from the Indicator.

2. The Indicator contains devices which are vulnerable to damage from electrostatic discharge. In order to minimise the risk of such damage occurring during the handling of the Indicator and its sub-assemblies, it is recommended that certain precautions be taken:

   (a) Never touch the tracks or components (except the link jumpers) on the PCBs.

   (b) Before handling a PCB, momentarily touch a convenient earthing point (e.g. a metal bench or rack) in order to discharge most of the static electricity stored.

   (c) Wear a wrist earthing strap.

3. The Indicator also contains a lithium battery on the CPU Board. When removing the CPU Board from the Indicator, ensure that it is not placed on a conducting surface; such contact would short-circuit the battery. IF IT IS REQUIRED TO CHANGE THE BATTERY, THIS OPERATION SHOULD BE PERFORMED BY A TRAINED TECHNICIAN.

7.1.1 Withdrawing the Indicator from its Housing

1. With an appropriate size screwdriver (5mm or 3/16-inch flat blade), rotate the locking screw (on the left-hand side of the Indicator front panel) in an anticlockwise direction to dis-engage the Indicator rear conectors from their sockets within the housing. Continue rotating the locking screw anticlockwise until the screw is free from its bush in the Indicator housing.

2. Gently withdraw the Indicator from its housing.

7.1.2 Separating the PCBs (If an Options Board is Fitted)

If the Indicator has an Options Board fitted, it will be necessary to separate the two PCBs (the CPU Board and the Options Board) in order to gain access to the link jumpers. This is achieved as follows:

1. Extract the screw securing the CPU Board (in the lower position as viewed from the front of the Indicator) to the bracket attached to the front panel assembly.

2. Grasp the guides (projecting to the rear from the right-hand side of the front panel - see Figure 7-1) and pull them outwards until the edges of the PCBs are released and the PCBs can be withdrawn backwards; grasp the guides on the left-hand side of the front panel and dis-engage the edges of the PCBs. The two PCBs may then be removed from the front panel assembly.

3. Extract the screw securing the Options Board to the pillar on the CPU Board (see Figure 7-2). Carefully pull the two Boards apart, ensuring that the two Boards remain parallel to each other in order that the plugs and sockets linking the two Boards are not bent or distorted.

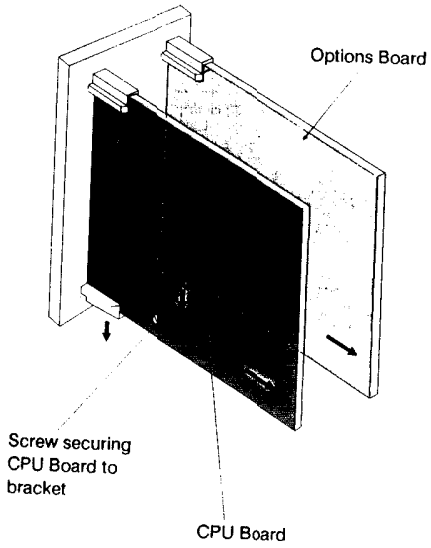


Figure 7-1 Detaching the PCBs from the Front Panel

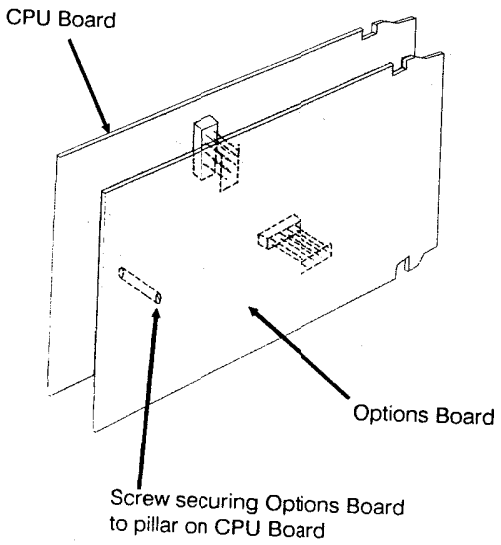


Figure 7-2 Separating the Two PCBs

7.2 SELECTING THERMOCOUPLE BREAK PROTECTION AND DC INPUT RANGE

The thermocouple break protection and DC input range are selected by means of the DIL switch on the CPU Board (see Figure 7-3). Switch settings are as shown in Table 7-1.

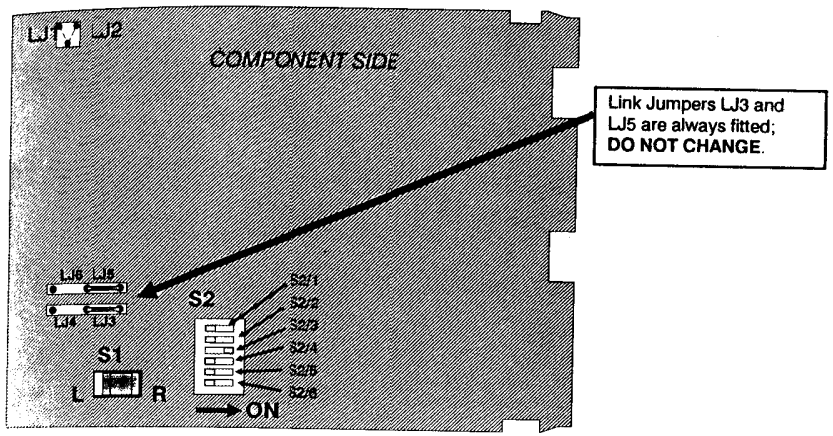


Figure 7-3 CPU Board Link Jumpers

Table 7-1 Input Type/Break Protection Selection

Thermocouple Break Protection (selected by S2/3 and S2/4 only):

Break Protection Type	Input Product Code	S1	S2/1	S2/2	S2/3	S2/4	S2/5	S2/6
Upscale	T----	R	OFF	ON	*OFF*	*ON*	OFF	OFF
Downscale	T1---21	R	OFF	ON	*ON*	*OFF*	OFF	OFF
No protection	T1---22	R	OFF	ON	*OFF*	*OFF*	OFF	OFF

See Subsection 6.2.1 for input range selection.
See Subsection 6.3 for fitting the Cold Junction Compensation sensor.
See Subsection 7.4 for °C/°F indication.

RTD Input Selection (selected by S2/1 only):

Input Product Code	S1	S2/1	S2/2	S2/3	S2/4	S2/5	S2/6
T2--- & T7---	L	OFF	ON	OFF	OFF	OFF	OFF

See Subsection 6.2.1 for input range selection.
See Subsection 6.3 for Cold Junction Compensation sensor removal.

DC Input Selection:

Input Product Code	S1	S2/1	S2/2	S2/3	S2/4	S2/5	S2/6
T4415, T4434, T4444 & T4445	R	OFF	OFF	OFF	OFF	ON	OFF
T3413 & T3414	R	OFF	OFF	OFF	OFF	ON	ON
T4443 & T4449 (Upscale Break Protection) *	R	OFF	ON	OFF	ON	OFF	OFF

* For Downscale and no Break Protection, see switch settings for T1---21 and T1---22 above.
See Subsection 6.2.1 for input range selection.

7.3 ALARM 2 OUTPUT OPTIONS BOARD (TYPE 450)

This Options Board provides the optional Alarm 2 output. Link jumpers should be fitted/parked as shown in Figure 7-4.

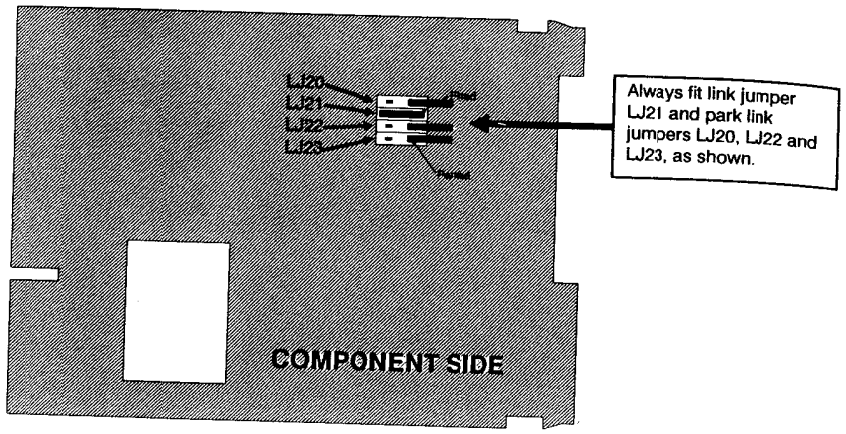


Figure 7-4 Options Board 450 - Link Jumpers

7.4 RS485 COMMUNICATIONS OPTIONS BOARD (TYPE 481)

This Options Board provides the RS485 Serial Communications facility (with or without the optional Alarm 2 output). Link jumpers should be fitted/parked as shown in Figure 7-5.

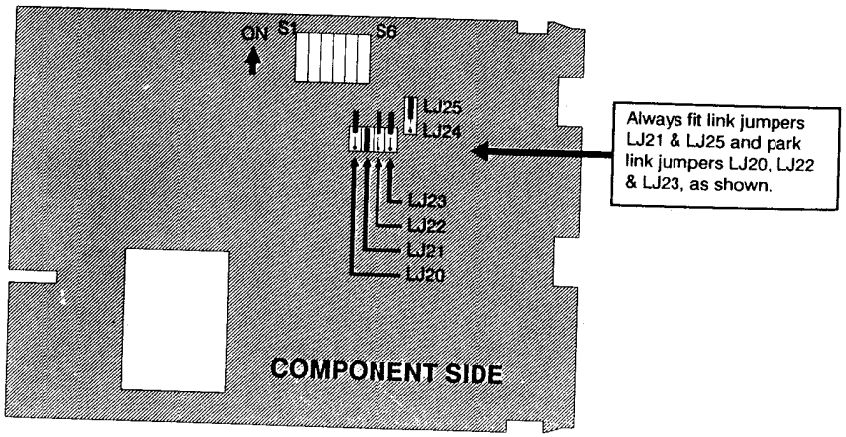


Figure 7-5 Options Board 481 - Link Jumpers

7.5 RECORDER OUTPUT OPTIONS BOARD (TYPE 496)

This Options Board provides the Recorder Output option (with or without the optional Alarm 2 output). The link jumpers should be fitted/parked/omitted as shown in Figure 7-6 . The Recorder Output range is determined by link jumpers on the Options Board, as shown in Table 7-6.

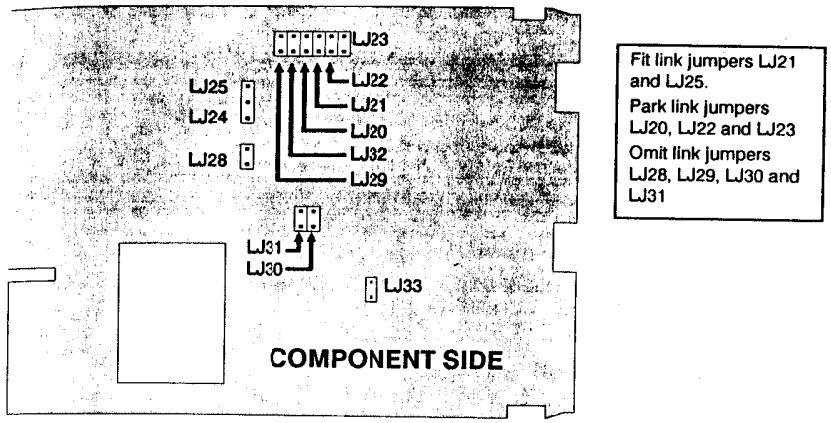


Figure 7-6 Options Board 496 - Link Jumpers

Table 7-2 Recorder Output Range Selection

Recorder Output Product Code	Recorder Output Range	Link Jumpers LJ32	Link Jumpers LJ33
X12	0 - 5V	P	X
X18	0 - 20mA	P	P
X19	4 - 20mA	X	P
X20	1 - 5V	X	X

X = Fitted P = Parked

7.6 CHANGING THE MAINS (LINE) SUPPLY VOLTAGE

On the CPU Board, link jumper LJ1 is fitted for operation on a 193 - 264V supply (Product Code L01) and link jumper LJ2 is fitted for operation on a 100 - 132V supply (Product Code L02). It is not possible to re-configure the Indicator to/from 24V operation (Product Code L04).

7.7 ASSEMBLING THE INDICATOR

7.7.1 Fitting the Options Board to the CPU Board (if required)

1. Hold the two Boards side-by-side with the component sides facing each other and the PCB connectors aligned.

2. Carefully align the multi-pin plugs on the Options Board with the sockets on the CPU Board and gently engage the plugs and sockets.

3. Insert the screw (made available during the previous separation of the Boards) through the hole in the Options Board into the pillar on the CPU Board and tighten until both Boards are secured together.

7.7.2 Fitting the Board(s) to the Front Panel Assembly

1. Align the Boards with the guides attached to the front panel; the CPU Board (the PCB with the transformer) should be in the lower position as viewed from the front. Ensure that the plugs on the CPU Board are aligned with the sockets on the Front Panel Assembly.

2. Push the Boards into the guides until all the teeth on the Boards locate firmly into the holes in the guides.

3. Insert the screw (made available during the previous dismantling of the Indicator) through the CPU Board into the bracket attached to the front panel; tighten the screw to secure the Boards in position.

7.7.3 Fitting the Indicator into its Housing

1. Carefully slide the Indicator, rear end first, into the housing, ensuring that the Boards locate against the outside of the guides moulded into the sides of the housing.

2. Push the Indicator firmly into position in order that the rear connectors on the boards make good connection with the terminals at the rear of the housing.

3. Engage the locking screw (on the left-hand side of the front panel) in its bush in the housing and tighten until the Indicator is secured in its housing.

APPENDIX A
SPECIFICATION FOR 3010 DIGITAL INDICATOR

INPUT

Input Types:	Thermocouple, Resistance Temperature Detector (RTD) and DC Linear.
Common Mode Rejection:	Negligible effect up to 264V 50/60Hz.
Series Mode Rejection:	1000% of span (at 50/60Hz) causes negligible effect.
Thermocouple Break Protection:	Upscale (standard), downscale (optional) or none (optional).
Thermocouple Calibration:	Complies with BS4937, NBS125 and IEC584 standards.
RTD (Pt100) Calibration:	Complies with BS1904 and DIN43760 standards.

OUTPUTS

Alarm 1:	Configurable from front panel to be one of: (a) Process High Alarm, direct-acting (b) Process High Alarm, reverse-acting (c) Process Low Alarm, direct-acting (d) Process Low Alarm, reverse-acting
Alarm 2 (Optional):	Configurable from front panel to be one of: (a) Process High Alarm, direct-acting (b) Process High Alarm, reverse-acting (c) Process Low Alarm, direct-acting (d) Process Low Alarm, reverse-acting
Recorder Output (Optional):	
Output Range:	4 - 20mA or 0 - 20mA into 500 ohms maximum 1 - 5V or 0 - 5V; output impedance = 250 ohms
Resolution:	> 10 bits
Accuracy:	±0.5% of span
Temperature Stability:	±0.025%/°C
Transducer Power Supply (Optional):	20V - 28V DC (nominal 24V DC). Minimum load impedance = 910Ω (e.g. capable of 22mA at 20V DC).

RS485 SERIAL COMMUNICATIONS LINK

Three-wire transmit/receive operation, driven from an isolated power supply. Transmitters and receivers conform to EIA Standard RS485.

ENVIRONMENT

Reference Conditions

Ambient Temperature:	20°C ±2°C
Supply Voltage:	120V or 240V ±1% 50/60Hz ±1%
Thermocouple Source Resistance:	< 10Ω

RTD (Pt100):	< 0.1Ω per lead, both leads equal.
Relative Humidity:	60% - 70% non-condensing

Operating Conditions

Ambient Temperature:	0°C - +50°C (operating), −20°C - +60°C (storage)
Supply Voltage:	193V - 264V @ 50/60Hz 100V - 132V @ 50/60Hz
Maximum Source Resistance:	
Thermocouple:	< 1000Ω
RTD (Pt100):	< 5Ω per lead (equal resistance in each lead).

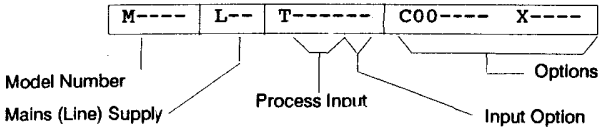
PERFORMANCE

Reference Accuracy:	Typically ±0.5% of span ±1lsd
Temperature Stability:	< 0.015% of span for 1°C change in ambient temperature.
Cold Junction Compensation:	< 0.1°C charge for 1°C change in ambient temperature.
Effect of Thermocouple Resistance:	< 0.1% of span error for resistance 0Ω - 100Ω.
Effect of RTD Lead Resistance:	< 0.1% of span error for 3Ω lead resistance.
Effect of Supply Voltage Change:	< ±0.1% of span error for supply voltage within specified limits.

GENERAL

Display:	Light-emitting diode (LED) display showing: 4-digit 7-segment numeric display One-character seven-segment display of 11 set-up parameter legends and four configuration parameter legends
Front Panel Controls:	Function Select Raise Lower
Dimensions:	Width: 96mm (3.78in) Height: 48mm (1.89in) Depth: 153mm (6.02in) Weight: 0.6kg (1.32lb)
Power Consumption:	Approximately 3VA.

APPENDIX B
PRODUCT CODES



MODEL NUMBER (M----)

M3010	USA and Europe

MAINS (LINE) VOLTAGE (L--)

L01	220V or 240V nominal supply
L02	110V or 120V nominal supply
L04	24V AC (nominal)

PROCESS INPUT - TYPE AND RANGE (T----)

Thermocouple

T1127	R	0 - 1650°C
T1128	R	32 - 3002°F
T1227	S	0 - 1650°C
T1228	S	32 - 3002°F
T1983	B	100 - 1820°C
T1984	B	212 - 3308°F
T1415	J	0 - 205°C
T1416	J	32 - 401°F
T1417	J	0 - 450°C
T1418	J	32 - 842°F
T1419	J	0 - 760°C
T1420	J	32 - 1400°F
T1525	T	-200 - +260°C
T1526	T	-328 - +500°F
T1541	T	0 - 260°C
T1542	T	32 - 500°F
T1719	K	0 - 760°C
T1720	K	32 - 1400°F
T1723	K	0 - 1371°C
T1724	K	32 - 2500°F
T1815	L	0 - 205°C
T1817	L	0 - 450°C
T1819	L	0 - 760°C

Thermocouple Break Protection

T----21	Downscale Break Protection
T----22	No Break Protection

Three-wire Resistance Temperature Detector (RTD)

T2230	−101.0 to +100.0°C
T2231	−150.0 to +212.0°F
T7201	−101.0 to +300.0°C
T7202	−150 to −572°F
T2297	−200 to +205°C
T2298	−328 to +401°F
T2295	0.0 to +100.0°C
T2296	32.0 to 212.0°F
T2251	0 to 300°C
T2229	32 to 572°F
T2221	0 to 600°C
T2222	32 to 1112°F

DC Linear

T4443	0 - 50mV
T4499	10 - 50mV
T4444	0 - 1V
T4415	0.2 - 1V
T4445	0 - 5V
T4434	1 - 5V
T3413	0 - 20mA
T3414	4 - 20mA

OPTIONS

Alarm 1 Options C00--

Alarm 1 fitted as standard - Process High Alarm direct-acting fitted if none specified

C0048	Process High Alarm (relay), direct-acting
C0049	Process High Alarm (relay), reverse-acting
C0078	Process Low Alarm (relay), direct-acting
C0077	Process Low Alarm (relay), reverse-acting

Alarm 2 Options (Alarm 1 Fitted as Standard)

C00--48	Process High Alarm (relay), direct-acting
C00--49	Process High Alarm (relay), reverse-acting
C00--78	Process Low Alarm (relay), direct-acting
C00--77	Process Low Alarm (relay), reverse-acting

Recorder Output Options

X12	0 - 5V
X18	0 - 20mA
X19	4 - 20mA
X20	1 - 5V

Independent Options

X06	RS485 Serial Communications (see NOTE 1 below)
X08	Input Transducer Power Supply (see NOTE 2 below)
X69	Spade Tags (Faston)
X73	1/4 - 1/8DIN Conversion Plate

NOTES

1. The RS485 Serial Communications (X06) option is not available if a Recorder Output (X12, X18, X19 or X20) is selected, or vice versa.
2. The Input Transducer Power Supply (X08) option is not available if a Recorder Output (X12, X18, X19 or X20) is selected, or vice versa.

Alphabetical Index

A

AL 1 Indicator, function of 1-2
AL 2 Indicator, function of 1-2
Alarm types available A-1
Automatic Exit from Set-Up Mode 4-4

C

Cold Junction Compensation Sensor
  When to install/remove 6-5
Configuration Mode
  Entry into 6-1
  Exit from 6-6
Cut-out Dimensions
  Multiple indicators 2-1
  Single indicator 2-1

E

Environmental conditions required A-1

F

FUNC key, function of 1-2

H

Handling precautions 2-2, 7-1

I

Input ranges available 6-2
Invalid Set-Up Parameter Adjustment
  Indication of 4-2

L

Lower key, function of 1-2

M

MAX Indicator, function of 1-2
Maximum Hold
  Display of value 3-1
  Reset 3-2
MIN Indicator, function of 1-2
Minimum Hold
  Display of value 3-1
  Reset 3-2
Mounting clamp, use of 2-2
Mounting panel specification 2-1

O

Overall Dimensions 2-1

P

Process Variable Offset
  Indication of presence of 3-1
Process Variable Out-of-Range display 3-1

R

Raise key, function of 1-2
Recorder Output ranges available A-1
RS485 Communications
  Message Formats 5-3
  Type 1 Message format 5-3
  Type 2 Message format 5-3
  Type 3 Message format 5-4
  Type 4 Message format 5-5
RTD extension leads, specification 2-5

S

Safety requirements 2-4
Set-Up Mode
  Entry into 4-1
  Exit from 4-4
  Parameter display sequence 4-1

T

Thermocouple cables, routing of 2-5
Transducer Power Supply, specification 2-7, A-1