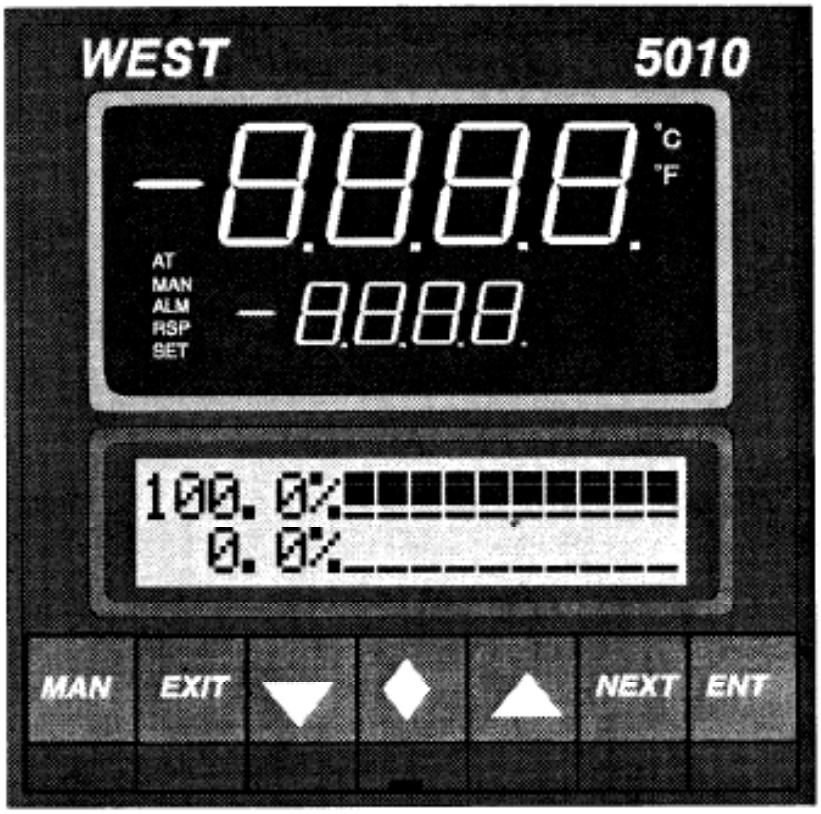
ISE, Inc

WEST 5010
INDUSTRIAL CONTROLLER

Site Manual

SM-0052-C0



WEST INSTRUMENTS

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PREFACE

This manual is intended for use in support of the installation, commissioning, configuration and day-to-day operation of the WEST 5010 Industrial Controller.

Our policy is one of continued improvement and, consequently, the information contained in this publication may differ in some respects from the instrument in question. Therefore, this document does not constitute an offer or part of an offer for sale.

CAUTION

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

MODEL 5010 INDUSTRIAL CONTROLLER SITE MANUAL

SM-0052-C0

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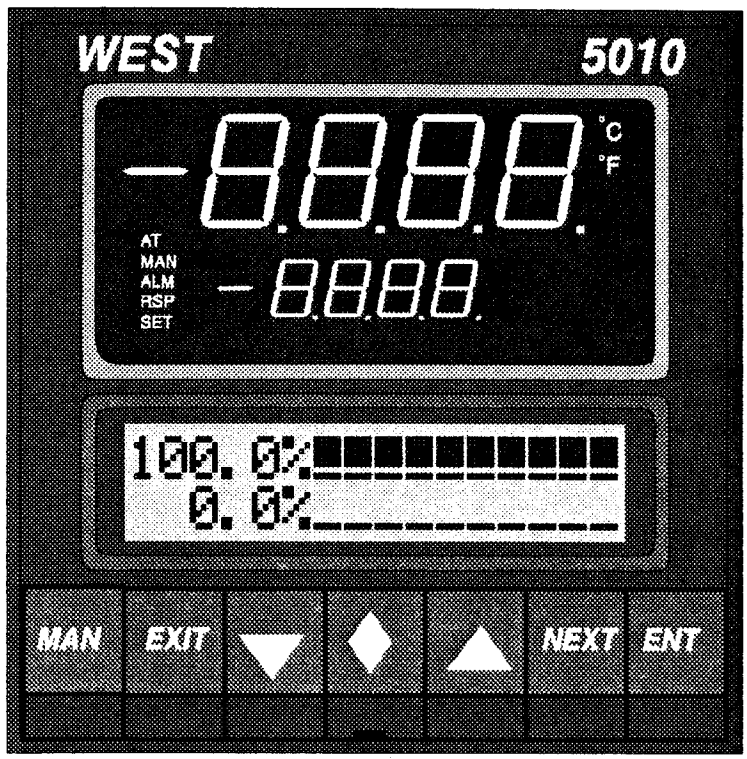


The WEST Model 5010 is a single-loop industrial controller equipped, as standard, with one universal input and two universal outputs. The sample rate on the input is selectable to be either 6 samples/second or 20 samples/second. The first universal output is always the primary control (HEAT) output or the clockwise VMD control output; the second universal output may be (a) an alarm output, (b) secondary control - i.e. a COOL output or anti-clockwise VMD control output - or (c) a re-transmitted output. Additional features include:

- PID control algorithms
- Auto/Manual control selection
- Gain Scheduling
- Self-Tune
- Pre-Tune
- Programmable digital input filter

With the range of options available (see Subsection 1.4), the Controller may be configured in any one of a variety of forms, typically:

(a) One HEAT output and three hardware alarms, or

(b) One HEAT output, one COOL output and two hardware alarms, or

(c) One HEAT output, one re-transmitted process variable value output, one re-transmitted set point value output plus one hardware alarm.

1.1 OPERATING MODES

The Controller has three operating modes:

Operator Mode: the normal mode for day-to-day operation. For full details of the Operator Mode, refer to Section 2.

Set-Up Mode: This mode is entered when it is necessary to commission (or re-commission) the Controller for a particular purpose. For full details of the Set-Up Mode, refer to Section 4.

Configuration Mode: Used to define the operation/configuration of the Controller for a particular application. For full details of the Configuration Mode, refer to Section 6.

1.2 OPERATOR CONTROLS, INDICATORS AND DISPLAYS

The 5010 Controller front panel is equipped with:

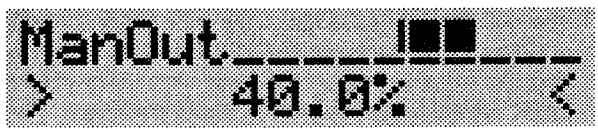
(a) A two-line alphanumeric LED display
(b) A 2 x 16 dot matrix LCD display
(c) Discrete back-lit legends
(d) Seven control keys

The functions of these displays, indicators and controls are dependent upon the current operating mode. For a description of the operation of these displays, indicators and controls, refer to:

(a) Section 2 of this Manual (for Operator Mode)
(b) Section 4 of this Manual (for Set-Up Mode), and
(c) Section 6 of this Manual (for Configuration Mode).

1.3 NUMERICAL EDITING (ADJUSTMENT) OF DISPLAYED VALUES

In all operating modes of the 5010 Controller. a single method is used to edit or adjust displayed numerical values. The parameter to be adjusted appears in the LCD display in the form:



in which the parameter value (on the lower display line) is enclosed in the Numeric Edit cursor characters. The keys used to change numeric values are:


Up key (used to increase value)


Down key (used to decrease value)


ALT key (used to modify rate of change of value)

The three-speed method of changing numerical values operates as follows:

Key(s) Depressed	Rate of Change
Up or Down	Slow
ALT/Up or ALT/Down	Medium
ALT alone immediately after ALT/Up or ALT/Down	Fast

1.4 OPTIONS AND VARIANTS

The following options are available for the 5010 Controller:

- Two additional universal outputs
- An auxiliary input which can be used to accept (a) an analogue (linear) Remote Setpoint input, or (b) a feedback/valve position indication signal for VMD applications.
- A digital input (DI1) which permits exterior selection of setpoint (switching between Setpoint 1/Setpoint 2 or Remote/Local Setpoint) or external switching between Auto/Manual Control. This option is available automatically on Controllers with VMD output or with four universal outputs; otherwise it must be ordered specifically.
- A serial communications port (RS232C, three-wire RS485 or five-wire RS485).
- Real Time Clock which gives the 5010 Controller the facility for up to eight pre-programmed events to be triggered at user-defined times of day/week and for alarm events to be logged. An internal back-up feature enables the Real Time Clock option to continue running for up to seven days in the event of a mains (line) power failure. The facilities added to each of the operating modes are:

Operator Mode:	Viewing Real Time Clock current setting
	Viewing current events
	Viewing alarm status (including whether alarms are inhibited or not)
Set Up Mode:	Setting the Real Time Clock
	Defining events
	Switching events on/off
	Enabling/disabling alarm logging
	Manually inhibiting alarms
Configuration Mode:	Selecting universal outputs to operate as event outputs

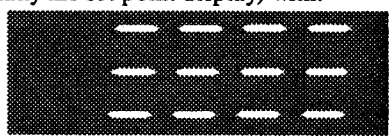
For more details of the options and variants available, refer to Appendix A.

1.5 SYSTEM INTEGRITY

The 5010 Controller is designed to meet EMI Emission Standard EN 55022 and EMI Susceptibility Standard EN55101; Digital filtering is incorporated to remove extraneous impulses on the process variable input. Low-power CMOS circuits are used extensively to minimise power dissipation (and hence maximise reliability). Hardware and software watchdogs are utilised to ensure trouble-free operation. The Controller contains high-integrity memory devices and is manufactured to BS 5750 Part 2 quality level.

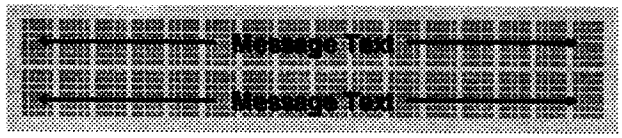
1.6 EXCEPTION MESSAGES

In the course of operation, a condition may arise in which it is necessary that persistent indication of that condition be given to the User (e.g. a hardware error), *whatever operating mode is in force at the time*. This type of condition is called an Exception Condition. An exception message will be generated, containing brief information on that condition; when such messages are generated, the front panel will indicate the existence of the message(s) by flashing the small LED display (normally the set point display) with:



Depression of the Up and Down keys simultaneously for more than two seconds will obtain the View/Setup Menu. The **NEXT** key should then be depressed repeatedly until the LCD display shows:

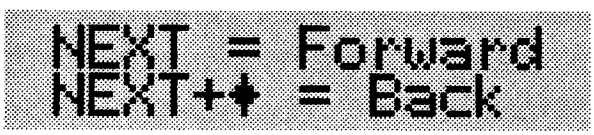
Depression of the **ENT** key will then cause display of the (first) exception message(s) in the form:



If more than one exception message exists, the User may then step through them by using the **NEXT** key. When an exception message is displayed, if corrective action is possible in the Controller's software, depression of the **ENT** key will implement that action. Alist of exception messages is given in Appendix C.

1.7 SHADOW SCREENS

Help information on most functions is available to the user in the form of self-explanatory Shadow Screens which, in most cases, explain the current display or prompt for some operator key action.. The Shadow Screen for the function currently being executed may be displayed by pressing (and holding down) the ALT key (see Subsection 2.1.2). The Shadow Screen will disappear as soon as this key is released. Throughout this manual, there will be no description of the Shadow Screen for a function unless that Shadow Screen serves a special purpose, in which case it will be illustrated in the description of that function. Typical Shadow Screens are shown below:

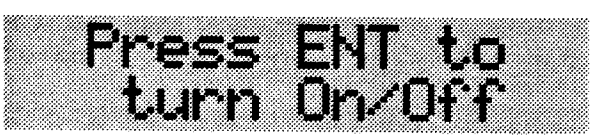


MEANING: Press the **NEXT** key to move to the next item/display in a series; hold down the ALT key and press the **NEXT** key to move to the previous item/display.

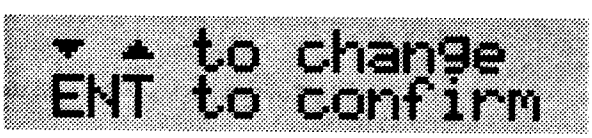
MEANING: Press the **EXIT** key to return to the menu from which the current display was selected.

MEANING: Press the **ENT** key to select the currently-displayed option; press the **NEXT** key to move to the next option in the sequence.

MEANING: Use the Up/Down keys to alter the value of the displayed parameter; press the **NEXT** key to move to the parameter in the series.



MEANING: The currently-displayed parameter/facility can be either ON or OFF. Press the **ENT** key to change the current setting.



MEANING: Use the Up/Down keys to select one of a specific range of settings of the displayed parameter; press the **ENT** key to confirm the new setting.

SECTION 2
OPERATOR INSTRUCTIONS

This Section describes the day-to-day operating mode of the 5010 Controller. In this mode, the operator may:

- View key parameters (Read Only displays)
- Change selected parameters (Read/Write displays)
- If the Real Time Clock Option is fitted:
  - View the current setting of the Clock
  - View current events
  - View alarm status

Some of the displays accessible to the Operator in this mode are mandatory and cannot be de-selected; others are defined in Set Up Mode (see Subsection 4.3.12). The mandatory displays are:

Read Only Displays:

Output power bar graph

Alarm status display (plus associated shadow screens)

Read/Write Displays:

Set point adjustment (single or dual set point)

Active set point display/selection (if dual set point is configured and if operator selection of set point is enabled in Configuration Mode - see Subsection 6.5)

Tuning On/Off selection

2.1 OPERATOR DISPLAYS, CONTROLS AND INDICATORS

The 5010 Controller displays, controls and indicators are shown in Figure 2-1.

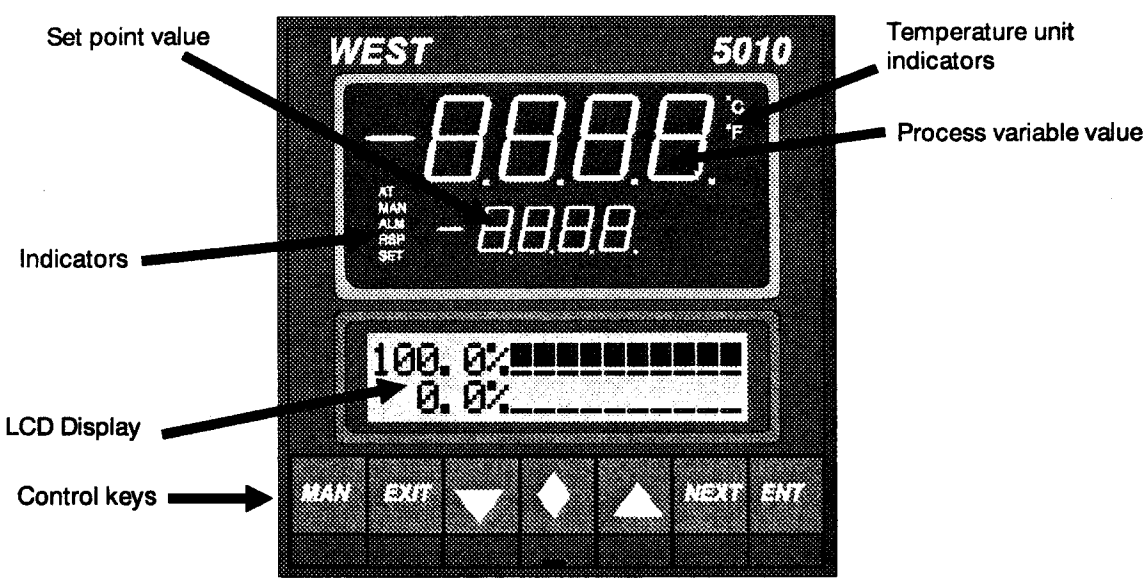


Figure 2-1 5010 Controller Front Panel

2.1.1 Displays

2.1.1.1 LED DISPLAYS

The Controller is equipped with two LED display areas. The upper (larger) display normally shows the value of the process variable whilst the lower (smaller) display shows the value of the set point.

2.1.1.2 LCD DISPLAY

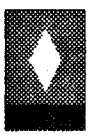
The LCD display area is used to display numeric parameter values, menus, shadow screens and the output power bar graph.

2.1.2 Controls

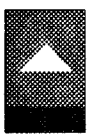
The seven operator controls and their functions in Operator Mode are as follows:

MAN key: This is used to select Manual Control or Automatic Control, if such selection is enabled in Set Up Mode (see Subsection 4.3.10). Each depression of this key will change the mode from Auto to Manual or vice versa.

EXIT key: In Operator Mode, this key is used to return from a read/write display to the read-only displays.



ALT key: Used to modify the action of the Up, Down and **NEXT** keys and (when depressed alone), to call up the appropriate Shadow Screen (see Subsection 1.7). The key-modifying actions are described in the following paragraphs, where applicable.



Up key: Used to increment the value of the displayed parameter. The increment rate may be changed by using this key in conjunction with the **ALT** key (see above and Subsection 1.3).

Down key: Used to decrement the value of the displayed parameter. The decrement rate may be changed by using this key in conjunction with the **ALT** key (see above and Subsection 1.3).

NEXT key: Used to select the next display (in a sequence of read- only dislpays) or (in a read/write display) to move the cursor to the next field or the first field in the next read/write display. The direction of movement is reversed if the **ALT** key is held down whilst this key is used.

ENT key: Used to select the Set Point Edit display (when a read-only display is shown), to confirm a selection, or to answer "yes" to a prompt.

2.1.3 Indicators

The Controller is equipped with the following indicators:

AT When ON, this indicates that Automatic Tuning is active. When flashing, indicates that Pre-Tune is active.

MAN Indicates whether Auto control or Manual control is selected (OFF = Auto, ON = Manual)

ALM When ON, indicates that an alarm is active.

RSP Indicates the active setpoint (ON = remote setpoint, OFF = local setpoint)

SET When ON, indicates that the Controller is in the Set Up Mode. When flashing, indicates that the Controller is in Set Up Mode but with Read Only displays (invalid password entered).

2.2 POWERING-UP THE CONTROLLER

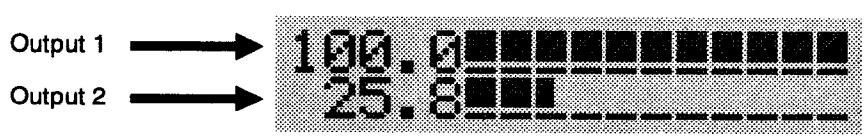
On switch-on, the Controller will briefly display all segements of its LED displays in a self-test mode. When this is complete, the upper (larger) LED display will show the current process variable value, the lower (smaller) LED display will show the currrent value of the (currently active) set point and the LCD display will show the read-only display selected as the start-up display in Set Up Mode (see Subsection 4.3.12.2). The default start-up display is the output power bar graph (see below).

2.3 STANDARD OPERATOR READ-ONLY DISPLAYS

2.3.1 Output Power Bar Graph

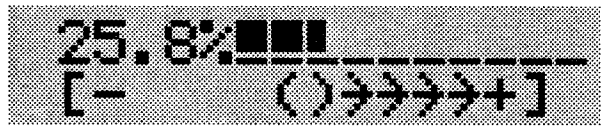
Unless another start-up display is defined in Set Up Mode (see Subsection 4.3.12.2), the output power bar graph is displayed automatically when the Controller has completed its self-test routine after power-up. If a different start-up display is defined, the output power bar graph display can be selected using the **NEXT** key. The display is of the form:

for a single output Controller or of the form:



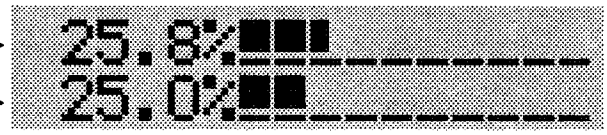
for a dual output Controller, or of one of the forms:

Open Loop VMD Output



Open Loop VMD Output with Valve Position Indication

Output Power →
Valve Position →



Closed Loop VMD Output

for a Controller with VMD output. For all VMD outputs, the user may specify the valve positions at which the valve is considered to be "Open" and "Closed" (see Subsection 6.12); for instance, as far as control of the process is concerned, it may be deemed that a valve which is 10% open may be considered to be closed and a valve which is 75% open may be considered to be open.

In the Open Loop VMD Output display, there is indication only that the valve is open/opening (arrows pointing to the "+ " sign), closed/closing (arrows pointing to the "–" sign) or stationary (no arrows). The sense of this indication is dependent upon the control output sense:

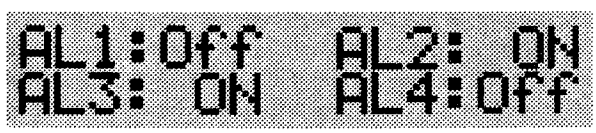
Reverse-acting:	SP > PV - Valve opens
	SP < PV - Valve closes
Direct-acting:	SP > PV - Valve closes
	SP < PV - Valve opens

In the display for Open Loop VMD with Valve Position Indication, there is the same "opening/closing" display on the lower line plus indication of the position of the valve (expressed as a percentage of total valve travel) on the upper line. The sense of the "opening/closing" display is as previously described.

In the Closed Loop VMD display, it is the percentage output power which is indicated (not the valve position).

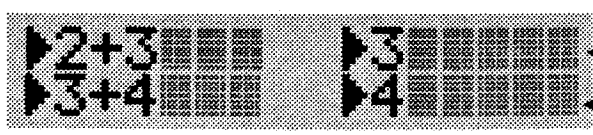
2.3.2 Alarm Status Display

This display is of the form:



which shows the current status of all the alarms (up to four). The alarms may be linked with the Controller's output(s); the linkage(s) may be displayed by depressing the **ALT** key which will display a Shadow Screen of the form:

Alarm 1 Linkages →
Alarm 3 Linkages →



← Alarm 2 Linkages
← Alarm 4 Linkages

the linkage for each alarm appearing in a position corresponding to that alarm in the alarm status display.

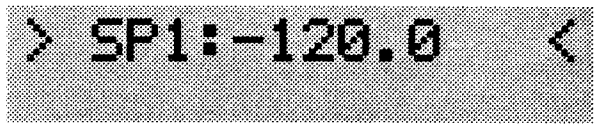
NOTE: The legend **(Soft)** appearing in any of the alarm status positions indicates that the associated alarm is not linked to any hardware output.

The alarm status display is selected using the **NEXT** key.

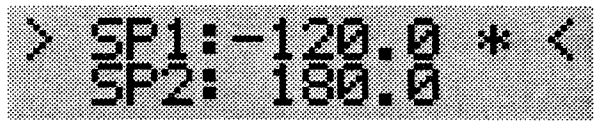
2.4 STANDARD OPERATOR READ/WRITE DISPLAYS

2.4.1 Set Point Adjustment

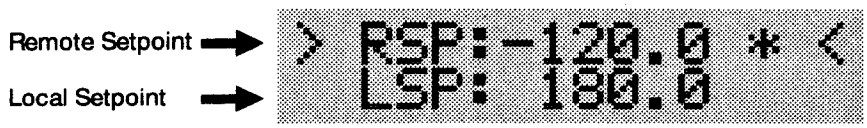
The operator may adjust the value(s) of the set point(s) and, if dual set points are configured and operator setpoint selection is enabled (see Subsection 6.5), select the setpoint to be currently active. The setpoint adjustment display is selected by depressing the **ENT** key when a read-only display is shown. This display is of the form:



for a single setpoint Controller, or:



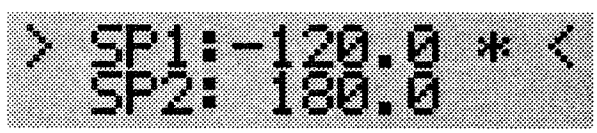
for a dual setpoint Controller, or:



for a Remote Setpoint Controller, the asterisk (in a dual setpoint or remote/local setpoint display) denoting the currently-active set point. The Up/Down keys (with the **ALT** key, if required) are used to change the value and, in the case of dual set points, the **NEXT** key is used to move the cursor from one field to the other:

2.4.2 Active Set Point Display/Selection

When a dual setpoint or remote/local setpoint adjustment display is shown, for example:



the setpoint selection display can be selected by depressing the **NEXT** key twice, whereupon the LCD display will be of the form:

NOTE

For a remote/local setpoint display, the remote setpoint is always Setpoint 1 and the local setpoint is always Setpoint 2.

The Up/Down keys can then be used to change the number of the active setpoint.

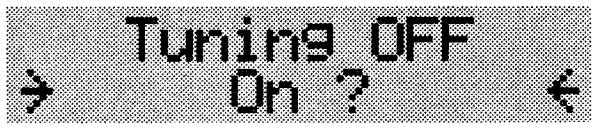
2.4.3 Tuning On/Off Display/Selection

NOTE

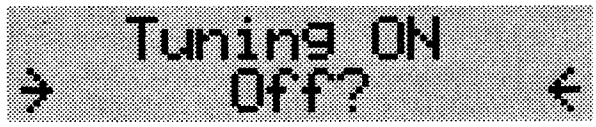
Tuning displays are not available if ON/OFF Control has been selected (see Subsection 6.7) or if the Controller has been configured for Open Loop VMD Output or Open Loop VMD Output with Valve Position Indication.

This display is selected as follows:

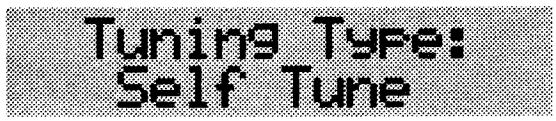
1. With the Controller displaying a read-only display, depress the **ENT** key to select the setpoint value(s) display.
2. If the Controller is configured for dual setpoints or remote/local setpoints and setpoint selection is enabled, depress the **NEXT** key to show the setpoint selection display.
3. Depress the **NEXT** key again, whereupon the LCD display will be of the form:



if tuning is currently inactive, or:



if tuning is currently active. The lower line in each case will appear only if the Tuning Lock has been disabled in Set Up Mode (see Subsection 4.3.11). Press the **ENT** key to change the tuning status or the **NEXT** or **EXIT** key to retain the current tuning status. Press the **ALT** key to obtain the Shadow Screen which indicates the type of tuning in use (see Subsection 4.3.3); this display is of the form:



and the lower line of this display will be one of:

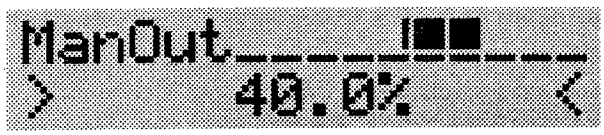
Gain Schedule	Gain Scheduling
Self Tune	Self-Tune
Pre+ Self Tune	Pre-Tune and Self-Tune
Pre-Tune	Pre-Tune
Manual Tune	Tuning Off

4. When the tuning is set as required (Off or On), depress the **NEXT** key to return to the set point value display or the **EXIT** key to return to the read-only displays.

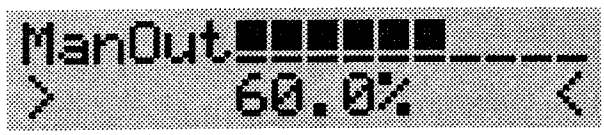
2.5 SELECTION OF AUTOMATIC/MANUAL CONTROL

If operator-selection of Automatic Control or Manual Control is enabled (see Subsection 4.3.10), the operator may change the control mode from Automatic to Manual or vice versa by depressing the **MAN** key.

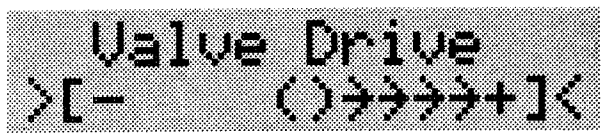
When Manual Control mode is first selected, the LCD display will show the Output Power Edit display automatically. The operator may subsequently re-select this display (from a read-only display) by depressing the **NEXT** key until the display appears. The Output Power Edit display is of one of the following forms (as appropriate):



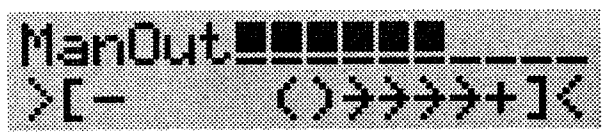
Dual Output; Output 1 (HEAT) set to 40%



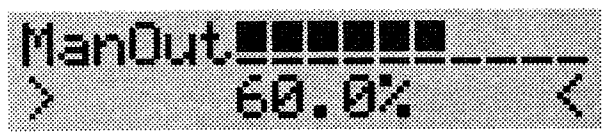
Single Output; 60% output power.



Open Loop VMD Output (valve opening/open)



Open Loop VMD Output with Valve Position Indication (valve opening/open)



Closed Loop VMD Output (60% output power applied)

For non-VMD outputs, the output power may be adjusted in the normal numerical editing manner (see Subsection 1.3). For VMD outputs, the Up key opens the valve and the Down key closes the valve.

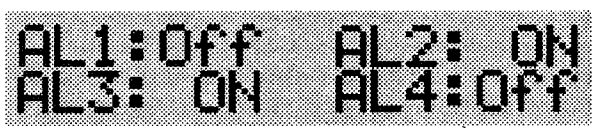
2.6 REAL TIME CLOCK DISPLAYS

If the Real Time Clock option is fitted, the displays available in Operator Mode are augmented with the following "Read Only" displays:

- Current date/time setting
- Current events
- Additional alarm status information

2.6.1 Viewing the Current Date/Time Setting

1. With the Controller showing the Alarm Status display:



(see Subsection 2.3.2), depress the **NEXT** key. The display will then change to the form:

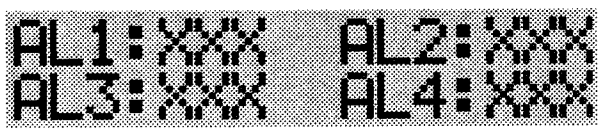
where the upper line shows the current day, date and time and the lower line (if any events have been defined and switched on) shows the event numbers; the most-recently activated event(s) will be indicated by flashing numbers.

2. Depress the **NEXT** key to display the details of the first of the events indicated by flashing numbers, in the form:

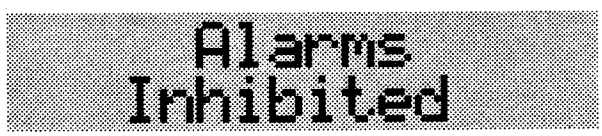
Information on the day/date settings can be displayed by depressing the ALT key. Another depression of the **NEXT** key will cause a return to the normal output power bar graph display or to the next user-defined Read Only display.

NOTE

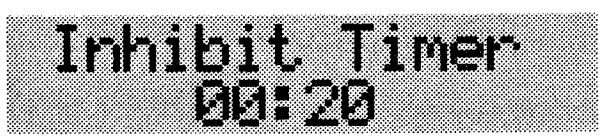
If the alarms have been inhibited, the Alarm Status display will show:



The Shadow Screen will then be:



if the alarms have been inhibited manually from the front panel keys (see Section 4) or:



if the alarms have been inhibited as a consequence of an event being triggered. This display indicates the length of time left (hours:minutes) to run before the Alarm Inhibit is removed.

2.6.2 Manually 'Waking"a 'Sleeping"Controller

If the Controller is in the "Sleep" state as a result of an event becoming active (see Section 4), the Controller may be manually "wakened" by simultaneously depressing the **MAN** and **ENT** keys for approximately five seconds. This will cause a simulated power-up sequence to be performed. All normal Operator Mode and Set Up Mode functions can then be accessed and executed. After all required operations have been completed, the Controller may be returned to the "Sleep" state (unless a WAKE event has meanwhile become active) by momentarily depressing the **MAN** and **ENT** keys simultaneously. **NOTE:** It is not possible to put an "awake" Controller to "sleep" manually unless it has previously been manually "wakened".

2.7 ADDITIONAL OPERATOR DISPLAYS

Other read-only and read/write displays may be made available to the operator, as the User requires (see Subsection 4.3.12). Refer to Section 4 for details of any displays added to the standard displays.

SECTION 3
INSTALLATION

3.1 UNPACKING

1. Remove the Controller from its packaging. The Controller is supplied with a mounting clamp, two screws and a panel sealing gasket.

NOTE

Retain the packing for future use, should it be necessary to transport the Controller 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 (on the Controller housing) corresponds to the Controller ordered.

3.2 PANEL-MOUNTING THE CONTROLLER

3.2.1 Pre-Requisites

The panel on which the Controller is to be mounted must be rigid and may be up to 6.00mm (0.25 inches) thick. The cut-out required for a single 5010 Controller is as shown in Figure 3-1.

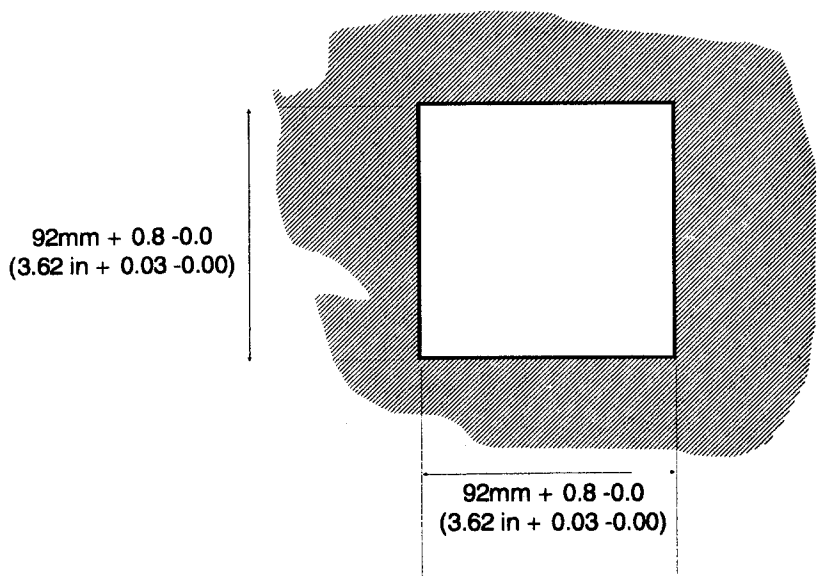


Figure 3-1 Mounting Panel Cut-out Dimensions

Several Controllers may be mounted side-by-side in a continuous cut-out, in which case the width of the cut-out (for n Controllers) should be:

(96n - 4) millimetres

or

(3.78n - 0.16) inches

The Controller is 160mm (6.30 inches) deep measured from the rear face of the front panel. The front panel is 96.00mm (3.80 inches) high. The Controller is 96.00mm (3.78 inches) wide and, when panel-mounted, projects out 12.50mm (0.50 inches) from the panel.

3.2.2 Panel-Mounting Procedure

1. If panel sealing is required, carefully press out the centre square from the gasket (the centre square is attached to the gasket at two points on each side). Tear the gasket backing sheet and peel of approximately one inch in order to provide a starting place for peeling the backing sheet off once the gasket is in place. Place the gasket around the Controller with the backing sheet facing the rear terminals of the Controller and gently push in stages until the non-adhesive face of the gasket is tight up against the rear face of the front panel (see inset in Figure 3-2). Ensure that the gasket is correctly positioned and is not creased, then remove the backing sheet from the adhesive face of the gasket.

2. Insert the rear of the Controller housing through the cut-out (from the front of the panel) and hold the Controller tightly in position against the panel, thereby sticking the sealing gasket (if used) to the front face of the mounting panel.

3. Slide the mounting clamp into place on the Controller (see Figure 3-2) and push it forward until it touches the rear of the mounting panel. Teeth on the arms which project to the rear of the clamp will engage with the ratchets moulded into the top and bottom surfaces of the Controller housing.

4. Gently tighten the screws in the clamp till 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 and, if the gasket is fitted, may reduce the sealing effect of the gasket..

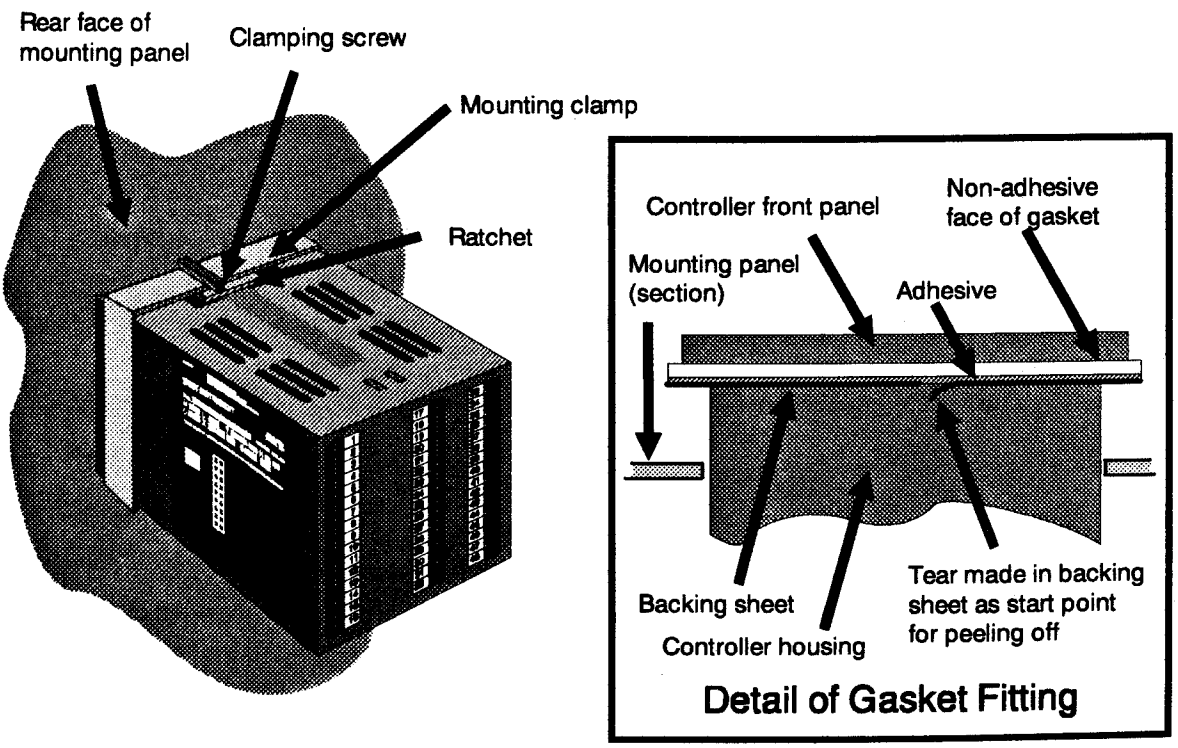


Figure 3-2 Panel-mounting a Controller

3.3 REMOVAL OF THE CONTROLLER FROM ITS HOUSING

The Controller may be removed from its housing (for servicing purposes or to replace sub-assemblies), leaving the housing and back-wiring atached to the mounting panel.

WARNING

The mains (line) supply must be disconnected from the Controller before any attempt is made to remove the Controller from its housing.

CAUTION

The Controller contains devices which are sensitive to electrostatic discharge. Whilst handling the Controller, precautions should be taken to minimise the risk of electrostatic discharge.

To remove the Controller from its housing, proceed as follows:

1. Carefully prise off the centre (◊) control key from the front panel to expose the retaining screw (see Figure 3-3).

CAUTION

This key is not hinged and will come completely away from the front panel; care should be taken that it is not lost whilst it is removed.

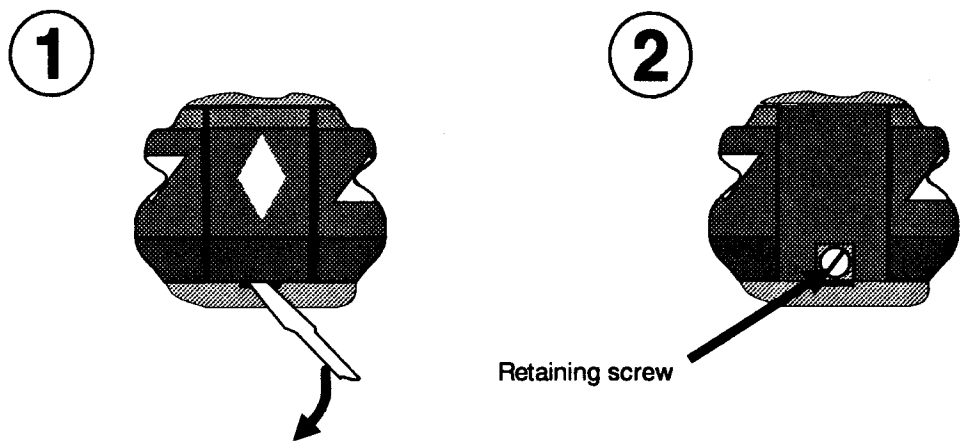


Figure 3-3 Gaining Access to the Retaining Screw

2. With a flat-bladed screwdriver of appropriate size (1/4-inch or 6mm), rotate the retaining screw in an anti-clockwise direction until the screw thread is completely dis-engaged from its bush. This will partially withdraw the Controller out of its housing.
3. Carefully pull the Controller completely out of its housing.

3.4 REPLACEMENT OF THE CONTROLLER IN ITS HOUSING

1. Carefully slide the Controller into its housing, ensuring that the Controller printed circuit boards locate against the outside of the board guides moulded in the top and bottom of the housing.
2. Push the Controller firmly into position such that sound connection is made between the printed circuit boards' edge connectors and the rear connections inside the housing.
3. Engage the thread of the retaining screw in its bush and tighten the screw until the Controller is securely in position inside the housing.

4. Replace the centre control key cover by engaging the tongue (at the top of the key cover) in its recess and pressing the bottom of the key cover into position.

3.5 CONNECTIONS AND WIRING

Connections for outputs and inputs are provided at the rear of the Controller housing. The connections to the rear terminals are shown in Figure 3-4.

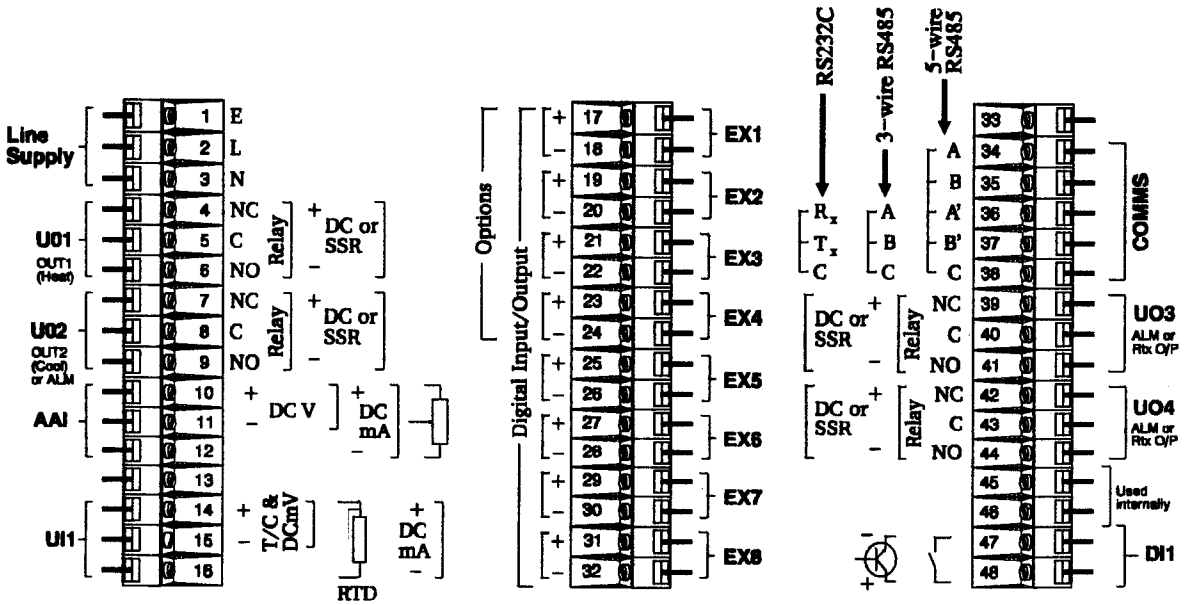


Figure 3-4 5010 Controller Rear Terminals

3.5.1 Mains (Line) Supply

The Controller is supplied to operate on 90 - 264V AC 50/60Hz. The connections are as shown in Figure 3-5.

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 to the neutral connection. Consideration should be given to the prevention of access by unauthorised personnel to the power connections. The Ground terminal (Terminal 1) should be connected to a protective ground conductor before any other connection is made; this should remain connected at all times. Power should be connected via a two-pole isolating switch and a 1A fuse, as shown in Figure 3-5.

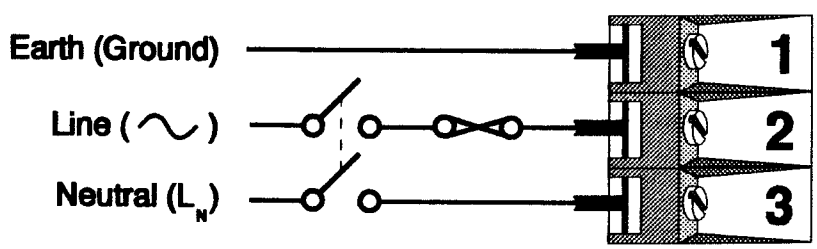


Figure 3-5 Mains (Line) Supply Connections

3.5.2 Thermocouple Input

The universal input UI1 may be connected to a thermocouple input as shown in Figure 3-6. The correct type of thermocouple extension leadwire or compensating cable must be used for the entire distance between the Controller and the thermocouple, ensuring that the correct polarity is observed throughout. Joints in the cable should be avoided, if possible. A cold junction compensation unit is fitted internally.

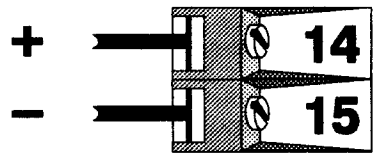


Figure 3-6 Thermocouple Input Connections

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 3-1.

Table 3-1 Thermocouple Extension Lead Colour Codes

Thermocouple Type	Cable Material	British (BS)	American (ASTM)	German (DIN)	French (NFE)	International (IEC)
T	Copper Constantan	+ White – Blue * Blue	+ Blue – Red * Blue	+ Red – Brown * Brown	+ Yellow – Blue * Blue	+ Brown – White * Brown
J	Iron/Constantan	+ Yellow – Blue * Black	+ White – Red * Black	+ Red – Blue * Blue	+ Yellow – Black * Black	+ Black – White * Black
K	Nickel Chromium Nickel Aluminium	+ Brown – Blue * Red	+ Yellow – Red * Yellow	+ Red – Green * Green	+ Yellow – Purple * Yellow	+ Green – White * Green
R S	13% Copper 10% Copper Nickel	+ White – Blue * Green	+ Black – Red * Green	+ Red – White * White	+ Yellow – Green * Green	+ Orange – White * Orange
B	Platinum/Rhodium		+ Grey – Red * Grey	+ Red – Grey * Grey		
L				+ Red – Blue * Blue		
E		+ Brown – Blue * Brown	+ Pink – Red * Pink			
W5						
N		+ Orange – Blue * Orange	+ Orange – Red * Orange			

3.5.3 Three-wire Resistance Temperature Detector (RTD) Input

RTD input connections to UI1 are shown in Figure 3-7. The compensating lead is connected to Terminal 15. For two-wire RTD inputs, Terminals 14 and 15 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).

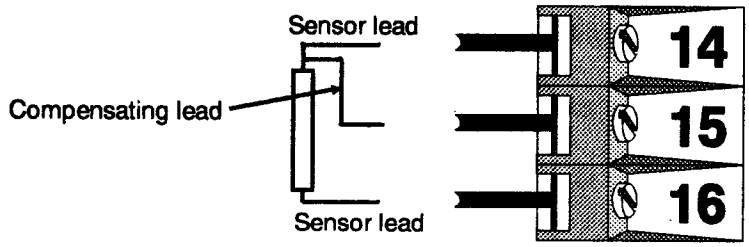


Figure 3-7 RTD Input Connections

3.5.4 DC Linear Input

Any one of a range of DC linear inputs can be accommodated on UI1 of the Controller (see Appendix B). Connections for the DC linear input are shown in Figure 3-8.

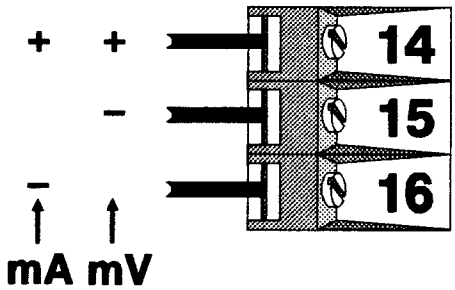


Figure 3-8 DC Linear Input Connections

3.5.5 Remote Setpoint Input (Product CodesX05, X37, X03, X38, X04, X36)

The Auxiliary Analogue Input may be used as a Remote Setpoint Input with connections as shown in Figure 3-9.

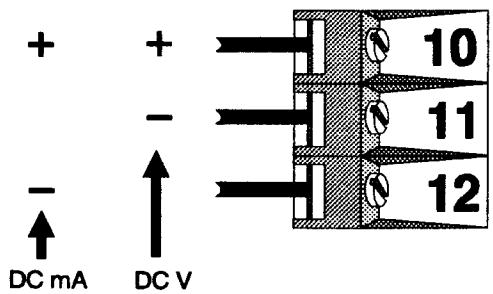


Figure 3-9 Remote Setpoint Input Connections

3.5.6 Digital Input - External Selection of Dual Setpoint (X681), Remote/Local Setpoint (X051, X371, X031, X381, X041, X361) or Auto/Manual Mode (X85)

This digital input can accommodate a voltage-free contact or open collector input which is used to select either setpoint in a dual setpoint Controller (X681) or to select remote setpoint or local setpoint in a Controller configured for remote setpoint input. The connections are as shown in Figure 3-10.

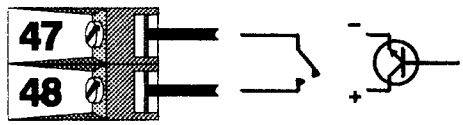


Figure 3-10 Digital Input Connections

3.5.7 Relay Outputs

Single-pole changeover relay outputs are available on universal outputs UO1 (Output 1/HEAT), UO2 (Output 2/COOL or Alarm), UO3 (Alarm) and UO4 (Alarm). The relay contacts are rated at 2A with a resistive load at 120/240V AC. UO1 and UO2 are not isolated from each other but are isolated from all other outputs and inputs. UO3 and UO4 are not isolated from each other but are isolated from all other outputs and inputs. These outputs may also be used as digital outputs. The universal output relay connections are shown in Figure 3-11.

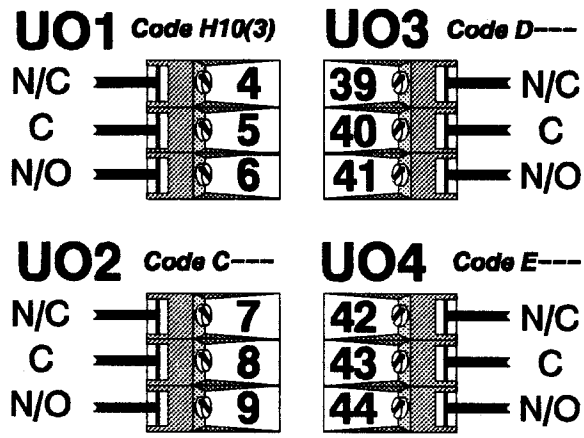
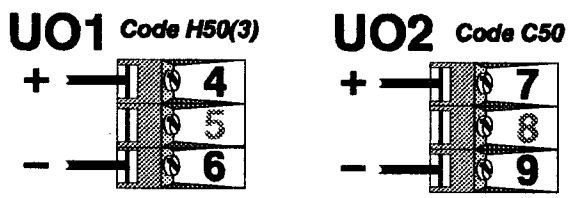


Figure 3-11 Universal Output Relay Connections

3.5.8 Solid State Relay (SSR) Outputs

TTL-compatible SSR outputs are available on universal outputs UO1 (Output 1/HEAT) and UO2 (Output 2/COOL). The SSR drive capability is greater than 4.5V DC into 250Ω maximum load. Fan-out is 1 for standard TTL. These may also be used as digital outputs. UO1 and UO2 are not isolated from each other but are isolated from all other outputs and inputs.The universal output SSR connections are shown in Figure 3-12.



NOTE

SSR outputs are not normally used on Universal Output 3 and Universal Output 4.

Figure 3-12 Universal Output SSR Drive Connections

3.5.9 DC Outputs

DC outputs are available on universal outputs UO1 (Output 1/HEAT), UO2 (Output 2/COOL or Re-transmitted Output), UO3 (Re-transmitted Output) and UO4 (Re-transmitted Output). Resolution is to 10 bits. The range (see Appendix B) is selected by internal link jumpers and from the Controller front panel. UO1 and UO2 are not isolated from each other but are isolated from all other outputs and inputs. UO3 and UO4 are not isolated from each other but are isolated from all other outputs and inputs. The DC Output connections are shown in Figure 3-13.

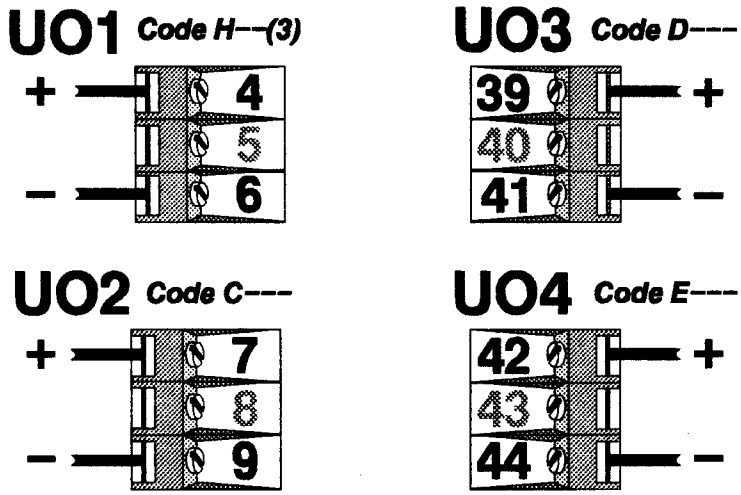


Figure 3-13 Universal Output DC Connections

3.5.10 Valve Motor Drive Outputs

The connections for VMD Outputs are shown in Figure 3-14.

N/C =	Normally Closed
COM =	Common
N/O =	Normall Open

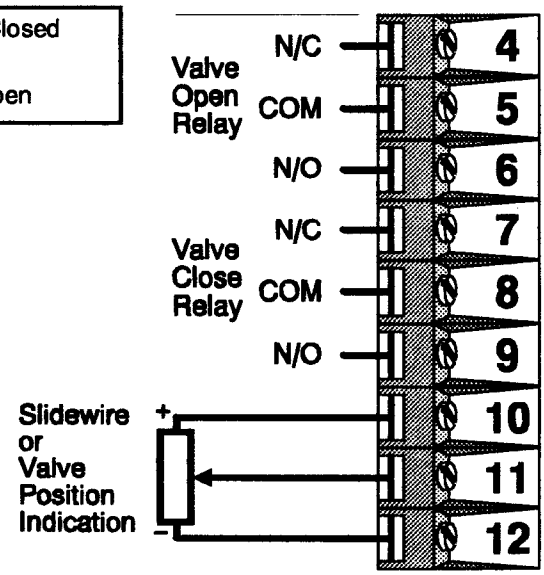


Figure 3-14 VMD Output Connections

3.5.10.1 VALVE MOTOR DRIVE - OPEN LOOP

The Controller is designed to switch on either the Valve Open relay or the Valve Close relay but not both simultaneously. However, under fault conditions, both relays can be switched on simultaneously. It is recommended, therefore, that an interlock be included in the connections for safety purposes (see Figure 3-15). This connects the motor supply via the "normally-closed" contacts of the relays. Refer also to Subsection 3.6.

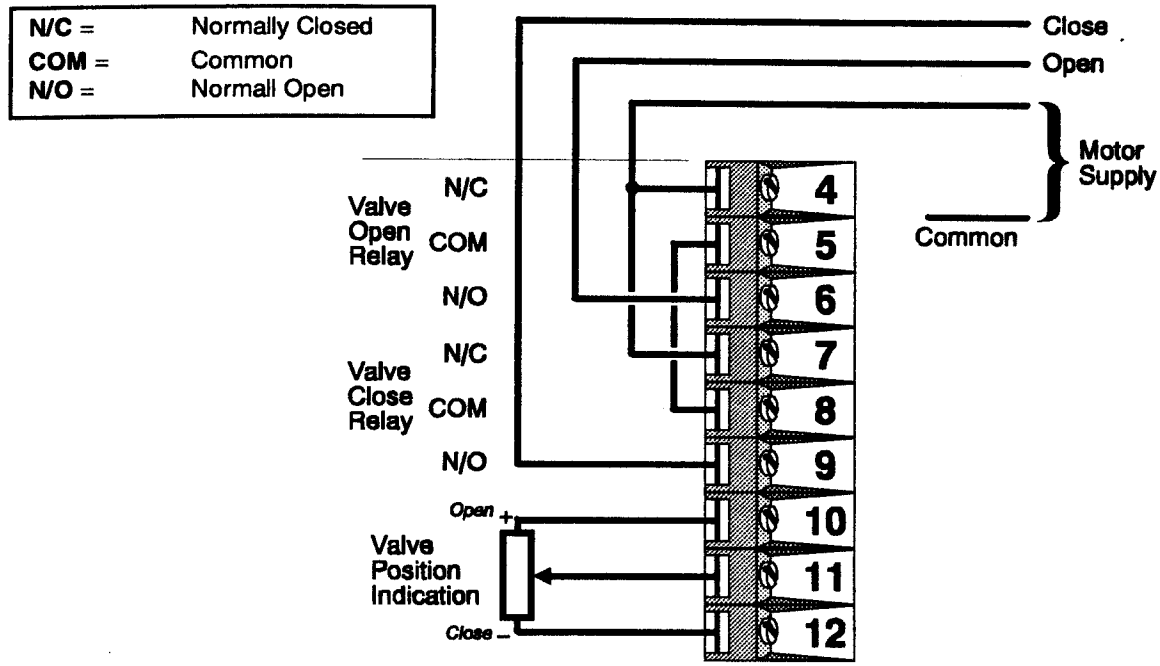


Figure 3-15 VMD Open Loop Outputs (with Interlock)

3.5.10.2 VALVE MOTOR DRIVE - CLOSED LOOP

The connections for VMD Closed Loop applications are shown in Figure 3-16.

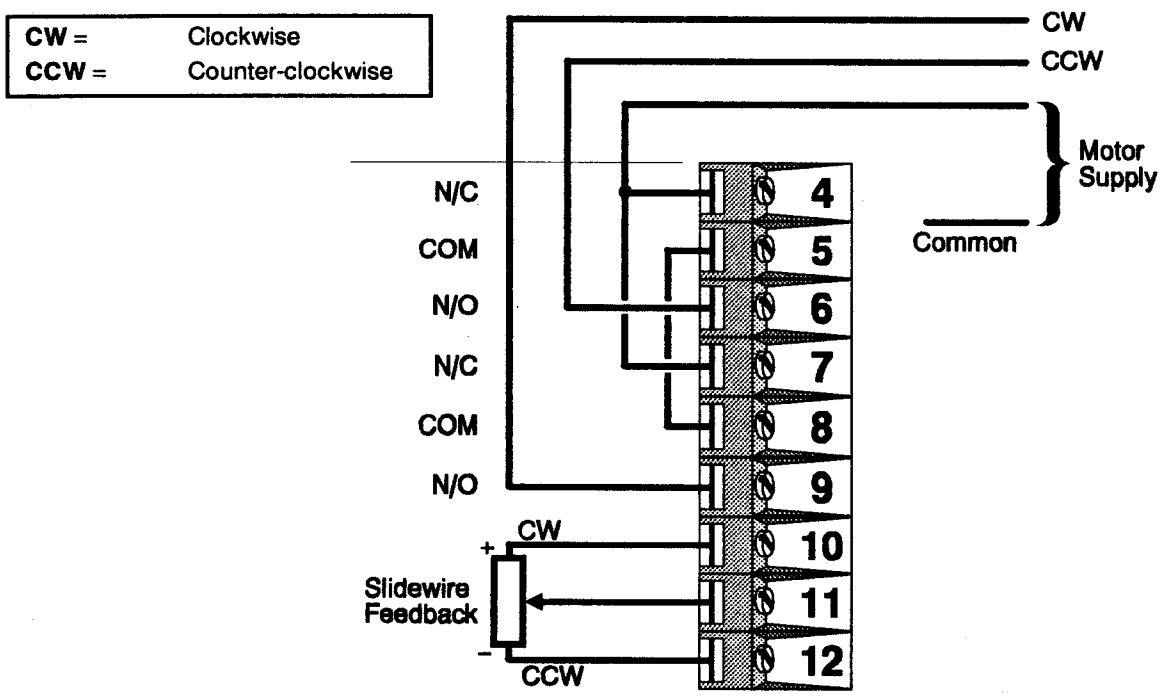


Figure 3-16 VMD Closed Loop Outputs (with Interlock)

3.5.11 Serial Communications

The connections for serial communications (RS232C, three-wire RS485 and five-wire RS485) are shown in Figure 3-17.

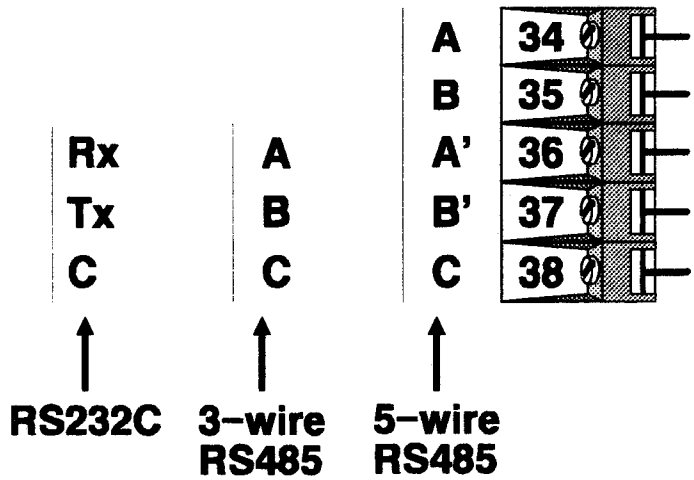


Figure 3-17 Serial Communications Connections

3.6 INDUCTIVE LOADS; EXTERNAL CONTACTORS AND MAINS-OPERATED RELAYS

WARNING

Operating the Controller with inductive loads and without the appropriate protection components may give rise to a hazard owing to high-voltage transients which may occur during switching cycles. Removal of the Controller's internal snubber components could give rise to a serious hazard. Mark IV Instruments do not accept responsibility for any damage which may occur as a consequence of the unauthorised removal of these components.

3.6.1 General Notes

The standard relay contacts fitted in the Controller are suitable for AC supply voltages in the range 24V - 240V. The relays are rated at up to 2A with a resistive load and up to 1A with an inductive load. The Controller contains voltage-dependent resistors (VDRs) across all relay contacts; these protect the internal circuits for all loads up to the maximum rating. No external protection components are necesary unless an external switch or contact is fitted in series with the controller relay contacts (see Subsection 3.6.2).

3.6.2 An External Switch in Series with an External Inductive Load

Damage may be caused to the Controller if the contacts of a switch, relay or contactor are connected externally in series with the Controller relay contacts, as shown in Figure 3-18. Under these conditions, the external contacts may operate whilst the Controller relay contacts are closed (i.e. when the internal protection circuits are short-circuited and, therefore, ineffective). In applications in which it is necessary to connect the contacts of an external switch, relay or contactor in series with the Controller relay contacts, a suitable VDR or snubber circuit must be fitted, either across the inductive load or across the unprotected contacts (as shown by the components with dotted outlines in Figure 3-18). The values shown in Table 3-2 may be used for these components.

NOTE

All capacitors should conform to VDE (Class X) and should be suitable for operation at 260V AC. All resistors (wire-wound or Allen Bradley HB) should have a minimum rating of 2 watts.

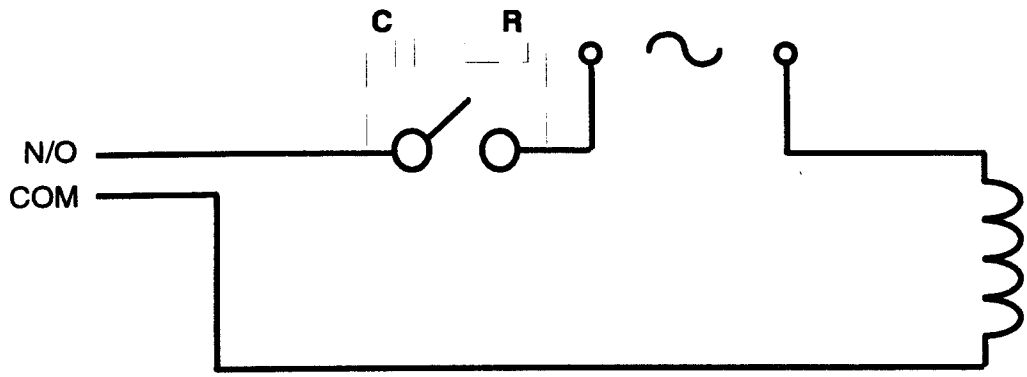


Figure 3-18 External Switch/Inductive Load in Series

Table 3-2 Protection Network Component Values

Load Current	Value of C (μF)	WEST Part No.	Value of R (Ω)	WEST Part No.
70mA	0.047	22206	22	23220-304
150mA	0.100	22207	47	23470-304
500mA	0.220	22208	47	23470-304
1A	0.470	22209	47	23470-304

SECTION 4
SET UP MODE & VIEW MODE

These two modes offer the following facilities:

(b) **Set Up Mode:** the user may view or (via password access) edit set up parameters.

(a) **View Mode:** The user may examine (i.e. view only) configuration parameters, presented in the form of condensed or summary displays

4.1 FRONT PANEL CONTROLS

The 5010 front panel controls are shown in Figure 4-1.

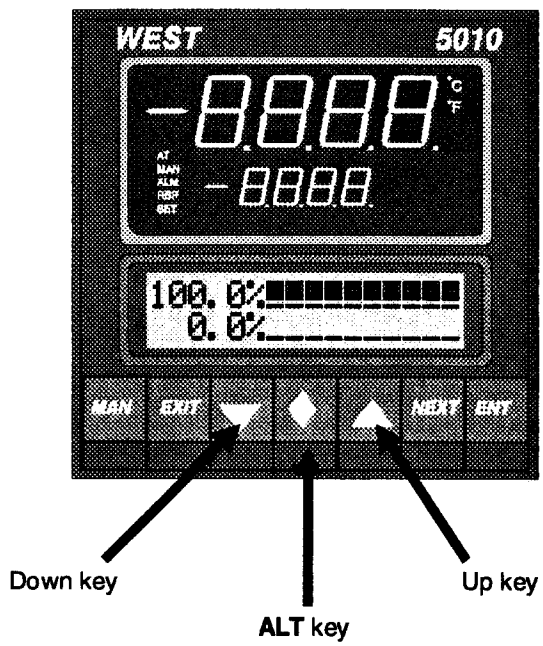
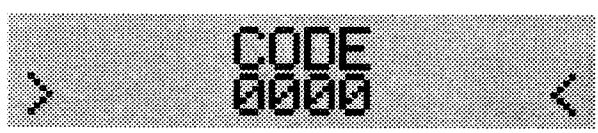


Figure 4-1 5010 Controller Front Panel

4.2 ENTERING SET UP MODE

To enter Set Up Mode, with the Controller in Operator Mode, depress the Up and Down keys simultaneously. The LCD display will then show:

To select the Set Up Mode, depress the **ENT** key. The LCD display will then show:



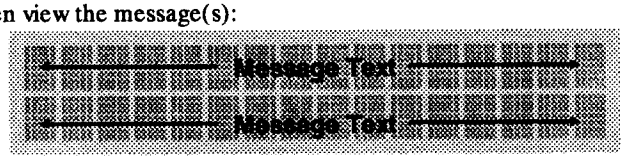
and the **SET** front panel indicator will then come ON. Enter the correct password (using the Up/Down keys) and depress the **ENT** key. The LCD display will then show the first of the Read/Write displays (see Subsection 4.3).

NOTE

If an incorrect password is entered, the **SET** indicator will flash; access will still be gained to the Read/Write displays, but the user will not be able to edit them. Note that if the user defines this password (see Subsection 4.3.9) to be zero, entry is gained by depressing the **ENT** key only. The default setting for this password is 0010.

If an Exception condition exists (see Subsection 1.6), the View/Setup menu display will be followed (after pressing the **NEXT** key) by the Message menu:

The exception condition will be indicated by the horizontal bars in the small LED display flashing. By pressing the **ENT** key, the user may then view the message(s):



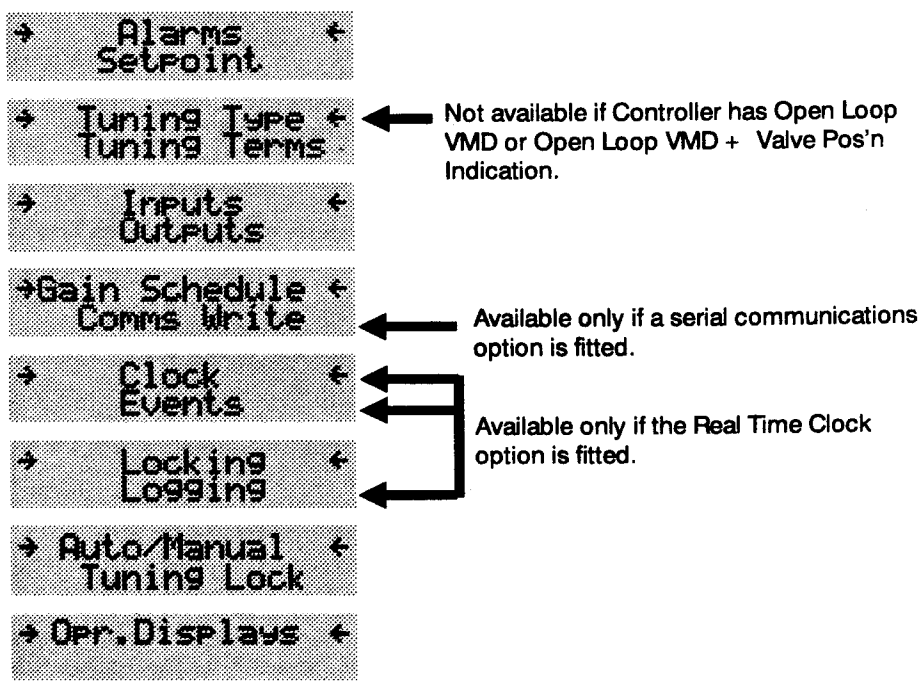
or, by depressing the **NEXT** key, obtain the Setup/View menu display.

4.3 SET UP MODE (READ/WRITE DISPLAYS)

NOTE

If Set Up Mode is selected with an incorrect password, all the displays described in this Subsection will be accessible in a Read Only mode i.e. it will not be possible to edit the displays. Access to the "Locking", "Auto/Manual", "Tuning Lock" and "Opr. Displays" displays will be blocked

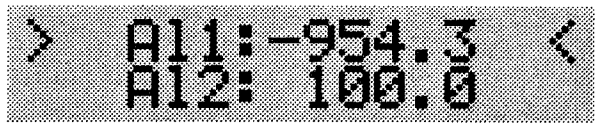
When this option is selected, the LCD display will show the first of a sequence of displays:



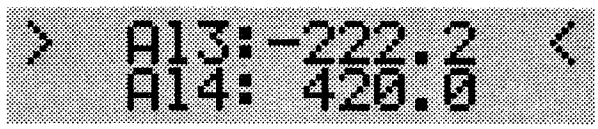
The user may then step through the displays and move the selection cursor in each display using the **NEXT** key (or **ALT/NEXT** keys). When the selection cursor is aligned with the desired option, depress the **ENT** key to select that option.

4.3.1 Alarms

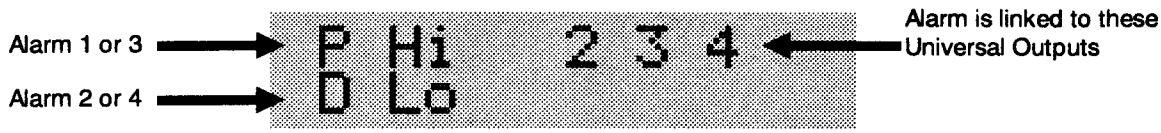
This option allows alarm values to be set and alarm types and linkages to outputs to be examined. The initial display is of the form:



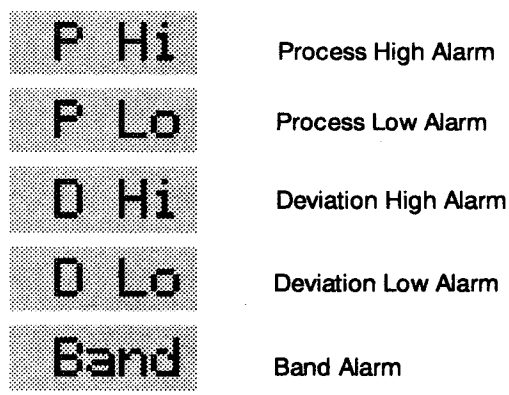
The alarm value may be adjusted with the Up/Down/ALT keys in the normal manner (see Subsection 1.3). The selection cursor may be moved to the lower line using the **NEXT** key. A further depression of the **NEXT** key will change the display to the form:



in which the **NEXT** key can be used to move the selection cursor to the lower line. The Shadow Screen for each alarm display (showing alarm type and linkages) is of the form:



The alarm types available are:

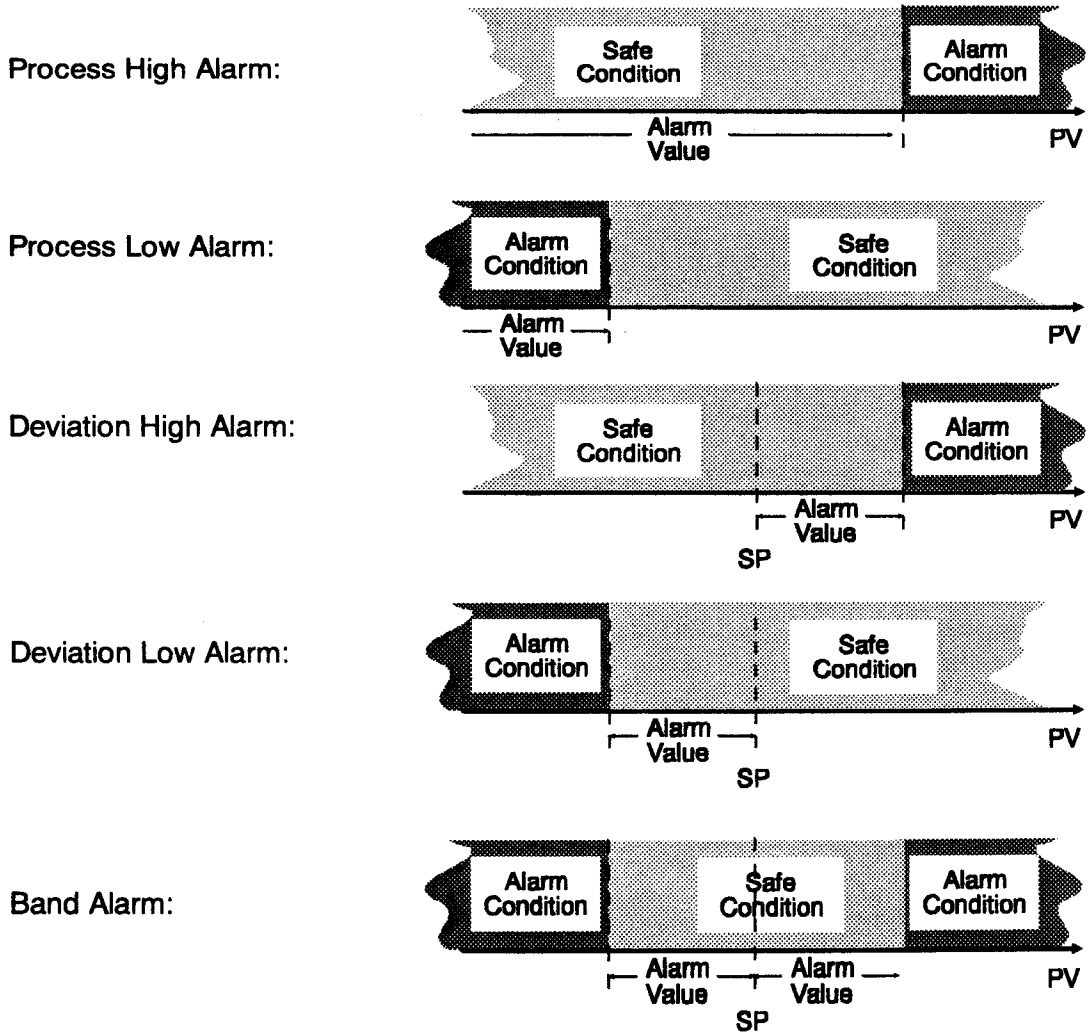


For any alarm which has no links to hardware, the alarm linkage field of the display will show:

The operation of the different types of alarm is shown in Figure 4-2.

NOTE

An asterisk to the right of an alarm display indicates that the alarm is currently active.



NOTE:

Direct-acting Alarms:

Alarm condition = Output active; Safe condition = Output inactive

Reverse-acting alarms:

Alarm condition = Output inactive; Safe condition = Output active

When Setpoint Ramping is enabled (see Subsection 4.4.2.2), deviation alarms and band alarms use the *target* setpoint as the reference value.

Figure 4-2 Alarm Operation

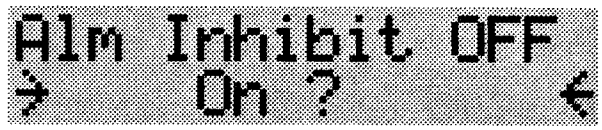
The default alarm values are dependent upon the alarm type in each case:

Process High Alarm:	Range Max.
Process Low Alarm:	Range Min.
Deviation High/Low and Band Alarms:	Span

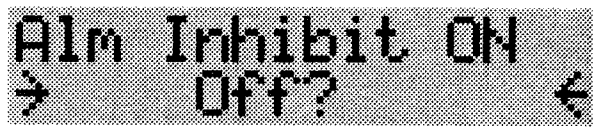
MANUALLY INHIBITING ALARMS

If the Controller is fitted with the Real Time Clock option, it is possible to inhibit operation of the alarms manually as follows:

1. With the Controller in Set Up Mode with the "**Alarms**" option selected and the display showing the alarm levels for Alarm 3 and Alarm 4, depress the **NEXT** key, which will change the display to:



if the alarms are currently enabled or:



if the alarms are currently inhibited.

2. If it is required to change the Alarm Inhibit status (i.e. **OFF** to **ON** or vice versa), depress the **ENT** key.

3. To return to the main Set Up Mode menu at the "**Alarms**" option, depress the **EXIT** key.

NOTE

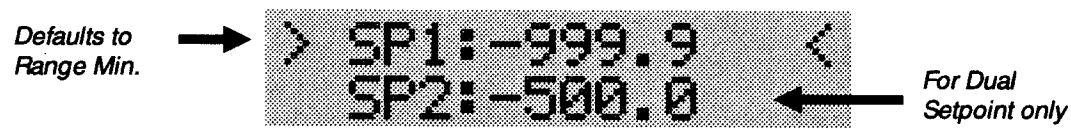
Manual inhibition of alarms will always override event-driven Alarm Inhibit actions, i.e. if alarms are inhibited manually, it is not possible for an event to enable them.

4.3.2 Setpoint

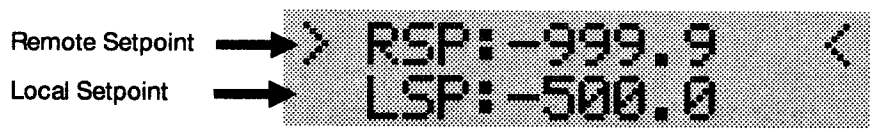
This option allows adjustment of the setpoint value, the setpoint maximum and minimum values, the setpoint ramp rate and, on Remote Setpoint Controllers, the Remote Setpoint Offset value.

4.3.2.1 SETPOINT VALUE

The initial display is of the form:



or, for remote setpoint Controllers:



The setpoint value maybe adjusted in the normal manner (see Subsection 1.3) and (on two-line displays) the cursor can be moved between the upper and lower lines using the **NEXT** key or **NEXT**/ALT keys.. Depression of the **NEXT** key will cause display of the setpoint ramp rate.

4.3.2.2 SETPOINT RAMP RATE

The display is of the form:

Defaults to OFF →

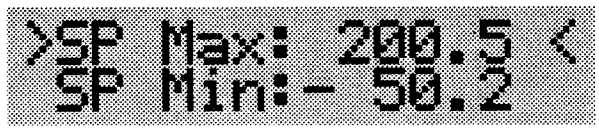
The rate value may be adjusted in the normal manner (see Subsection 1.3). Set point ramping can be disabled by attempting to set the rate to a value greater than 9999, in which case the displayed value will change to OFF. Once set point ramping is disabled, only depression of the Down key alone will re-enable ramping (Down changes the value to 9999). Depression of the **NEXT** key will cause display of the Set Point Maximum and Minimum parameters.

4.3.2.3 SETPOINT MAXIMUM AND MINIMUM

This option allows adjustment of the set point maximum and minimum values. The display is of the form:

Defaults to Range Max. →

Defaults to Range Min. →



The cursor may be moved to the lower line by depressing the **NEXT** key. The maximum/minimum values may be adjusted in the normal manner (see Subsection 1.3). If the cursor is on the lower line, depression of the **NEXT** key will cause a return to the setpoint value display (for non-Remote Setpoint Controllers) or, on Remote Setpoint Controllers, will cause display of the Remote Setpoint Offset value (see next Subsection)

4.3.2.4 REMOTE SETPOINT OFFSET

This parameter is used, for instance, when the remote setpoint source signal and the process variable signal are of substantially different magnitudes and the range of remote setpoint variation is small compared to its overall magnitude. This offset can then be used to "cancel out" the magnitude differences. When this option is selected, the LCD display is of the following form:

The value may be adjusted in the normal manner (see Subsection 1.3). Depression of the **NEXT** key will cause a return to the Setpoint Value display.

4.3.3 Tuning Type

This option indicates whether tuning is enabled or disabled, the current tuning type and (via a selection menu) enables the user to select the tuning type required. The initial display is of the form:

Default →

Depression of the **NEXT** key will move the selection cursor to the lower line. Another depression of the **NEXT** key will change the display to the form:

and a further **NEXT** key depression will move the selection cursor to the lower line.

NOTE

An asterisk to the right of a tuning type description denotes the current tuning type.

When the selection cursor is aligned with the required tuning type, depress the **ENT** key to select that tuning type.

4.3.4 Tuning Terms

This option permits the user to define the tuning terms appropriate to the application and controller configuration. Using the **NEXT** key or ALT/**NEXT** keys, the user may step through a sequence of displays, which for non-VMD output Controllers is as follows:

Omitted for single output ON/OFF control. →
For dual output only →

```
> PB1: 999.9 % <
  PB2: 900.0 %
```

Default= 10%

Omitted for ON/OFF control. →

```
> Rate: 02:59 <
```

Default= 30s

Omitted for ON/OFF control. →

```
  Reset: 03:00
```

Default = 5mins

Only for ON/OFF control or dual-output Controller with ON/OFF secondary output. →
Dual-output Controller only. →

```
> Hys:    2.0 % <
  D'Iap: -20 %
```

Default= 0.5%

Default= 0%

Omitted for ON/OFF control. →

```
> M.Res: 80.0% <
```

Default= 50%

For VMD output Controllers, the sequence is:

Closed Loop VMD only

```
> PB : 999.9 % <
  D'band: 0.0 %
```

Open Loop VMD (with or without Valve Position Indication) only

```
> PB : 999.9 % <
  M.T.T.:    90s
```

← *Motor Travel Time*

```
> Rate: 02:59 <
  Reset: 03:00
```

Open Loop VMD (with or without Valve Position Indication) only

```
  Min. On-Time
>      10.0    <
```

Minimum Relay ON Time (in seconds)

Closed Loop VMD only

```
> M.Res: 80.0% <
```

NOTE

Only the terms needed will appear in the sequence.

The selected term value may be adjusted in the normal manner (see Subsection 1.3).

The Proportional Band and Overlap/Deadband terms are illustrated in Figure 4-3.

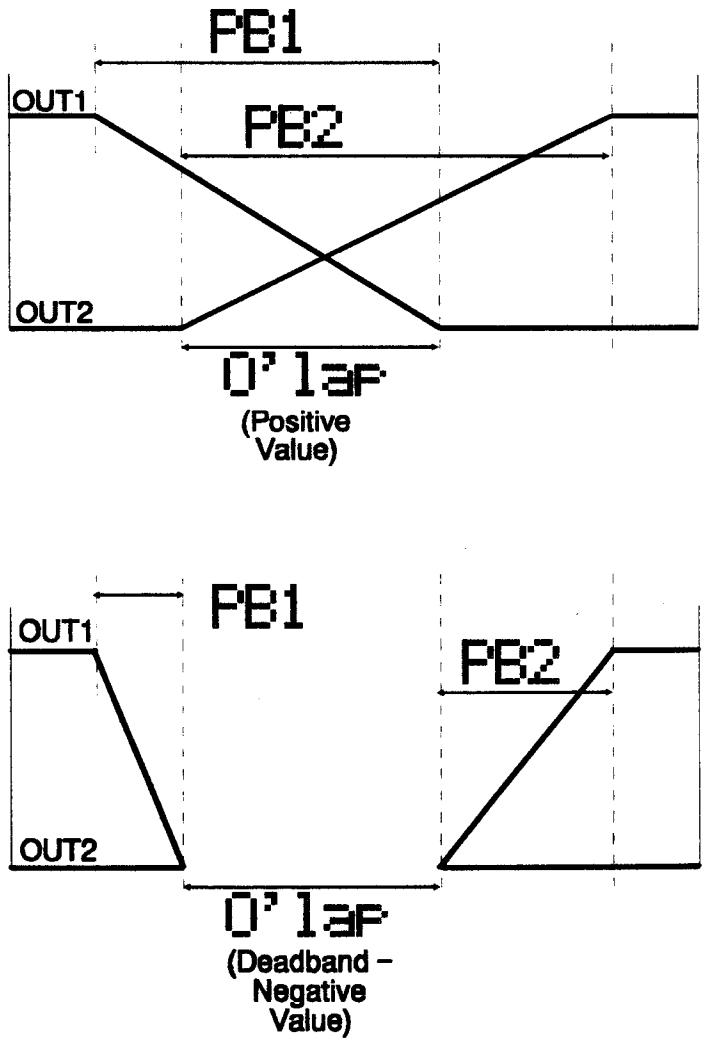


Figure 4-3 Proportional Band and Deadband/Overlap

NOTE

When Self-Tune is active, the P, I and D terms in this sequence will appear as Read Only displays. When Gain Scheduling is active, the terms offered will be those of the current gain scheduling breakpoint and, for each such displayed term, the normal Shadow Screen will be replaced with a display indicating the number of the current gain scheduling breakpoint, in the form:

The tuning terms are defined as follows:

Reset (Integral): This parameter will be available unless the Controller is using an ON/OFF control algorithm. Expressed as minutes and seconds.

Rate (Derivative): This parameter will be available unless the Controller is using an ON/OFF control algorithm. Expressed as minutes and seconds.

Proportional Band(s): This parameter is available unless the Controller has a single-output ON/OFF control algorithm. In the case of any other single output Controller or a Controller with VMD output, only one proportional band is available. In the case of a dual output Controller, Proportional Bands 1 and 2 will be available. Expressed as a percentage of the control span.

Hysteresis: Available only for a Controller using an ON/OFF control algorithm or for a dual-output Controller with an ON/OFF secondary output. Expressed as a percentage of the control span.

Overlap/Deadband: Available only for a dual-output or closed loop VMD Controller. Expressed as a percentage of (Proportional Band 1 + Proportional Band 2).

Manual Reset Value: Available for all but ON/OFF Controllers. Expressed as a percentage of output power.

Motor Travel Time (MTT): This is the time taken, on a Closed Loop VMD Controller, for the motor to move the valve from "fully open" to "fully closed" or vice versa.

Minimum ON Time: On an Open Loop VMD Controller (with or without Valve Position Indication), this is the minimum motor movement time.

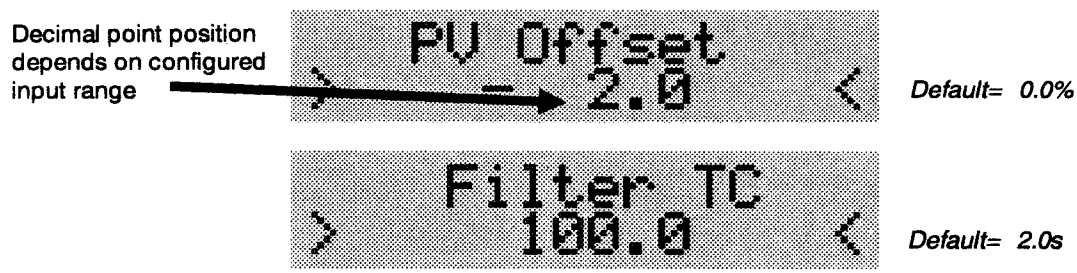
4.3.5 Inputs

This option enables adjustment of the two input parameters:

(a) Process Variable Offset

(b) Input Filter Time Constant

When the Inputs option is selected, the LCD display shows the first of two input parameter displays:



which enables adjustment of the process variable offset parameter. The second display is selected by depressing the **NEXT** key. Adjustment of either parameter value is achieved in the normal manner (see Subsection 1.3).

The two input parameters are defined as follows:

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

Displayed PV value = Actual PV Value + Process Variable Offset

The displayed process variable value is limited by the Input Range Trimming parameters in Configuration Mode (See Subsection 6.3.1). The displayed process variable value is used for both display and alarm purposes. If a process variable re-transmitted output is used, it is modified in a similar manner.

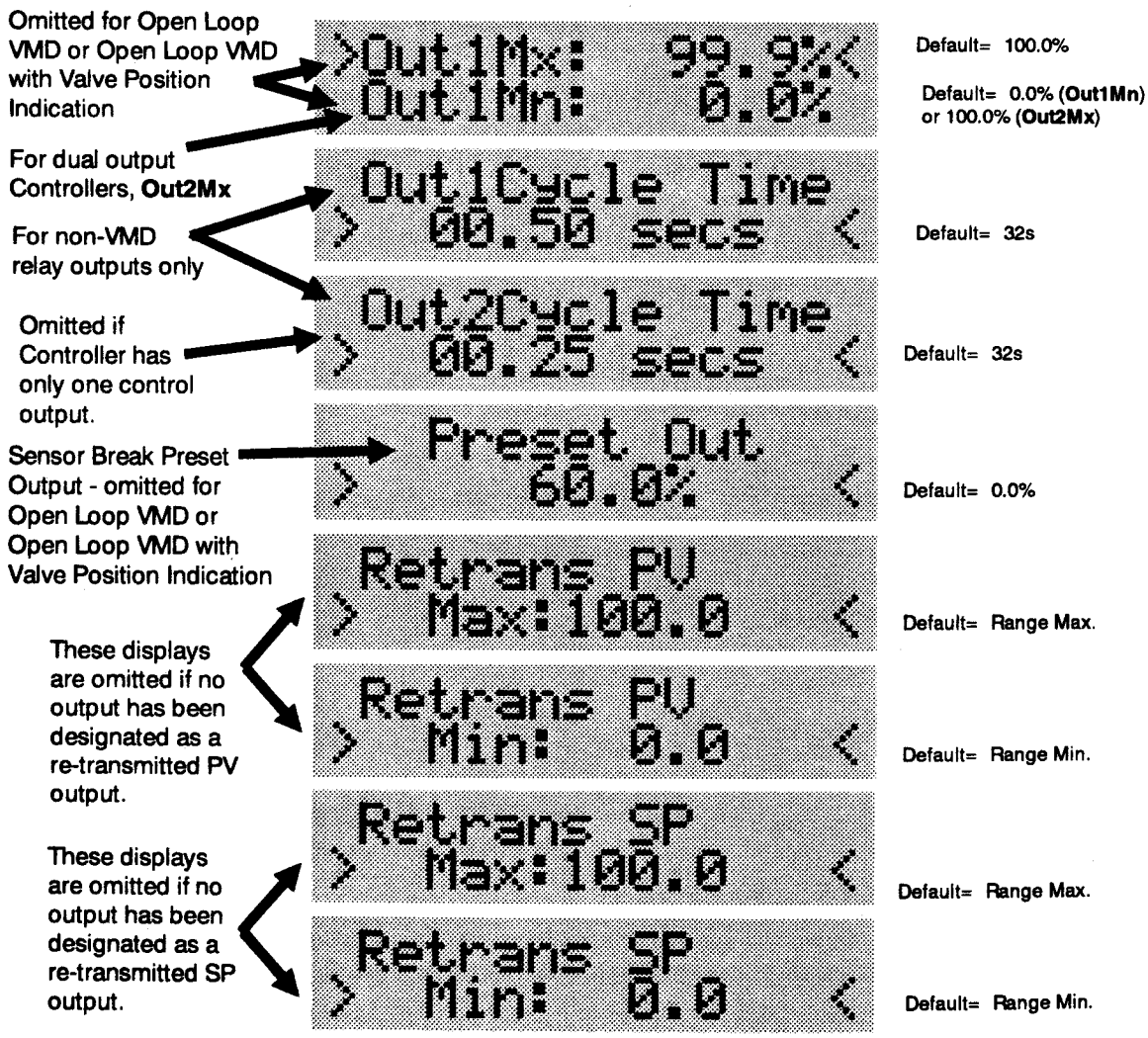
NOTE

The process variable offset value should be selected with caution. Any adjustment to this parameter is, in effect, a calibration adjustment. Injudicious application of values to this parameter could lead to the displayed PV value bearing no meaningful relationship to the actual PV value. There is no front panel indication when this parameter is in effect (i.e. has been set to a non-zero value).

Filter Time Constant: The Controller is equipped with a digital filter which is used to filter out any extraneous impulses on all Controller functions (process input, control, alarms etc.). The time constant for this filter may be adjusted within the range 0.0 - 100.0 seconds with a resolution of 0.1 seconds.

4.3.6 Outputs

When this option is selected, the first of a sequence of displays (stepped through with the **NEXT** key) appears:

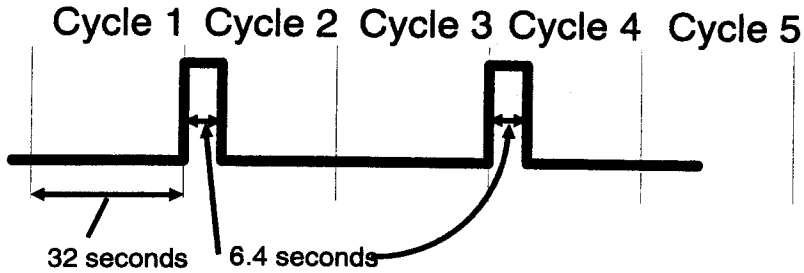


Selection of this option enables adjustment of the following parameters:

Output Maximum and Minimum Values: The value of Output 1 (HEAT) and (if fitted) Output 2 (COOL) may be limited in order to protect the process being controlled. Each limit is expressed as a percentage of the total power available on the specified output.

Output Cycle Time: The cycle time for Output 1 (HEAT) and (if fitted) Output 2 (COOL) may be adjusted over a series of values in the range 0.25 - 512 seconds. For relay-type outputs, the cycle time should be as large as possible, in order to maximise the life of the relays. For SSR outputs, the lower values in the series may be selected. *NOTE: This cycle time is also dependent upon the value of Minimum Relay On/Off Time in Configuration Mode (see Subsection 6.7) - minimum Output Cycle Time = 8 x Minimum Relay On/Off Time.*

Example: If the Output Cycle Time is set to 32 seconds, the Minimum Relay ON/OFF Time is set to 4 seconds and the output requirement was for 10% of maximum output power, the relay output would follow the pattern shown below:



In order to give 10% output power, in theory, the relay ON pulse duration during each output cycle should be 10% of 32 seconds = 3.2 seconds. However, the Minimum Relay ON/OFF Time is set to 4 seconds; therefore there will be no relay ON pulse in Cycle 1; this 3.2 seconds will be added to the nominal duration of the ON pulse for Cycle 2, giving an actual ON pulse duration of 6.4 seconds in Cycle 2. This sequence is then repeated, giving a 6.4-second ON pulse every alternate output cycle (every 64 seconds). This provides an average power output of 10% of maximum output power.

Sensor Break Preset Output: This parameter defines the output value set when a break in the sensor circuit is detected. It is expressed as a percentage of total available output power.

Re-transmitted Analogue Output Maximum and Minimum: If a re- transmitted analogue output exists, these parameters can be adjusted to define the maximum and minimum values of that output. The resolution of these parameters is zone-dependent and is expressed as a range between zone range maximum and zone range minimum (see Subsection 6.3.1). If the re-transmitted output maximum value is set to less than the re-transmitted output minimum value, the sense of the re-transmitted output will be reversed.

4.3.7 Gain Scheduling

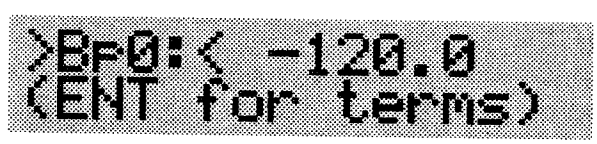
This option enables the user (a) to select the value at which each breakpoint's PID terms come into effect, and (b) to define those terms for each breakpoint.

NOTE

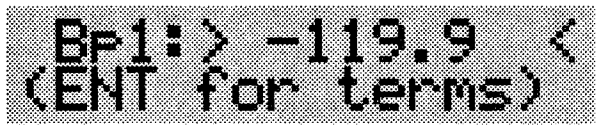
Breakpoint 0 is always a fixed break value and cannot be changed.

4.3.7.1 SELECTING BREAKPOINT AND VALUE

The initial display is of the form:



The Up/Down keys may be used to select the required breakpoint number (in the range 0 - 5). Breakpoint 0 is always set to the Range Minimum value and cannot be altered. For Breakpoints 1 - 5, the **NEXT** key may then be used to move the selection cursor to the Value field:



Default= Range Max.

whereupon the value may be changed in the normal manner (see Subsection 1.3).

There are some basic rules for determining breakpoint values:

1. Within the range of the parameter chosen in Configuration Mode (see Subsection 6.9) to act as the reference value, Breakpoint 0 will always have the value of the Range Minimum parameter. The initial default value for Breakpoints 1 - 5 is that of the Range Maximum parameter. If the Breakpoint Reference parameter is output power (see Subsection 6.9), the "Range Minimum" value will be 0% (for a single output Controller) or –100% (for a dual output Controller) and the "Range Maximum" value will be 100%.

NOTE

Breakpoints made equal to the Range Maximum value are disabled.

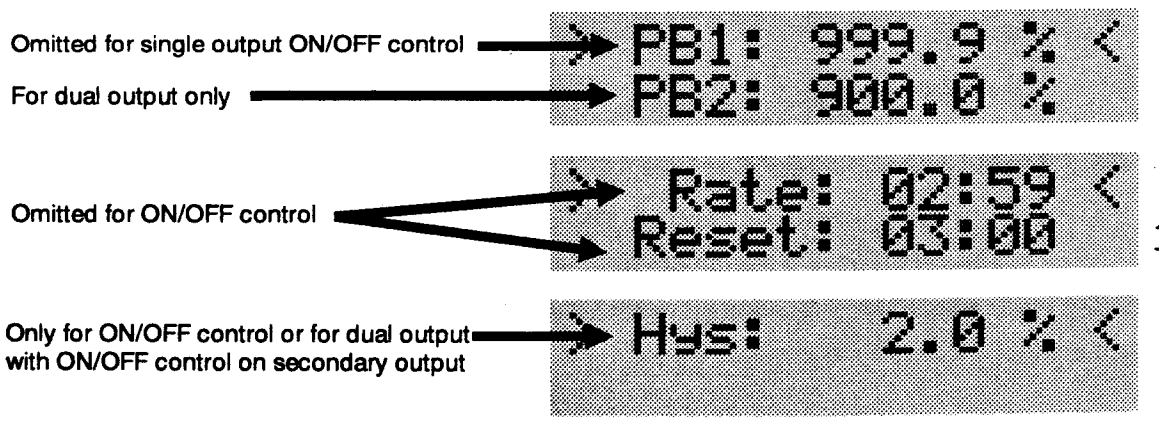
2. In assigning non-default values to Breakpoints 1 - 5, they must be set in order of value. Thus, Breakpoint 1 must have the lowest value, Breakpoint 2 must have the next lowest value etc. For this reason, it is impossible to make the value of Breakpoint n less than the value of Breakpoint (n-1) or greater than the value of Breakpoint (n+ 1).

3. If two or more breakpoints have an identical value, the PID terms for all but the most-recently defined breakpoint will be rendered inapplicable. Thus, if BPn, BP(n+ 1) and BP(n+ 2) are set to the same value, the PID terms for BPn and BP(n+ 1) effectively disappear and the PID terms for BP(n+ 2) will prevail.

If an attempt is made to contravene these rules, the original breakpoint value will be retained and the new value will not be implemented. Once the breakpoint value has been determined, depression of the **ENT** key will enable the user to set the PID terms for that breakpoint.

4.3.7.2 ENTERING BREAKPOINT PID TERMS

Selection of this option will cause the appearance of the first of a sequence of displays:



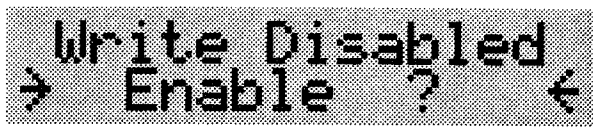
Parameter definitions and default values are as for the standard PID terms (see Subsection 4.3.4). The **NEXT** key may be used to advance, parameter by parameter, through the sequence. The **EXIT** key can be used to return to the breakpoint number/value display for selection of another breakpoint. The values of each parameter may be adjusted in the normal manner (see Subsection 1.3).

Transition across breakpoints is accompanied by a full bumpless transfer of power (except on Open Loop VMD outputs).

4.3.8 Comms Write Permission

This enables/disables all Write operations (i.e. modifications) on parameters via the serial communications link. When this option is selected, the LCD display will show either of:

If modification of parameters via the link is currently enabled.



If modification of parameters via the link is currently disabled.

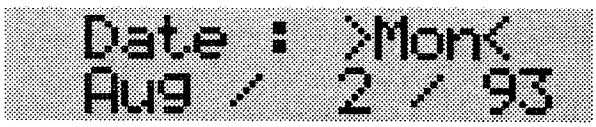
The current status of the communications link can be (a) changed, by depressing the **ENT** key, or (b) retained, by depressing the **EXIT** key.

4.3.9 Setting the Time/Date on the Real Time Clock

1. With the Controller in Set Up Mode and the Clock option selected, the display will initially be of the form:

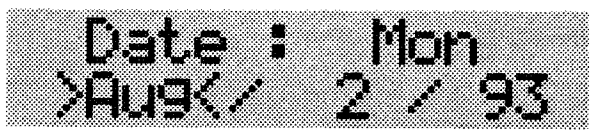
Use the Up/Down keys to set the time as required.

2. Depress the **NEXT** key, whereupon the display will change to the form:



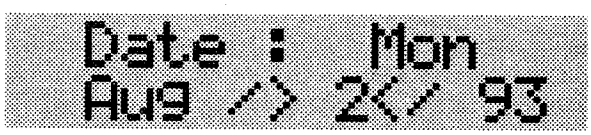
Use the Up/Down keys to set the Day of the Week as required.

3. Depress the **NEXT** key to move the cursor to the Month field:



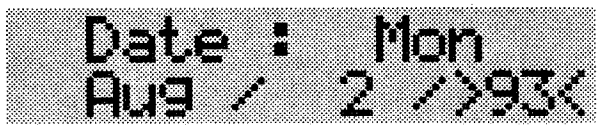
and use the Up/Down keys to set the month as required.

4. Depress the **NEXT** key to move the cursor to the Day of the Month field:



and use the Up/Down keys to set the day of the month as required.

5. Depress the **NEXT** key to move the cursor to the Year field:



and use the Up/Down keys to set the year as required.

6. Depress the **EXIT** key to return to the Set Up Mode menu at the Clock option.

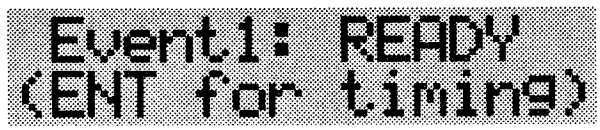
4.3.10 Defining Events/Setting the Alarm Inhibit Timer

NOTE

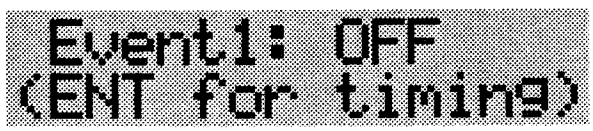
It is recommended that an event is switched OFF before changes are made to its definition, since a change to the definition will re-enable an event which has already been triggered.

1. With the Controller in Set Up Mode, select the Events menu option, whereupon the display will change to the form:

2. Depress the **ENT** key to select the Define option. The display will then change to the form:



if the displayed event is witched on or:



if the displayed event is switched off.

3. Use the **NEXT** key to select the required Event Number (1 - 8) then depress the **ENT** key to change the display to the form:

4. Use the Up/Down keys to select the required effect for that event, which will be one of the following:

The effects available are as follows:

SP⇒SPMAX: When the event is active, the setpoint (SP1 only) is set to Setpoint Maximum.

SP⇒SPMIN: When the event is active, the setpoint (SP1 only) is set to Setpoint Minimum.

SP1⇒SP2: When the event is active, the setpoint is switched from Setpoint 1 to Setpoint 2 (available for dual setpoint controllers only).

SP2⇒SP1: When the event is active, the setpoint is switched from Setpoint 2 to Setpoint 1 (available for dual setpoint controllers only).

SLEEP: When the event is active, the Controller is put into the "Sleep" state in which (a) all displays will go blank (except for a flashing decimal point - to indicate that the Controller is still under mains power), and (b) all outputs will simulate a "mains off" condition i.e. all output relays will be de-energised, all linear outputs will be at 0V or 0mA, whichever is appropriate.

WAKE: When the event is active, if the Controller is in the "Sleep" state, a simulated power-up sequence is performed to restore the Controller to its normal operational state.

UOn ON: Available only if one or more universal outputs have been selected as an event output. When the event is active, the selected output is driven ON (i.e. relay output = energised, SSR output = ON, DC linear output = full scale output).

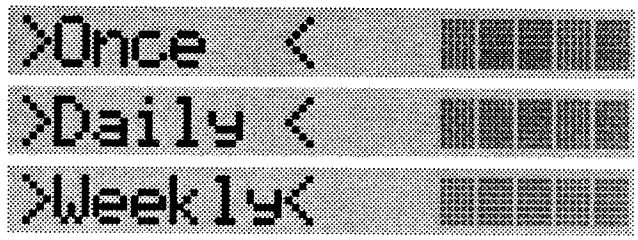
UOn OFF: Available only if one or more universal outputs have been selected as an event output. When the event is active, the selected output is driven OFF (i.e. relay output = de-energised, SSR output = OFF, DC linear output = zero scale output).

NOTE

In the case of the **UOn ON** and **UOn OFF** effects, if more than one universal output has been selected as an event output, the display will initially show the lowest-numbered of the event outputs. Depressions of the Up/Down keys will step through the ON/OFF states for each event output available and will eventually cause a return to the **SP⇒SPMAX** display.

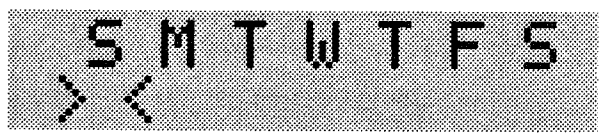
5. When the required event effect has been selected, depress the **NEXT** key to move the cursor to the "Frequency" field:

This field can be set (using the Up/Down keys) to one of the following:

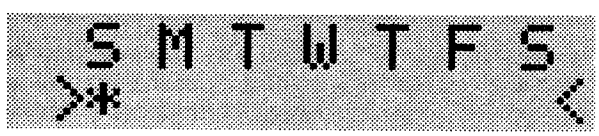


6. When the frequency has been selected as required, depress the **NEXT** key to move the cursor to the "Time" field:

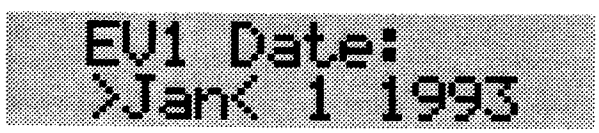
and, using the Up/Down keys, set the time of day (24-hour clock) at which the event is to become active. Then depress the **NEXT** key to change the display to:



if the frequency has been set to **Daily**, or:



if the frequency has been set to **Weekly**, or:



if the frequency has been set to **Once**.

7. If the frequency has been set to **Daily**, use the **NEXT** key to move the cursor from one day to the next and, at each day where the event is required to go active, depress the **ENT** key, whereupon an asterisk will appear in between the cursors in that day's position. The **ENT** key may also be used to cancel an event which was previously set for that day.

8. If the frequency has been set to **Weekly**, use the Up/Down keys to position the asterisk under the required day of the week.

9. If the frequency has been set to **Once**:

(a) Use the Up/Down keys to set the "Month" field as required, then depress the **NEXT** key to move the cursor to the "Day of the Month" field. (Note that, if the month is changed, the "Day of the Month" field is automatically set to 1).

(b) Use the Up/Down keys to set the "Day of the Month" field as required, then depress the **NEXT** key to move the cursor to the "Year" field.

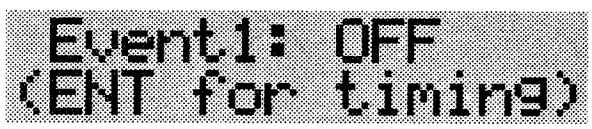
(c) Use the Up/Down keys to set the "Year" field as required.

10. When the event timing has been set as required, depress the **NEXT** key to change the display to the form:

where the lower line will display either OFF or a value in the range 00 hours 00 minutes to 24 hours 00 minutes (alarms will be inhibited for the specified time when the event becomes active). If required, use the Up/Down keys to adjust the Alarm Inhibit time.

11. With the Alarm Inhibit Time set as required, depress the **NEXT** key to repeat Steps 4 - 10 or the **ENT** key to return the display to the form:

or:



as appropriate. Then, either (a) repeat Steps 3 - 10 for each additional event to be defined, or (b) depress the **EXIT** key to return to the "Define" menu option.

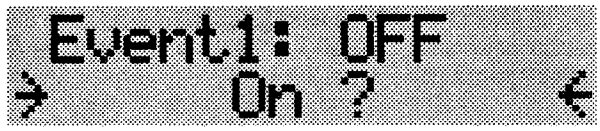
NOTE

A depression of the **EXIT** key at any time will cause a return to the "**Eventn: READY**" or "**Eventn: OFF**" display; a second depression of the **EXIT** key will cause a return to the "**Define**" menu option; a third depression of the **EXIT** key will cause a return to the "**Events**" option in the main Set Up Mode menu.

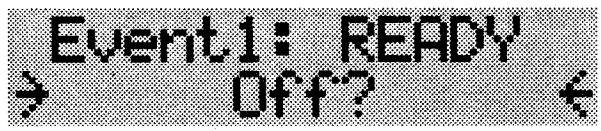
4.3.11 Switching Events On/Off

1. With the Controller in Set Up Mode, select the "Events" menu option, which will change the display to the form:

2. Depress the **NEXT** key to move the cursor to the "Switch On/Off" option and then depress the **ENT** key. The display will change to the form:



if the displayed event is currently **OFF** or:



if the displayed event is currently **READY**.

3. Change the event number as required by depressing the **NEXT** key.

4. With the required event number displayed, if it is desired to change the state of the displayed event (**OFF** to **READY** or **READY** to **OFF**), depress the **ENT** key.

5. Repeat Steps 3 and 4 for each event whose status (i.e. **READY** or **OFF**) is to be viewed/changed. When all events are at the required status, depress the **EXIT** key to return to the "**Switch On/Off**" menu option. A second depression of the **EXIT** key will cause a return to the main Set Up Mode menu at the "**Events**" option.

4.3.12 Setting the Locking Code

The password for entry into Set Up Mode may be changed by anyone who enters the Read/Write displays of Set Up Mode, using the normal numeric entry process (see Subsection 1.3). The LCD display will be of the form:

Once the new password is entered, depress the **EXIT** key to return to the Set Up Mode Edit menu at the Locking option. Changes to this password will have immediate effect. This display is not available for inclusion in the Operator Display List. The default setting for the locking code is 0010.

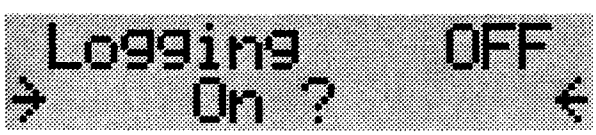
4.3.13 Enabling/Disabling Alarm Logging

NOTE

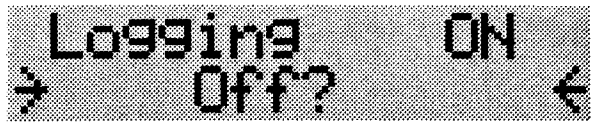
This facility is available only if the Controller is fitted with *both* the Real Time Clock option *and* the Serial Communications option.

With this facility enabled, every change of alarm state will cause a log message to an external printer via the serial communications link. Alarm logging is enabled/disabled as follows:

1. With the Controller in Set Up Mode, displaying the main menu, select the "**Logging**" option. This will cause the display to change to:



if alarm logging is currently disabled, or:



if alarm logging is currently enabled.

2. If it is required to change the Alarm Logging status (i.e. **OFF** to **ON** or vice versa), depress the **ENT** key.

3. Depress the **EXIT** key to return to the main Set Up Mode menu at the "**Logging**" option.

The alarm log message format is:

dd/mm/yy hh:mm **Alm:**xx (cc) **ON**< CR> < LF>

where:

dd = day of month (01 - 31)

mm = month (01 - 12)

yy = year (00 - 99)

hh = Time - hours (00 - 23)

mm = time - minutes (00 - 59)

xx = Alarm Number (00 - 04)

cc = Communication address of Controller (01 - 32)

< CR> = Carriage Return

< LF> = Line Feed

NOTE

Alarm logging and any other serial communications cannot be used simultaneously.

4.3.14 Enabling/Disabling Auto/Manual Control Selection

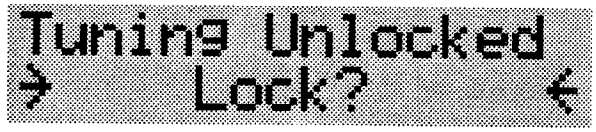
When this option is selected, the LCD display will show either of two displays:

Default

Depression of the **ENT** key will cause Auto/Manual Selection to be enabled/disabled, as appropriate. If the **EXIT** key is depressed instead, the status will not change and a return will be made to the Set Up Edit menu at the **Auto/Manual** option.

4.3.15 Tuning Lock

When this option is selected, the LCD display will show either:



or:

as appropriate. Depression of the **ENT** key will cause Tuning to be locked/unlocked, as appropriate (Unlocked - Tuning may be selected/de-selected in Operator Mode; Locked - Operator cannot select/de-select tuning). If the **EXIT** key is depressed instead, the status will not change and a return will be made to the Set Up Edit menu at the **Tuning Lock** option. The default setting is Unlocked.

4.3.16 Defining Operator Displays

This option enables selection (via entry of the correct password for Set Up Mode) of the displays available in Operator Mode. Its display is not available for inclusion in the Operator List.

NOTES

1. The Operator List can accommodate up to eight Read Only display entries and Eight Read/Write display entries. The List will always contain two Read Only entries and three Read/Write entries by default:

Read Only:

Output Power bar graph

Alarm Status display (+ shadow screens)

Read/Write:

Set Point adjustment (single or dual SP)

Active Set Point display/selection (if a dual set point is configured and operator control of set point values is enabled)

Tuning On/Off display and selection

These default displays cannot be de-selected.

2. In some instances, a sequence of displays can be added to the Operator List at the "cost" of just one entry on the list.

Selection of this option causes display of the View/Setup menu (whereby Read Only or Read/Write displays can be chosen) and then:

The user may then select addition/deletion of items to/from the Operator List (by depressing the **ENT** key) or definition of the Start-Up display which is automatically shown when the Controller is powered up (by depressing the **NEXT** key then the **ENT** key). When the user has selected the desired option, the LCD display will return to

an appropriate top-level menu in a special sub-mode called Display Define Mode, in which the user may move through the menu hierarchy and select options in the normal manner. When the required display is reached, it may be selected (if not currently selected) or de-selected (if currently selected) by depressing the **ENT** key. The user will not be able to select the following options from the Read/Write displays whilst Define Display sub-mode is active:

1. Locking
2. Op. Displays
3. Auto/Manual Enable/Disable
4. Tuning Lock

NOTE

Displays currently in the Operator List and the currently-selected Start-Up display are denoted by an up-arrow (⇑) in the right-hand side of the display.

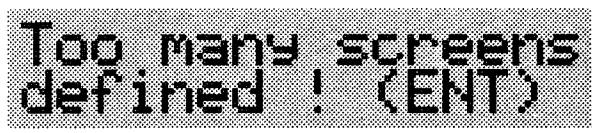
Whilst the Controller is in the Define Display sub-mode, the set point LED display will show:

4.3.16.1 ADDING/DELETING DISPLAYS TO/FROM THE OPERATOR LIST

When this option is selected, the initial display is of the View/Set Up menu, in order that the user may select Read Only or Read/Write displays in the normal manner. The user may then view the displays in the normal manner.

NOTE

If the Operator List (Read Only section or Read/Write section) is already full, selection of another display for insertion into the list will cause the LCD display to show:



The user should then depress the **ENT** key to acknowledge the display, whereupon a return is made to the original display. When all desired displays have been selected, the user must return to the View/Setup menu (by use of the **EXIT** key) from whence a depression of the **EXIT** key will cause a return to the Set Up Edit menu at the **Op. Displays** option and the Display Define sub-mode will be terminated (and the LED display will return to its normal set point value display).

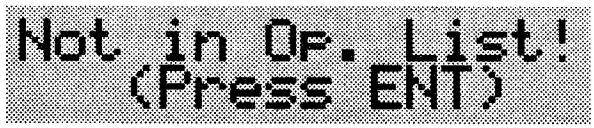
4.3.16.2 DEFINING THE START-UP DISPLAY

Selection of this option will cause the first items on the View Only menu to be shown. The user may step through the displays currently in the Operator List in the normal manner. When the required display appears, it may be selected/de-selected in the normal manner.

NOTE

Selection of a new start-up display automatically de-selects the original start-up display. Therefore, if the start-up display is to be changed, there is no need to de-select the original start-up display first. If an existing start-up display is de-selected and no other display is selected in its place, the default start-up display (output power bar graph) is automatically selected.

If the selected display is not on the Operator List, the LCD display will show:

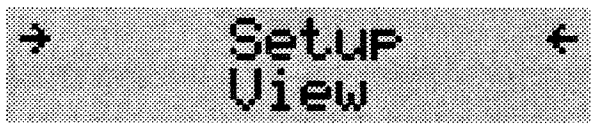


The user should then depress the **ENT** key to acknowledge the message, whereupon the start-up display will remain unchanged.

Depression of the **EXIT** key whilst one of the Read Only displays is shown will cause a return to the View/Setup menu. Another depression of the **EXIT** key will terminate the Display Define sub-mode and return to the Set Up Mode Edit menu at the **Op. Displays** option.

4.4 ENTERING VIEW MODE

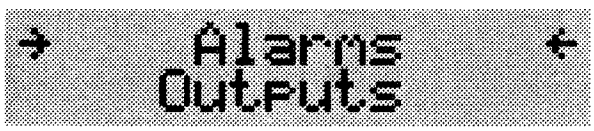
To enter View Mode, with the Controller initially in Operator Mode, depress the Up and Down keys simultaneously, whereupon the LCD display will show:



Depress the **NEXT** key to move the cursor to the lower line and then depress the **ENT** key. The LCD display will then show the Initial View Mode display (see Subsection 4.5).

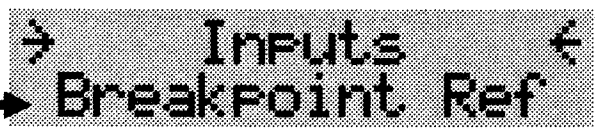
4.5 VIEW MODE

When this mode is selected, the LCD display will initially show:



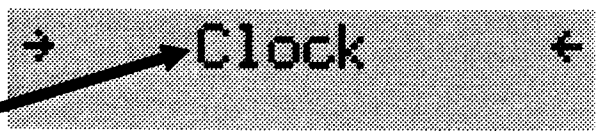
A single depression of the **NEXT** key will move the selection cursors to the Outputs option. Further depression of the **NEXT** key will cause the the following displays to appear in sequence (and the selection cursors to move to the next option):

Omitted if Controller has VMD outputs



Appears only if Controller has a serial communications option.

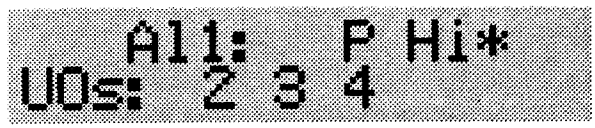
Appears only if Controller has a Real Time Clock option.



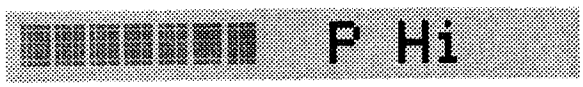
The display sequence and cursor movement can be reversed by holding down the **ALT** key whilst depressing the **NEXT** key. When the selection cursor is aligned with the display of the desired option, select the option by depressing the **ENT** key. A return can be made from any option to the menu by depressing the **EXIT** key.

4.5.1 Alarms

When this option is selected, the LCD display will show the types, linkages to outputs and status for alarms, in the form:



where the lower line of the display will show the outputs to which that alarm is linked. An asterisk to the right of an alarm indicates that the alarm is currently active. The alarm types displayed may be any of the following:



Process High Alarm

Process Low Alarm

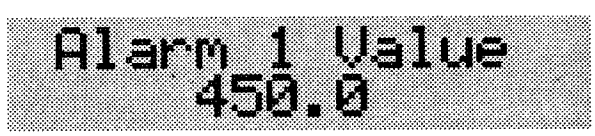
Deviation High Alarm

Deviation Low Alarm

Band Alarm

For any alarm which has no links with hardware, the lower line will display:

The user may step through the alarm displays using the **NEXT** key (or ALT/**NEXT** keys). Depression of the ALT key will cause a display of the value for the currently-selected alarm, in the form:

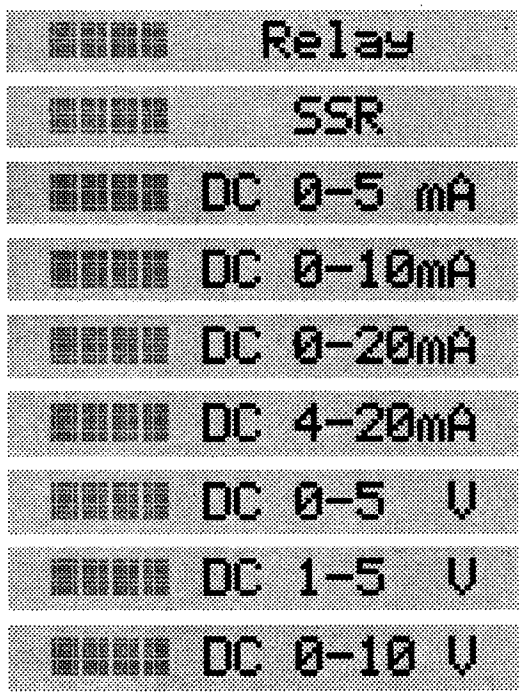


4.5.2 Outputs

When this option is selected, the LCD display is of the form:

which shows the output type on Universal Output 1 and its use. The user may then step to displays for the other outputs using the **NEXT** key (or **ALT/NEXT** keys). For an alarm output, the display will be of the form:

The output type displayed in each case will be one of the following:



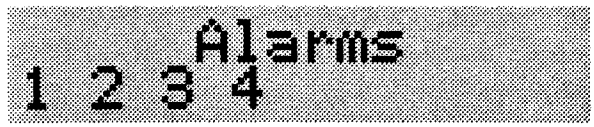
and the use will be one of the following:

Out.1	Output 1 (HEAT) - UO1 only
VMD CW	VMD Output (Clockwise) - UO1 only
Out.2	Output 2 (COOL) - UO2 only
VMD ACW	VMD Output (Anti-clockwise) - UO2 only
Alarm Dir	Direct-acting Alarm - not UO1
Alarm Rev	Reverse-acting Alarm - not UO1
Retrans.SP	Re-transmitted Output (Set Point) - not UO1
Retrans.PV	Re-transmitted Output (Process Variable) - not UO1
Event	Event Output (only if Real Time Clock option is fitted) - not UO1

NOTE

When any of these screens are selected for inclusion in the Operator Display List (see Subsection 4.3.12), all outputs can be viewed in Operator Mode using the **NEXT** key (or **ALT/NEXT** keys), in effect adding several screens to the List but using up only one entry on that List (maximum number of List entries is eight Read Only displays and eight Read/Write displays).

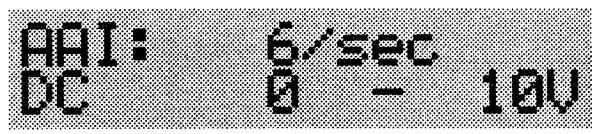
For each output, when links are made to alarms, the Shadow Screen shows the alarms to which the output is linked, in the form:



4.5.3 Inputs

When this option is selected, the LCD display initially shows the type, range and sample rate of the Universal Input, in the form:

For non-linear inputs, the information on the lower line will be the input range maximum/minimum as trimmed by the Range Trim function in Configuration Mode (see Subsection 6.3.1). For details of how to set the response to a break in the sensor circuit, see Subsection 4.3.6. If the Auxiliary Analogue Input is fitted, depression of the **NEXT** key will cause the LCD display to show a similar display for the Auxiliary Analogue Input, in the form:



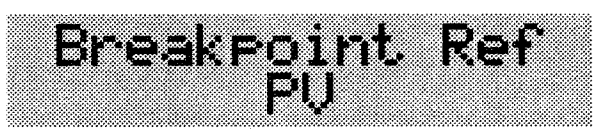
where the lower line indicates the AAI's linear input range. Another depression of the **NEXT** key will show Digital Input information, in the form:

where the Digital Input function may be one of:

A/M Switch (external selection of Auto or Manual control mode - see Subsection 6.13)
SP Switch (external selection of dual setpoint or remote/local setpoint - see Subsection 6.5)
Unused

4.5.4 Breakpoint Reference (Gain Scheduling)

This option shows the Breakpoint Reference parameter in the following form:



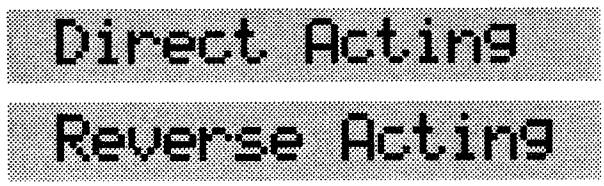
The types of breakpoint reference which may be displayed are:

SP	Value of current active setpoint (SP)
PV	Value of process variable (PV)
DEV	Value of deviation (PV – SP)
OUT	Value of output power

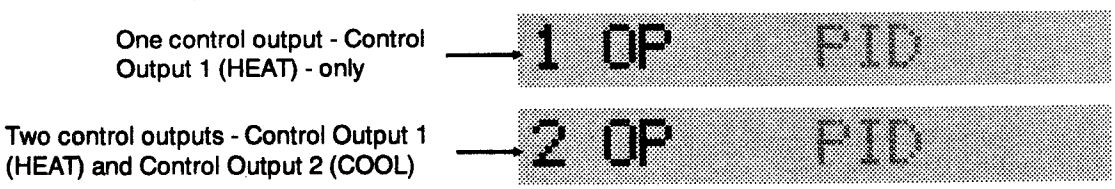
4.5.5 Control Status

This option allows the user to examine the output sense and control algorithm of the Controller, which are displayed in the form:

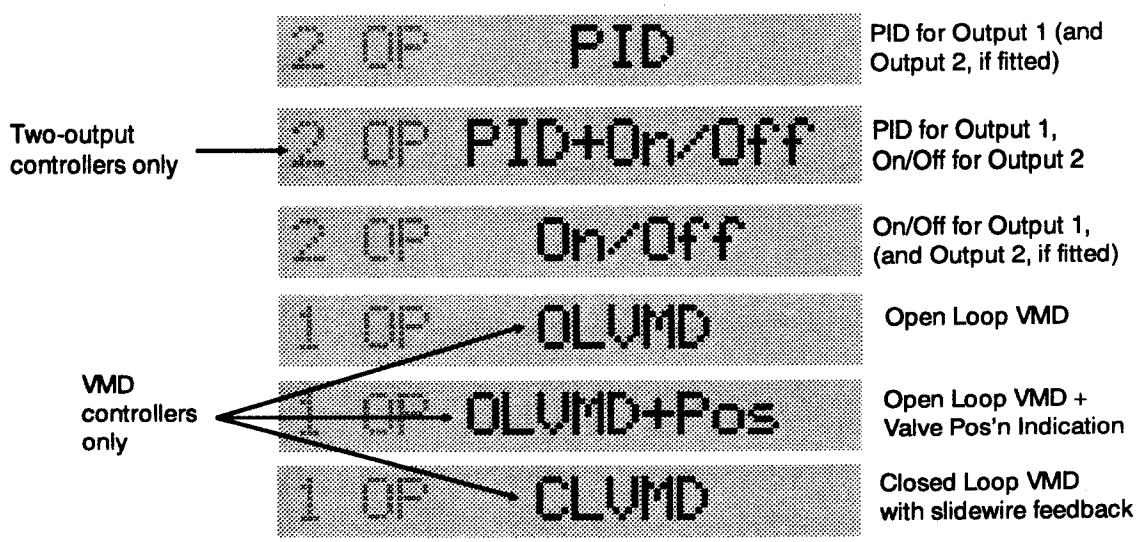
The sense of Control Output 1 will be either of:



Control Output 2 (if fitted) will always operate in the opposite sense to Control Output 1. The "Number of Control Outputs" field will be either of:

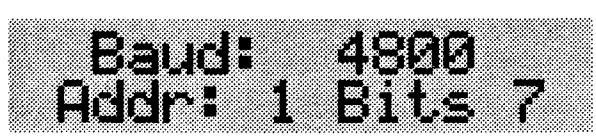


The Control Algorithm will be one of the following:



4.5.6 Communications

This option displays the parameter values for the serial communications link to a master device. When this option is selected, the initial LCD display is of the form:



which shows the Baud rate (4800, 9600 or 19200), address (in the range 1 - 32) and number of bits (7 or 8). Depression of the **NEXT** key changes the display to the form:

which shows the parity (even or odd) and communications protocol.

4.5.7 Clock

Selection of this option (accessible only if the Real Time Clock option is fitted) causes the Controller to display the current time/date.

4.6 EXIT FROM SET UP MODE OR VIEW MODE

To exit from Set Up Mode or View Mode, press the **EXIT** key repeatedly until the normal Operating Mode display (e.g. Output Power) is restored.

SECTION 5
SERIAL COMMUNICATIONS

The 5010 Controller may be equipped with a three-wire RS422-compatible (Product Code X06), five-wire RS422-compatible (Product Code X07) or RS232C-compatible (Product Code X83) serial communications facility, by which means communication may occur between the Controller and a master device (e.g. a computer or terminal).

5.1 RS485/RS232C CONNECTIONS

The connections for Controllers equipped with one of the serial communications options are shown in Section 3. Communication is at a user-selectable rate from the range 4800, 9600 and 19200 Baud and the cable used should be suitable for data transfer at the selected rate of the required distance. Transmitters/receivers conform to the recomendations in the EIA Standard RS422 or RS232C, as appropriate.

5.2 COMMUNICATIONS WRITE PERMISSION

When Communications Write Permission is granted (in Set Up Mode), the Controller parameters maybe adjusted by the master device via the serial communications link. If Communications Write Permission is not granted, the Controller will not adjust or change any parameters in response to commands received from the master device. Whether permission is granted or not, the Controller will return the requested information in response to a Type 2 Interrogation message (see Subsection 5.4.5) from the master device.

5.3 SELECTION OF COMMUNICATIONS CHANNEL ADDRESS

The address for each Controller is defined in Configuration Mode (see Subsection 6.10). Up to 32 Controllers, each with a unique address, may be connected to the master device.

5.4 PHYSICAL REQUIREMENTS

5.4.1 Character Transmission

Characters transmitted comprise (by default) one start bit, seven data bits, one even parity bit and one stop bit. The user may select the number of data bits (7 or 8), parity checking (Odd or Even) used and the Baud rate used (4800 Baud, 9600 Baud or 19200 Baud) on the asynchronous communications link - see Subsection 6.10).

5.4.2 Line Turn-Round

The communications link is operated as 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 can transmit. It is important that a transmitter releases the transmission lines before another device starts transmission. This imposes the following restraints on the master device:

(a) The transmitter must release the transmission lines within a specific time (dependent upon the Baud rate used) 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 master device must be taken into account. The time limit is 6 milliseconds (for 4800 Baud), 3 milliseconds (for 9600 Baud) or 1.5 milliseconds (for 19200 Baud).

(b) The transmitter must not start transmission until a specific time (dependent upon the Baud rate used) has elapsed since the reception of the last character of a message. This time is 6 milliseconds (for 4800 Baud), 3 milliseconds (for 9600 Baud) or 1.5 milliseconds (for 19200 Baud).

All WEST Controllers having 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.

5.4.3 Communications Protocol

The protocol assumes half duplex communications (in spite of the electrical capability of the RS232C option). 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 the reply to the query. All messages, in either direction, comprise:

(a) A Start of Message character
(b) One or two address characters (uniquely defining the slave)
(c) A parameter/data character string
(d) An End of Message character

Messages from the master device may be one of four types:

Type 1:

L {N} ? ? *

Type 2:

L {N} {P} {C} *

Type 3:

L {N} {P} # {DATA} *

Type 4:

L {N} {P} I *

where all characters are in ASCII code and:

L	is the Start of Message character (Hex 4C)
{N}	is the slave Controller address (in the range 1 - 32); addresses 1 - 9 may be represented by a single digit (e.g. 7) or in two-digit form, the first digit being zero (e.g. 07).
{P}	is a character which identifies the parameter to be interrogated/modified (Hex 41 - 7E) - see Table 5-2.
{C}	is the command (see below)
#	indicates that {DATA} is to follow (Hex 23)
{DATA}	is a string of numerical data in ASCII code (see Table 5-1)
*	is the End of Message character (Hex 2A)

No space characters are permitted in messages.

Table 5-1 {DATA} Element Format/Decimal Point Posn.

First Four Digits	Fifth Digit
+ abcd	0
+ abc.d	1
+ ab.cd	2
+ a.bcd	3
–abcd	5
–abc.d	6
–ab.cd	7
–a.bcd	8

Table 5-2 Commands/Parameters and Identifiers

Identifier Character	Parameter/Command	Identifier Character	Parameter/Command
A	Setpoint Maximum	a	Alarm Type
B	Output 1 Maximum Power	b	Output 1 Minimum Power
C	Alarm 1 Value	c	Alarm 3 Value
D	Rate (Derivative) Value	d	Breakpoint Rate (Derivative) Value
E	Alarm 2 Value	e	Alarm 4 Value
F	Hysteresis/Minimum ON-Time	f	Breakpoint Hysteresis
G	Input Range Maximum	g	Output 2 Maximum Power
H	Input Range Minimum	h	Alarm Output Links
I	Reset (Integral) Value	i	Breakpoint Reset (Integral) Value
J	Manual Reset	j	Output Alarm Links
K	Overlap/Deadband	k	Breakpoint Value
L	Controller Status	l	Input Range Type
M	Process Variable Value	m	Input Filter Time Constant
N	Output 1 Cycle Time	n	Setpoint Mode
O	Output 2 Cycle	o	Output Type & Usage
P	Proportional Band 1 Value	p	Breakpoint Proportional Band 1 Value
Q	Decimal Point Position	q	Breakpoint Reference
R	Remote Setpoint Value	r	Control Algorithm & Action
S	Setpoint Selection	s	Select Setpoint
T	Setpoint Minimum Value	t	Time/Date
U	Proportional Band 2/Motor Travel Time value	u	Breakpoint Proportion Band 2 Value
		v	Process Variable Offset Value
V	Deviation	w	Safety Preset Output Value
W	Power Output	x	Set Item Number
X	Remote Setpoint Maximum Value	y	Input Sample Rate
Y	Remote Setpoint Minimum Value	z	Enter Configuration Mode
Z	Controller Commands	{	Re-Transmitted Setpoint Max. Value
[	Re-Transmitted PV Maximum	|	Re-Transmitted Setpoint Min. Value
\	Re-Transmitted PV Minimum	}	Output Relay Time
]	Scan Table	~	Remote Setpoint Offset
^	Setpoint Ramp Rate		
_	Setpoint/Remote Setpoint Value		

5.4.4 Type 1 Message

L{N} ??*

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

L{N} ?A*

An inactive Controller will give no reply.

5.4.5 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 Controller. {P} identifies the parameter (as defined in Table 5-2) and {C} represents the command to be executed, which may be one of the following:

+ (Hex 2B) - Increment the value of the parameter defined by {P}
– (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 Controller is of the form:

L{N} {P} {DATA} A*

where {DATA} comprises five ASCII-coded digits whose format is shown in Table 5-1. The data is the value requested in a query message or the new value of the parameter after modification. If the action requested by the message from the master device would result in an invalid value for that parameter (either because the requested new value would be outside the permitted range for that parameter or because the parameter is not modifiable), the Controller replies with a negative acknowledgement:

L{N} {P} {DATA} N*

The {DATA} string in the negative acknowledgement reply will contain an error number, giving an indication of the reason for the failure of the request. If the process variable or the deviation is interrogated whilst the process variable is outside the range of the Controller, the reply is:

L{N} {P} < ??> 0A*

if the process variable is over-range, or

L{N} {P} < ??> 5A*

if the process variable is under-range.

Scan Tables

A parameter identifier character] in the message from the master device indicates that a "Scan Table" operation is required. This provides a facility for interrogating the values of groups of parameters and status in a single message from the master device. The reply to such a command would be in the form:

L{N}] xx aaaaa bbbbb ccccc ddddd eeeee A*

where xx is the number of data digits to follow; this is 20 for a single-control-output instrument and 25 for a dual-control-output instrument. The digits are expressed as shown in Table 5-1. For further information, refer to Subsection 5.5.6.3.

5.4.6 Type 3 Message

L{N} {P} # {DATA} *

This message type is used by the master device to set a parameter to the value specified in {DATA}. The command is not implemented immediately by the slave Controller; the slave will receive this command and will then wait for a Type 4 message (see below). Upon receipt of a Type 3 message, if the {DATA} content and the specified parameter are valid, the slave Controller reply is of the form:

L{N} {P} {DATA} I *

indicating that the Controller is ready to implement the command. If the parameter identifier {P} is not alphabetic, the command 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 Controller replies with a negative acknowledgement in the form:

L{N} {P} {DATA} N *

5.4.7 Type 4 Message

L{N} {P} I *

This type of message is sent by the master device to the addressed slave Controller following a successful Type 3 message transmission and reply to/from the same slave Controller. Provided that the {DATA} content and the parameter specified in the preceding Type 3 message are still valid, the slave Controller will then set the parameter to the desired value and will reply in the form:

L{N} {P} {DATA} A *

where {DATA} is the new value of the parameter. If the new value or parameter specified is invalid, the slave Controller will reply with a negative acknowledgement in the form:

L{N} {P} {DATA} N *

where {DATA} is the current (unaltered) value of the parameter. If the immediately-preceding message received by the slave Controller 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 device is available on request from your nearest WEST division.

5.4.8 Broadcast Message

The master device may send a Type 2 Increment/Decrement command or Type 3/4 message to all the slave Controllers on a communications link by making the controller address {N} in that message equal 00 (note that it is necessary to use two digits in this address). In this way, the master device may set a specific parameter to a specified value in all its slave Controllers using one message only. There will be no acknowledgement of a broadcast message, therefore it will be necessary for the master device subsequently to check each Controller individually to verify that the command has been implemented.

5.5 INDIVIDUAL PARAMETERS

The individual parameters and how they may be interrogated/modified are described below. Unless otherwise stated, the {DATA} element will follow the standard five-digit format and the decimal point position must be correct for the new value to be accepted and for modification to occur.

NOTE

The communications identifier character {P} for each parameter is shown to the right of each subsection heading.

5.5.1 Input Parameters

5.5.1.1 PROCESS VARIABLE OR MEASURED VARIABLE {P} = M

This parameter may be interrogated only, using a Type 2 message. If the process variable is out of range, the five-digit {DATA} field in the reply will not contain a number, but will contain **< ??> 0** (over-range) or **< ??> 5** (under-range).

5.5.1.2 PROCESS VARIABLE OFFSET {P} = V

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It modifies the actual process variable value (as measured at the Controller's input terminals) in the following manner:

Modified PV value = Actual PV value + process variable offset value

The modified PV value is limited by Range Maximum and Range Minimum and is used for display and alarm purposes and for re-transmitted PV outputs.

NOTE

This parameter value should be selected with care. Any adjustment to this parameter is, in effect, an adjustment to the Controller's calibration. Injudicious application of values to this parameter could lead to the displayed PV value having no meaningful relationship to the actual PV value.

5.5.1.3 INPUT BASE RANGE TYPE {P} = 1

This parameter may be interrogated (using a Type 2 message) or modified, if preceded by an **Enter Configuration Mode** command with no intervening non-configuration Write operations via the communications link (using a Type 3/4 message sequence). This command indicates/defines the base range of the input specified by a preceding **Set Item Number** command. For the 5010 Controller, the only valid Item Number settings are 1 (for the Universal Input) or 3 (for the Auxiliary Analogue Input). Any other value will cause an error message to be returned to the master device. Range types are encoded as a number in the first four digits of the five-digit {DATA} element in the message (the decimal point position being zero). The codes are as follows:

Number	Product Code	Input Type/Range
0000	T6405	T/C "J" –100 to 760°C
0001	T6406	T/C "J" –150 to 1400°F
0002	T6407	T/C "J" –100.0 to 450.0°C
0003	T6408	T/C "J" –150.0 to 840.0°F
0004	T6805	T/C "L" –100 to 760°C
0005	T6806	T/C "L" –150 to 1400°F
0006	T6807	T/C "L" –100.0 to 450.0°C
0007	T6808	T/C "L" –150.0 to 840.0°F
0008	T6709	T/C "K" –200 to 1372°C
0009	T6710	T/C "K" –328 to 2500°F
0010	T6711	T/C "K" –200.0 to 450.0°C
0011	T6712	T/C "K" –328.0 to 840.0°F
0012	T6617	T/C "E" –100 to 800°C
0013	T6618	T/C "E" –150 to 1472°F
0014	T6513	T/C "T" –200.0 to 400.0°C
0015	T6514	T/C "T" –328.0 to 750.0°F
0016	T1127	T/C "R" 0 to 1650°C
0017	T1128	T/C "R" 32 to 3002°F
0018	T1227	T/C "S" 0 to 1650°C
0019	T1228	T/C "S" 32 to 3002°F
0020	T1983	T/C "B" 100 to 1820°C
0021	T1984	T/C "B" 212 to 3308°F
0022	T5111	T/C "W5" 0 to 2316°C
0023	T5112	T/C "W5" 32 to 4201°F
0024	T5373	T/C "N" 0 to 1300°C
0025	T5349	T/C "N" 32 to 2372°F
0026	T7215	RTD 3W –200 to 850°C
0027	T7216	RTD 3W –328 to 1562°F
0028	T7213	RTD 3W –200.0 to 400.0°C
0029	T7214	RTD 3W –328.0 to 750.0°F
0030	T4011	DC Linear 0 - 10mV
0031	T4043	DC Linear 0 - 50mV
0032	T4045	DC Linear 0 - 5V
0033	T4034	DC Linear 1 - 5V
0034	T4046	DC Linear 0 - 10V
0035	T3039	DC Linear 0 - 10mA
0036	T3013	DC Linear 0 - 20mA
0037	T3014	DC Linear 4 - 20mA
0032 *	X04	AAI 0 - 5V
0033 *	X38	AAI 1 - 5V
0034 *	X36	AAI 0 - 10V
0035 *	X03	AAI 0 - 10mA
0036 *	X37	AAI 0 - 20mA
0037 *	X05	AAI 4 - 20mA

The Item Number must be set to 1 in all instances except those marked with an asterisk, in which the Item Number must be set to 3.

5.5.1.4 INPUT RANGE MAXIMUM {P} = G

For a linear input, this will be Scale Maximum; for a non-linear input, this will be the trimmed maximum value (as opposed to the base range maximum value). This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The decimal point position is as for the input range.

5.5.1.5 INPUT RANGE MINIMUM {P} = H

For a linear input, this will be Scale Minimum; for a non-linear input, this will be the trimmed minimum value (as opposed to the base range minimum value). This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The decimal point position is as for the input range.

5.5.1.6 DECIMAL POINT POSITION {P} = Q

For a linear Universal Input, this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This parameter cannot be modified if the Universal Input range is non-linear.

NOTE

If the Controller is configured for Remote Setpoint operation and the Auxiliary Analogue Input is used as the Remote Setpoint input, the Auxiliary Analogue Input decimal point position will be the same as the Universal Input decimal point position.

5.5.1.7 INPUT FILTER TIME CONSTANT {P} = m

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence.

5.5.1.8 INPUT SAMPLE RATE {P} = y

This parameter may be interrogated using a Type 2 message or may be modified (if preceded by an **Enter Configuration Mode** command with no intervening non-configuration modifications via the communications link) using a Type 3/4 message sequence. The sample rate is defined by the five-digit {DATA} element in a message, in which the decimal point positon (fifth) digit must be set to 1 and the other four digits must be set to 0006 (6 samples/second) or 0020 (20 samples/second). Any other value will cause an error message to be returned to the master device.

NOTE

For this command (interrogation only), the Item Number must be set to 1, otherwise an error message will be returned to the master device. The Auxiliary Analogue Input (if fitted) sample rate is slaved to that of the Universal Input.

5.5.1.9 AUXILIARY ANALOGUE INPUT MAXIMUM VALUE {P} = X

For a Controller which is fitted with an Auxiliary Analogue Input (for use either as a Remote Setpoint input or as feedback for VMD operation), this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It may be set to any value in the range –9999 to 9999 and will correspond to the Auxiliary Analogue Input range maximum (e.g. for a 0 - 20mA input, this parameter value corresponds to 20mA). For Remote Setpoint applications, the decimal point position will always correspond to that for the Universal Input. This parameter is not available if the Controller does not have an Auxiliary Analogue Input.

NOTE

This command is also used to interrogate/modify the Remote Setpoint Maximum Value (see Subsection 5.5.3.5)

5.5.1.10 AUXILIARY ANALOGUE INPUT MINIMUM VALUE {P} = Y

For a Controller which is fitted with an Auxiliary Analogue Input (for use either as a Remote Setpoint input or as feedback for VMD operation), this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It may be set to any value in the range –9999 to 9999 and will correspond to the Auxiliary Analogue Input range minimum (e.g. for a 0 - 20mA input, this parameter value corresponds to 0mA). For Remote

Setpoint applications, the decimal point position will always correspond to that for the Universal Input. This parameter is not available if the Controller does not have an Auxiliary Analogue Input.

NOTE

This command is also used to interrogate/modify the Remote Setpoint Minimum Value (see Subsection 5.5.3.6)

5.5.2 Output Parameters

5.5.2.1 POWER OUTPUT VALUE {P} = W

For non VMD Controllers, the value of this parameter may range between 0.0% and 100.0% (for a single-output Controller) or -100.0% and 100.0% for a dual output Controller.

For non-VMD Controllers, if Manual control is not selected, this parameter may be interrogated only using a Type 2 message; if Manual control is selected, this parameter may be adjusted using a Type 2 message or a Type 3/4 message sequence.

For Closed Loop VMD Controllers, this parameter may be adjusted using a Type 2 message or a Type 3/4 message sequence. For Open Loop VMD Controllers, this parameter may be interrogated only using a Type 2 message. For a Controller configured for Open Loop VMD operation without valve position indication, the response to an interrogation will contain either positive values (indicating that the valve is open or opening) or negative values (indicating that the valve is closed or closing).

5.5.2.2 OUTPUT 1 MAXIMUM POWER {P} = B

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the power limit for Universal Output 1 and may be set in the range 0.0% to 100.0% of full power. The default value is 100.0%. The decimal point position is set to 1.

NOTE

This parameter is not available if the Controller is fitted with a VMD output option.

5.5.2.3 OUTPUT 1 MINIMUM VALUE {P} = b

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the minimum power limit for Universal Output 1 and may be set in the range 0.0% to 100.0% of full power. The default value is 0.0%. The decimal point position is set to 1.

NOTE

This parameter is not available if the Controller is fitted with a VMD output option.

5.5.2.4 OUTPUT 2 MAXIMUM POWER {P} = g

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the power limit for Universal Output 2 (if used as a control output) and may be set in the range 0.0% to 100.0% of full power. The decimal point position is set to 1. The default value is 100.0%.

NOTE

This parameter is not available if the Controller is fitted with a VMD output option or if the Controller has only one control output.

5.5.2.5 OUTPUT 1 CYCLE TIME {P} = N

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The value to which this is set is dependent upon the output type and the nature of the process to be controlled. For relay outputs, this parameter should be set to as large a value as possible (consistent with satisfactory control of the

process) in order that the life of the relay be maximised. For SSR outputs, lower values may be used. The decimal point position is set to 0.

NOTE

Cycle Time values must be written correctly if a Type 3/4 message sequence is used i.e. the value must be a power of 2 in the range 2 - 512 (2, 4, 8, etc.).

5.5.2.6 OUTPUT 2 CYCLE TIME {P} = O

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The value to which this is set is dependent upon the output type and the nature of the process to be controlled. For relay outputs, this parameter should be set to as large a value as possible (consistent with satisfactory control of the process) in order that the life of the relay be maximised. For SSR outputs, lower values may be used. The decimal point position is set to 0.

NOTE

Cycle Time values must be written correctly if a Type 3/4 message sequence is used i.e. the value must be a power of 2 in the range 2 - 512 (2, 4, 8, etc.).

5.5.2.7 SENSOR BREAK PRESET OUTPUT {P} = W

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. When a break in the sensor circuit is detected, the output will be set to a value defined by this parameter, which is adjustable in the range 0.0% to 100.0% (for a single output Controller) or –100.0% to 100.0% (for a dual output Controller). Any value outside this range will cause an error message to be sent to the master device. The decimal point position is set to 1.

5.5.2.8 RE-TRANSMITTED PV MAXIMUM VALUE {P} = [

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the maximum scale value for the Controller's Retransmitted Process Variable output and may be adjusted within the range –9999 - 9999. This value corresponds to the Universal Input scale maximum and the decimal point position will always be the same as that for the Universal Input.

If the Controller has no outputs configured as re-transmitted process variable outputs, receipt of this command will cause an error message to be returned to the master device.

NOTE

If this parameter is set to a value less than the Re-transmitted PV Minimum Value, the sense of the re-transmitted output is reversed.

5.5.2.9 RE-TRANSMITTED PV MINIMUM VALUE {P} = \

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the minimum scale value for the Controller's Retransmitted Process Variable output and may be adjusted within the range –9999 - 9999. This value corresponds to the Universal Input scale minimum and the decimal point position will always be the same as that for the Universal Input.

If the Controller has no outputs configured as re-transmitted process variable outputs, receipt of this command will cause an error message to be returned to the master device.

NOTE

If this parameter is set to a value greater than the Re-transmitted PV Maximum Value, the sense of the re-transmitted output is reversed.

5.5.2.10 RE-TRANSMITTED SETPOINT MAXIMUM VALUE {P} = {

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This parameter defines the maximum output value for a Re-Transmitted Setpoint output. If no outputs are configured as re-transmitted setpoint outputs, receipt of the command will cause an error mesage to be returned to the master device. The decimal point position is as for the setpoint.

NOTE

If this parameter is set to a value less than the Re-transmitted Setpoint Minimum Value, the sense of the re-transmitted output is reversed.

5.5.2.11 RE-TRANSMITTED SETPOINT MINIMUM VALUE {P} = |

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This parameter defines the minimum output value for a Re-Transmitted Setpoint output. If no outputs are configured as re-transmitted setpoint outputs, receipt of the command will cause an error mesage to be returned to the master device. The decimal point position is as for the setpoint.

NOTE

If this parameter is set to a value greater than the Re-transmitted Setpoint Maximum Value, the sense of the re-transmitted output is reversed.

5.5.2.12 OUTPUT TYPE AND USAGE {P} = o

This parameter may be interrogated using a Type 2 message or may be modified (if preceded by an **Enter Configuration Mode** command with no intervening non-configuration modifications via the communications link) using a Type 3/4 message sequence. This parameter indicates/defines the usage and type for the output number equal to the current value of the Item Number (set by the most-recent preceding **Set Item Number** command). Therefore, acceptable values of Item Number are 1,2,3 and 4 (dependent on how many universal outputs are configured in the Controller. Receipt of this command whilst the Item Number is set to an invalid value will cause an error message to be returned to the master device. The Output Type is encoded in the first two digits of the {DATA} element in the message and Output Usage is encoded in the second two digits (the fifth digit being zero). The Output Type codes used are as follows:

Code	Output Type	Code	Output Type	Code	Output Type
0	Relay	3	DC 0 - 10mA	6	DC 0 - 5V
1	SSR Drive	4	DC 0 - 20mA	7	DC 1 - 5V
2	DC 0 - 5mA	5	DC 4 - 20mA	8	DC 0 - 10V

The Output Usage codes are as follows:

Code	Output Usage	Code	Output Usage
0	Control Output 1	5	Re-Transmitted Process Variable
1	Control Output 2	6	Event
2	Alarm (Direct-acting)	7	VMD (clockwise)
3	Alarm (Reverse-acting)	8	VMD (anti-clockwise)
4	Re-Transmitted Setpoint		

5.5.2.13 OUTPUT ALARM LINKS {P} = j

This parameter may be interrogated only, using a Type 2 message. The Output to which the command applies is defined by a preceding **Set Item Number** command. If the Item Number is set to less than 1 or greater than 4, an error message will be returned to the master device. The {DATA} element in the response to an interrogation comprises a five-digit numerical representation of a 16-bit binary number. Each bit of that binary number represents an alarm, Alarm 1 being represented by Bit 0 (least significant bit) and so on. If a given bit is set, the specified output is linked to the alarm represented by that bit. If a given bit is reset, no link exists between the specified output and the alarm represented by that bit.

5.5.2.14 MINIMUM RELAY ON/OFF TIME {P} = }

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The output to which the command applies is defined by the current value of the Item Number. If the Item Number is less than 1 or greater than 4, receipt of this command will cause an error message to be returned to the master device., This parameter defines the minimum time for which a relay can be ON/OFF. It also affects the Output Cycle Time (see Subsection 4.3.6). The decimal point position is set to 0.

5.5.3 Setpoint Parameters

5.5.3.1 SETPOINT 1 VALUE {P} = S

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It can be set to any value between Setpoint Maximum (see Subsection 5.5.3.1) and Setpoint Minimum (see Subsection 5.5.3.2). With the Controller configured for Remote Setpoint operation, this parameter is the Local Setpoint value.

5.5.3.2 SETPOINT 2 VALUE {P} = _

For a Controller configured for Dual Setpoint, this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It can be set to any value between Setpoint Maximum (see Subsection 5.5.3.1) and Setpoint Minimum (see Subsection 5.5.3.2).

If the Controller is configured for remote setpoint operation, this parameter is the remote setpoint value and can be interrogated only, using a Type 2 message.

If the Controller is not configured for either Dual Setpoint or Remote Setpoint operation, this parameter is not accessible.

5.5.3.3 REMOTE SETPOINT VALUE {P} = R

If the Controller is configured for Remote Setpoint operation, this parameter may be interrogated only using a Type 2 message. If the Controller is not configured for Remote Setpoint operation, this parameter is not accessible.

5.5.3.4 SETPOINT RAMP RATE {P} = ^

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the rate at which the current setpoint can be made to ramp and can be set to a value in the range 1 - 9999 increments per hour. If it is desired to switch setpoint ramping OFF, a Type 3/4 message sequence should be used in which the {DATA} element of the Type 3 message should be set to 00015. If setpoint ramping is OFF, the {DATA} element in the response to an interrogation will be set to 00015.

5.5.3.5 SELECT SETPOINT {P} = s

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This parameter selects the setpoint to be used and is only modifiable if the Controller is in Dual Setpoint mode and operator selection of setpoint is enabled. Otherwise, an error message will be returned to the master device. The setpoint is selected by setting the first four digits of the {DATA} element in a message to either 1 or 2 (the fifth digit is set to zero) to select Setpoint 1 or Setpoint 2 respectively. Any other value in the {DATA} element will cause an error message to be returned to the master device.

5.5.3.6 SETPOINT MAXIMUM VALUE {P} = A

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the maximum value which may be assigned to a setpoint. The default value is Input Range Maximum. The permissible range is between the current setpoint value and Input Range Maximum (see Subsection 5.5.1.1). The decimal point position is as for the input range.

5.5.3.7 SETPOINT MINIMUM VALUE {P} = T

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the minimum value which may be assigned to a setpoint. The default value is Input Range Minimum It may be set

to a value between Input Range Minimum (see Subsection 5.5.1.2) and the current value of the setpoint. The decimal point position is as for the input range.

5.5.3.8 REMOTE SETPOINT MAXIMUM VALUE {P} = X

For a Controller which is fitted with an Auxiliary Analogue Input (for use either as a Remote Setpoint input or as feedback for VMD operation), this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It may be set to any value in the range –9999 to 9999 and will correspond to the Auxiliary Analogue Input range maximum (e.g. for a 0 - 20mA input, this parameter value corresponds to 20mA). For Remote Setpoint applications, the decimal point position will always correspond to that for the Universal Input. This parameter is not available if the Controller does not have an Auxiliary Analogue Input.

NOTE

This command is also used to interrogate/modify the Auxiliary Analogue Input Maximum Value (see Subsection 5.5.1.5)

5.5.3.9 REMOTE SETPOINT MINIMUM VALUE {P} = Y

For a Controller which is fitted with an Auxiliary Analogue Input (for use either as a Remote Setpoint input or as feedback for VMD operation), this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It may be set to any value in the range –9999 to 9999 and will correspond to the Auxiliary Analogue Input range minimum (e.g. for a 0 - 20mA input, this parameter value corresponds to 0mA). For Remote Setpoint applications, the decimal point position will always correspond to that for the Universal Input. This parameter is not available if the Controller does not have an Auxiliary Analogue Input.

NOTE

This command is also used to interrogate/modify the Auxiliary Analogue Input Minimum Value (see Subsection 5.5.1.6)

5.5.3.10 REMOTE SETPOINT OFFSET {P} = ~

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It modifies the actual setpoint value (as detected at the Controller's Auxiliary Analogue Input terminals) in the following manner:

Modified remote setpoint value = Actual remote setpoint value + remote setpoint offset value

The modified remote setpoint value is limited by Remote Setpoint Maximum (see Subsection 5.5.3.5) and Remote Setpoint Minimum (see Subsection 5.5.3.6). It enables the Controller to compensate for any bias in the raw Remote Setpoint signal and is also used for re-transmitted setpoint outputs. If the Controller is not configured for Remote Setpoint operation, receipt of this command will cause an error message to be returned to the master device.

5.5.3.11 SETPOINT MODE {P} = n

This parameter may be interrogated using a Type 2 message or may be modified (if preceded by an **Enter Configuration Mode** command with no intervening non-configuration modifications via the communications link) using a Type 3/4 message sequence. The decimal point position is set to 0. The setpoint mode is represented by the first four digits of the five-digit {DATA} element in the message, as follows:

Four-digit Number	Setpoint Mode
0000	Single Setpoint
0001	Dual Local (internal) Setpoint with Operator Switching
0002	Dual Local (internal) Setpoint with External Switching
0003	Remote Setpoint + Local Setpoint with Operator Switching
0004	Remote Setpoint + Local Setpoint with External Switching

If an attempt is made to select a remote setpoint mode on a Controller which does not possess the hardware appropriate to remote setpoint operation, an error mesage will be returned to the master device.

5.5.4 Alarm Parameters

5.5.4.1 ALARM 1 VALUE {P} = C

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the level at which Alarm 1 will go active (the alarm operation will be dependent upon the alarm type selected for Alarm 1 - see Subsection 5.5.4.5). The decimal point position is as for the input range.

5.5.4.2 ALARM 2 VALUE {P} = E

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the level at which Alarm 2 will go active (the alarm operation will be dependent upon the alarm type selected for Alarm 2 - see Subsection 5.5.4.5). The decimal point position is as for the input range.

5.5.4.3 ALARM 3 VALUE {P} = c

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the level at which Alarm 3 will go active (the alarm operation will be dependent upon the alarm type selected for Alarm 3 - see Subsection 5.5.4.5).

5.5.4.4 ALARM 4 VALUE {P} = e

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the level at which Alarm 4 will go active (the alarm operation will be dependent upon the alarm type selected for Alarm 4 - see Subsection 5.5.4.5).

5.5.4.5 ALARM TYPE {P} = a

This parameter may be interrogated using a Type 2 message or modified using a Type 3/4 message sequence. The {DATA} element in the Type 3 message is the normal five-digit number. However, the current Item Number value indicates the number of the alarm to be modified and the first four digits of the {DATA} element define the alarm type, as follows:

Four-digit Number	Alarm Type	Four-digit Number	Alarm Type
0000	Unused	0003	Deviation High
0001	Process High	0004	Deviation Low
0002	Process Low	0005	Band

A Type 2 Interrogate message may be used to read the current alarm type, but this message should be preceded by a **Set Item Number** command to specify the alarm to be interrogated. If the Item Number is less than 1 or greater than 4, an error message will be returned to the master device.

5.5.4.6 ALARM OUTPUT LINKS {P} = h

This parameter may be interrogated using a Type 2 message or (if preceded by an **Enter Config Mode** command with no intervening non-configuration Write operations via the communications link) may be modified by a Type 3/4 message sequence. This identifies and (for modification) defines the outputs to which the specified alarm (defined by a preceding **Set Item Number** command) is linked. The {DATA} element in the response to an interrogation or the Type3/4 message command comprises a five-digit numerical representation of a 16-bit binary number. Each bit of that binary number represents an output, Universal Output 1 being represented by Bit 0 (least significant bit) and so on. If a given bit is set, the specified alarm is linked to the output represented by that bit. If a given bit is reset, no link exists between the specified alarm and the output represented by that bit.

5.5.5 Tuning Parameters

5.5.5.1 RATE (DERIVATIVE TIME CONSTANT) {P} = D

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the derivative time constant for the control algorithm. The {DATA} element is in a format in which the first two digits represent minutes and the second two digits represent seconds. The decimal point is used as the separator between the minutes and seconds digits (i.e. set to 2 decimal places); the decimal point position must be as described, otherwise modification will not occur.

5.5.5.2 RESET (INTEGRAL TIME CONSTANT) {P} = I

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The {DATA} element is in a format in which the first two digits represent minutes and the second two digits represent seconds. The decimal point position complies with this format and the decimal point is used as a separator between the minutes digits and the seconds digits. The decimal point must be in the correct position for modification to occur.

5.5.5.3 MANUAL RESET/INTEGRAL PRE-LOAD {P} = J

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. The decimal point position is as for the input range.

NOTE

This parameter is not available for Controllers with ON/OFF control.

5.5.5.4 HYSTERESIS/MINIMUM ON TIME {P} = F

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the switching hysteresis (for Controllers with an ON/OFF control output - primary or secondary output) or the motor switching hysteresis (for Controllers with VMD output).

NOTE

If the Controller does not have an ON/OFF control output or VMD output, this parameter is not applicable.

5.5.5.5 OVERLAP/DEADBAND {P} = K

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. On non-VMD Controllers, this parameter may be set to positive and negative values (a positive value indicates overlap, a negative value indicates deadband). On VMD Controllers, only positive values are acceptable; they will always indicated deadband. The decimal point position = 0.

NOTE

This parameter is not applicable to Controllers with only one control output.

5.5.5.6 PROPORTIONAL BAND 1 VALUE {P} = P

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This may be set to a value in the range 0.5% - 999.9% of Output 1 power range. The decimal point position is set to 1.

5.5.5.7 PROPORTIONAL BAND 2/MOTOR TRAVEL TIME VALUE {P} = U

For a dual control output or VMD output instrument only, this parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. It defines the value of Proportional Band 2 (for non-VMD Controllers) or Motor Travel Time (for Controllers with VMD output). The Proportional Band 2 value may be set in the range 0.5% - 999.9% of Output 2 power range. The decimal point position is set to 1.

5.5.5.8 BREAKPOINT RATE (DERIVATIVE TIME CONSTANT) VALUE {P} = d

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This is the derivative (Rate) value for the currently-selected gain scheduling breakpoint. The breakpoint is selected by a preceding **Set Item Number** command. If the Item Number is set to less than 0 or greater than 5, an error message is returned to the master device.

5.5.5.9 BREAKPOINT RESET (INTEGRAL TIME CONSTANT) {P} = i

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This indicates/defines the Integral (Reset) time constant value for the currently-selected gain scheduling breakpoint (specified by a preceding **Set Item Number** command). If the Item Number is set to less than 0 or greater than 5, an error message will be returned to the master device.

5.5.5.10 BREAKPOINT HYSTERESIS {P} = f

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This is the hysteresis value for the currently-selected gain scheduling breakpoint. The breakpoint selected is defined by the Item Number in a preceding **Set Item Number** command. If the Item Number is set to less than zero or greater than 5, an error message will be returned to the master device.

5.5.5.11 BREAKPOINT PROPORTIONAL BAND 1 {P} = p

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This is the Proportional Band 1 value for the currently-selected breakpoint (defined by a preceding **Set Item Number** command). The permissible range of values for this parameter is between 0.0% and 100.0%. If any other value is assigned or the Item Number is set to less than 0 or greater than 5, an error message will be returned to the master device. The decimal point position is set to 1.

5.5.5.12 BREAKPOINT PROPORTIONAL BAND 2 {P} = u

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This is the Proportional Band 2 value for the currently-selected breakpoint (defined by a preceding **Set Item Number** command). If the Controller is not configured for dual output operation, receipt of this command will cause an error message to be returned to the master device. This parameter may be set in the range 0.0% to 100.0%. If any other value is assigned or the Item Number is set to less than 0 or greater than 5, an error message will be returned to the master device. The decimal point position is set to 1.

5.5.5.13 BREAKPOINT REFERENCE {P} = q

This parameter may be interrogated using a Type 2 message or may be modified (if preceded by an **Enter Configuration Mode** command with no intervening non-configuration modifications via the communications link) using a Type 3/4 message sequence. The breakpoint reference parameter is defined by a number contained in the first four digits of the {DATA} element of a message (the fifth digit being zero). The coding is as follows:

Code	Breakpoint Reference
0	Setpoint (SP)
1	Process Variable (PV)
2	Deviation (PV – SP)
3	Output Power

5.5.5.14 BREAKPOINT VALUE {P} = k

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This is the value at which the currently-selected breakpoint (defined by a preceding **Set Item Number** command which sets the Item Number in the range 0 - 5) becomes active. The permissible range of values, decimal point position etc. for this parameter is dependent upon the Breakpoint Reference Parameter. If any invalid value is assigned or the Item Number is set to less than 0 or greater than 5, an error message will be returned to the master device.

5.5.5.15 CONTROL ACTION {P} = r

This parameter may be interrogated using a Type 2 message or may be modified (if preceded by an **Enter Configuration Mode** command with no intervening non-configuration modifications via the communications link) using a Type 3/4 message sequence. This parameter defines the tuning algorithm used and is encoded as a type number in the first four digits of the {DATA} element in a message. The fifth digit of this element is set to 0 if the control is reverse-acting or to 1 if the control is direct-acting. Coded type numbers are as follows:

Code	Tuning Algorithm
0	PID
1	PID + ON/OFF *
2	ON/OFF
3	Open Loop VMD **
4	Open Loop VMD + Valve Position Indication **
5	Closed Loop VMD **

* Applicable only to dual-output Controllers.
** Applicable only to Controllers fitted with an Auxiliary Analogue Input..

5.5.6 Status Parameters

5.5.6.1 CONTROLLER STATUS {P} = L

This parameter may be interrogated only, using a Type 2 message. This parameter is qualified by the most-recent preceding **Set Item Number** command. If the Item Number is set greater than 3, an error message will be returned to the master device. For Item Number = 1 or 2, the five-digit numeric format is used, with status information encoded in all five digits as the decimal representation of a 16-bit binary number; each bit in the binary number has a particular significance. If a specific bit is a 1, that associated condition pertains; if a bit is a 0, the associated condition does not pertain. For Item Number = 3, the {DATA} element in the returned message contains a number which represents the current tuning type. Refer to Figure 5-1.

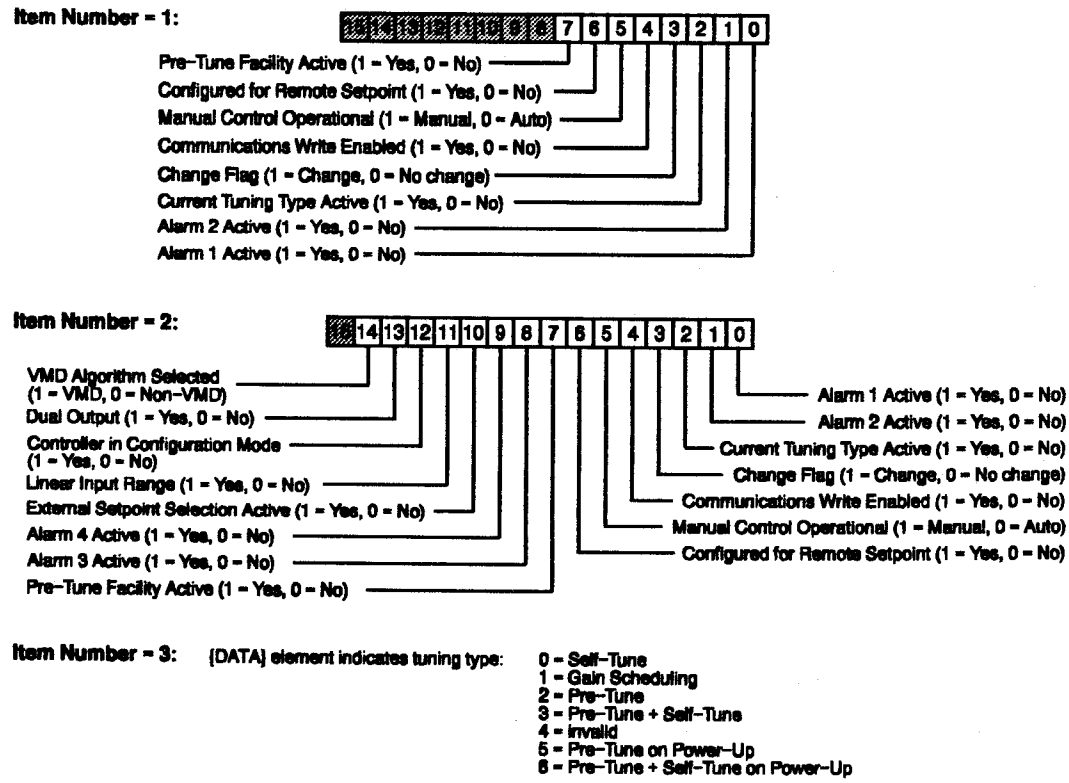


Figure 5-1 Controller Status Report Format

5.5.6.2 ARITHMETIC DEVIATION (PROCESS VARIABLE - SETPOINT) VALUE {P} = V

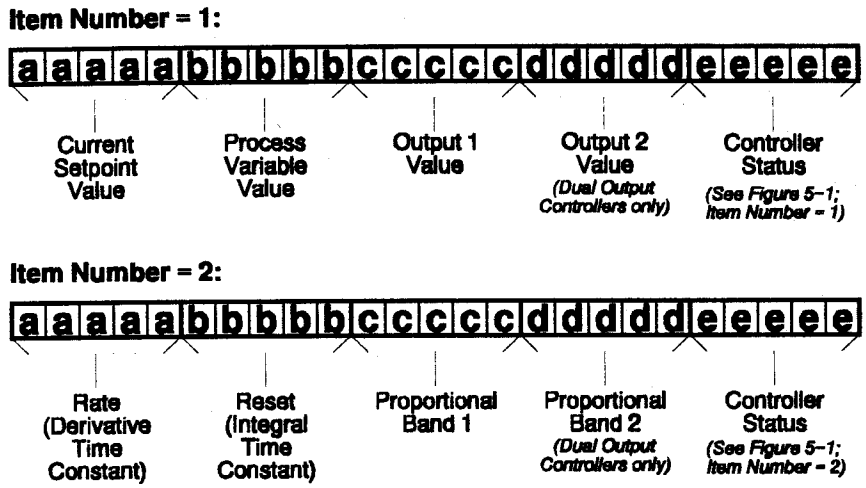
This parameter may be interrogated only, using a Type 2 message. It is the difference between the current process variable value and the current setpoint value.

5.5.6.3 SCAN TABLE {P} =]

The Scan Table operation takes the form of a Type 2 interrogation command which accesses a set of information (held in the {DATA} element in the response) defined by the setting of the Item Number in the most-recent preceding **Set Item Number** command. The Item Number may be 1 or 2 and defines the contents of the {DATA} element. The response would be in the form:

L{N}] xx aaaaa bbbbb ccccc ddddd eeeee A *

where xx is the number of data digits in the {DATA} element to follow; this is 20 for a single-control-output instrument and 25 for a dual-control-output instrument. These digits are illustrated in Figure 5-2.



Total {DATA} element length = 20 characters (single output) or 25 characters (dual output)

Figure 5-2 Scan Table Response Format

Any value of Item Number other than 1 or 2 will cause an error message to be returned to the master device.

5.5.7 Special Commands/Parameters

5.5.7.1 CONTROLLER COMMANDS {P} = Z

These Write Only parameters accept modification by a Type 3/4 message sequence only. Each command is defined by the decimal number contained in the first four digits in the five-digit {DATA} field in the message, as follows:

Number	Controller Command	Number	Controller Command
1	Activate Manual Control	7	Select Self-Tune as current tuning type
2	De-activate Manual Control	8	Select Gain Scheduling as current tuning type
3	Activate selected tuning type	9	Select Pre-Tune as current tuning type
4	De-activate selected tuning type	10	Select Pre-Tune on power-up as current tuning type
5	Request Pre-Tune (if selected as current tuning type)	11	Select Pre-Tune + Self Tune as current tuning type
6	Abort Pre-Tune	12	Select Pre-Tune on power-up + Self Tune as current tuning type

The decimal point position is set to 0.

5.5.7.2 SET ITEM NUMBER {P} = x

This parameter may be modified/interrogated using a Type 2 message or a Type 3/4 message sequence. This parameter is used by certain other commands to specify a current item (e.g. Alarm, Output) to which the command is to be applied. Once the item number is set, it will retain that value until either (a) it is subsequently changed by another **Set Item Number** command, or (b) the Controller is powered-down. When the Controller is powered up, the Item Number is set automatically to 1. In general, the commands which are qualified by the Item Number value will return an **Item Number out of range** error mesage to the master device if the current value is invalid for that command. Commands which use the Item Number are as follows:

Command/Parameter	Function of Item Number	Refer to Subsection:
Scan Table	Selects different data sets	5.5.6.3
Controller Status	Selects different formats	5.5.6.1
Breakpoint Rate (Derivative Time Constant)	Selects Breakpoint	5.5.5.8
Breakpoint Reset (Integral Time Constant)	Selects Breakpoint	5.5.5.9
Breakpoint Hysteresis	Selects Breakpoint	5.5.5.10
Breakpoint Proportional Band 1	Selects Breakpoint	5.5.5.11
Breakpoint Proportional Band 2	Selects Breakpoint	5.5.5.12
Breakpoint Value	Selects Breakpoint	5.5.5.14
Input Range Type	Selects Input Number	5.5.1.3
Input Sample Rate (Read)	Selects Input Number	5.5.1.8
Alarm Type (Read)	Selects Alarm Number	5.5.4.5
Alarm Output Links	Selects Alarm Number	5.5.4.6
Output Alarm Links	Selects Universal Output Number	5.5.2.13
Output Type & Usage	Selects Universal Output Number	5.5.2.12

5.5.7.3 ENTER CONFIGURATION MODE {P} = z

This command is in the form of a Type 3/4 message sequence only. Receipt of this command removes the Write Protection from Configuration Mode parameters in order that they may be modified. Access to Configuration Mode parameters will remain available until a non-configuration parameter is modified or until this command is explicitly cancelled (see below). The Type 3 message contains a five-digit {DATA} element which must be set to 99990. Any other value will be interpreted as a request to cancel access to the Configuration Mode parameters. Access to the Configuration Mode parameters is always inhibited on power-up.

NOTE

This command provides or cancels communications link access to the Controller's Configuration Mode parameters; *it does not put the Controller into Configuration Mode.*

Parameters which require to be preceded by this command are listed in Table 5-3.

Thus, once an **Enter Configuration Mode** command has been executed, either the Item Number or any one or more of the parameters in the table above may be modified as many times as required, until a modification is made, via the communications link, to a parameter not listed above, whereupon access to the Configuration Mode parameters is again inhibited.

Table 5-3 Configuration Mode Parameters

Parameter/Command	Identifier	Refer to Subsection:
Input Range Maximum	G	5.5.1.4
Input Range Minimum	H	5.5.1.5
Alarm Type	a	5.5.4.5
Alarm Output Links	h	5.5.4.6
Output Alarm Links	j	5.5.2.13
Input Range Type	l	5.5.1.3
Setpoint Mode	n	5.5.3.11
Output Type & Usage	o	5.5.2.12
Breakpoint Reference	q	5.5.5.13
Control Action	r	5.5.5.14
Input Sample Rate	y	5.5.1.8
Minimum Relay ON/OFF Time	}	5.5.2.14

5.6 ERROR CODES

The circumstances under which the 5010 Controller will ignore a message received from the master device are:

- Parity error detected
- Syntax error detected
- Timeout elapsed
- Receipt of a Type 4 message without a preceding Type 3 command message.

Negative acknowledgements will be returned if, in spite of the received message being notionally correct, the Controller cannot supply the requested information or perform the requested operation. The protocol will return error information in the {DATA} element of a negative acknowledgement message. The error code occupies the first four digits of the {DATA} element, the fifth digit always being zero. Error codes are as shown in Table 5-4.

Table 5-4 Error Codes

Error Code	Error
0001	Illegal request.
0002	An attempt has been made to modify a "Read Only" parameter.
0003	Requested modification to the parameter value will move that parameter above its valid range.
0004	Requested modification to the parameter value will move that parameter below its valid range.
0005	The parameter/command requested does not exist.
0006	The command does not match the current hardware/configuration.
0007	Parameter modifications via the Communications link are inhibited.
0008	An attempt has been made to modify a Configuration Mode parameter when there is no prevailing Enter Configuration Mode command (see Subsection 5.5.7.3).
0009	Current Item Number value is out of range for the currently-selected parameter.
0010	Incorrect or invalid decimal point position digit.
0011	Incomplete command - please try again later.

SECTION 6
CONFIGURATION MODE

In this mode, the User may specify the long-term (i.e. relatively unchanging) aspects of the Controller's operation.

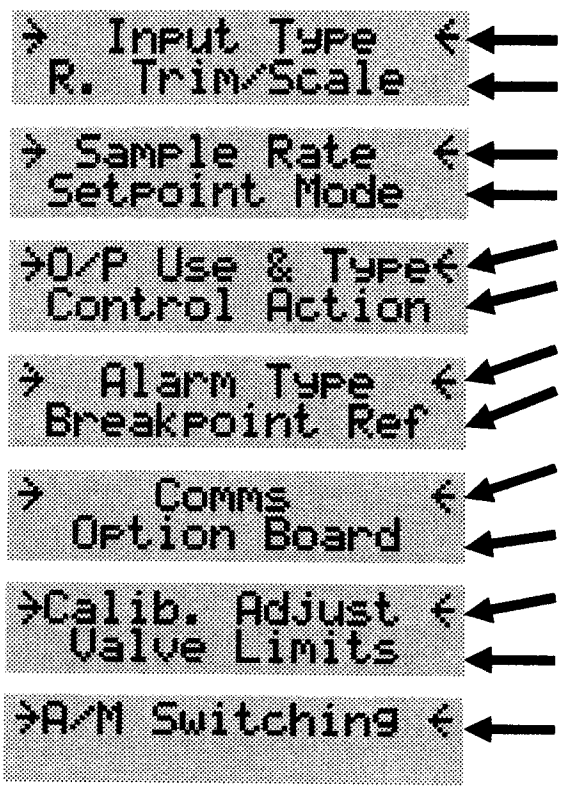
6.1 ENTRY INTO CONFIGURATION MODE

Configuration Mode is protected by a "Combination Lock" which operates as follows:

1. If the Controller is powered-up, power-down.
2. Power-up the Controller and hold down the Up and Down keys. The LCD display will initially (after five seconds) show:

followed (after a further five seconds, if the keys are not released) by:

3. As soon as this display appears, depress the **EXIT** key to enter Configuration Mode. The LCD display will then show the first of the sequence of menu displays:



Define input usage and base range

Range trimming (non-linear inputs) and range scaling (linear inputs)

Select sample rate (6/s or 20/s)

Define setpoint control mode

Define output type and assignment

Define output sense and control algorithm

Define alarm type and linkage to output(s)

Define source parameter for Gain Scheduling breakpoints

Define Comms data format, Baud rate and address. *Only if Comms option fitted.*

Appears only if Option Board fitted.

Adjust calibration for Universal Input and Auxiliary Analogue Input

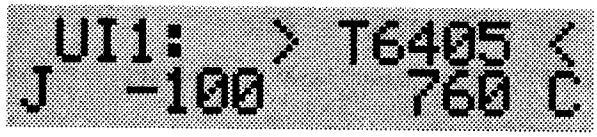
For VMD Outputs only. Define limit of valve movement.

Select/disable external Auto/Manual switching. *Only if external SP switching not selected.*

The User may then move the selection cursor to the required menu display/option using the **NEXT** key (to move forward through the menu) or the ALT/**NEXT** keys (to move backward through the menu).

6.2 DEFINING INPUT USAGE AND BASE RANGE

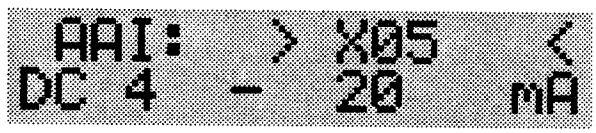
When the Input Type option is selected, the LCD display initially is of the form:



Use the Up/Down keys to step through the product codes available until the desired code is displayed; as the product code is changed, so will the range information on the lower line of the LCD display. When the desired product code and its associated input base range is displayed, confirm the selection by depressing the **ENT** key.

Refer to Appendix A for a full list of the Universal Input product codes available.

Once the product code/input range for the Universal Input have been selected, if the Auxiliary Analogue Input is fitted, depression of the **NEXT** key will show the current AAI details (normally a Remote Setpoint Input) in the form:

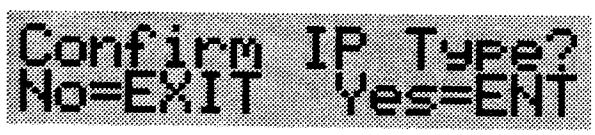


Use the Up/Down keys to step through the RSP Input product codes available until the desired code is displayed; as the product code is changed, so will the range information on the lower line of the LCD display. When the desired product code and its associated RSP input range is displayed, confirm the selection by depressing the **ENT** key.

NOTE

If the Controller is configured for Open Loop VMD operation with Valve Position Indication or Closed Loop VMD operation, this display will show the product code X36 and the input range 0 - 10V; this cannot be altered whilst the Controller is configured for VMD operation. For a full list of input types and their product codes, see Appendix A.

Depression of the **EXIT** key will then cause a return to the Configuration Mode menu (if no changes await confirmation). If changes are made to the currently-displayed input information and the user then tries to select another input display (using the **NEXT** key or **ALT/NEXT** keys) or tries to return to the Configuration Mode menu (using the **EXIT** key) without confirming the changes, the LCD display will show:



The user must then take the appropriate key action before other input information or the Configuration Mode menu can be displayed.

6.3 INPUT RANGE TRIMMING OR SCALING

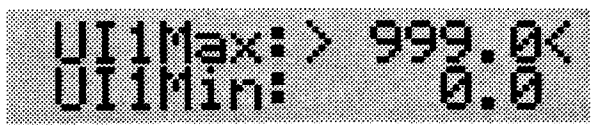
This option allows the User to:

(a) further restrict the base range of a non-linear input by defining trimming maximum and minimum values.

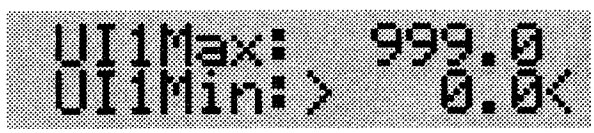
(b) scale a DC linear input.

6.3.1 Input Range Trimming (Non-Linear Inputs Only)

When this option is selected for a non-linear input, the LCD display is initially of the form:



showing the trimmed limits for the Universal Input **UI1Max/UI1Min** (those for the Auxiliary Analogue Input **AAI1Max/AAI1Min** are shown in later displays). The Range Maximum Trim value can be changed using the normal numeric editing keys (see Subsection 1.3). Any changes made must be confirmed by depressing the **ENT** key. Depression of the **EXIT** key at this point will cause a return to the Configuration Mode menu. Depression of the **NEXT** key will move the selection cursor to the Range Minimum Trim field:



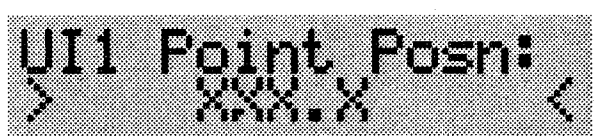
This value can be adjusted using the normal numeric editing keys (see Subsection 1.3). Any changes made must be confirmed by depressing the **ENT** key. Depression of the **EXIT** key at this point will cause a return to the Configuration Mode menu.

NOTE

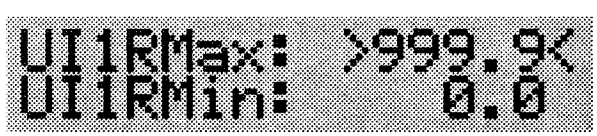
The trimmed span cannot be made less than 25% of the base span.

6.3.2 Range Scaling (DC Linear Inputs Only)

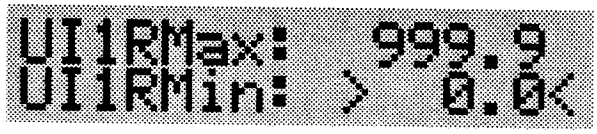
When this option is chosen for a DC linear input, the LCD display is initially of the form:



which enables the User to define the decimal point position for that input. The Up key will move the decimal point to the left, the Down key will move the decimal point to the right and the **ENT** key should be used to confirm any changes made. Depression of the **NEXT** key will change the display to the form:



in which the input range maximum and minimum values (with the decimal point in the position defined in the previous display) may be adjusted in the normal manner (see Subsection 1.3). Any changes must be confirmed by depressing the **ENT** key. The **NEXT** key will move the cursor to the Range Minimum field:



whose value can be adjusted in the same manner. **NOTE:** If **UIRMax** is made less than **UIRMin**, the slope of the input characteristic is reversed

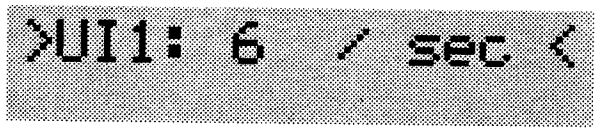
6.4 SELECTING INPUT SAMPLE RATE

This option enables the User to select either of the two sample rates available (6 samples/second or 20 samples/second) for the universal input.

NOTE

Any auxiliary analogue input(s) fitted will automatically have the same sample rate as the universal input.

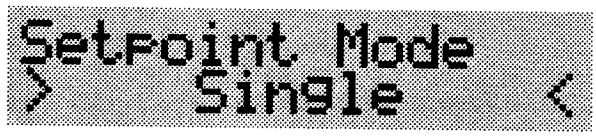
When this option is selected, the LCD display is of the form:



The Up/Down keys may be used to change the sample rate for the input and the **ENT** key is then used to confirm the change.

6.5 SELECTING THE SETPOINT MODE

This option allows the User to select the mode in which the setpoint(s) will be controlled. The LCD display is of the form:



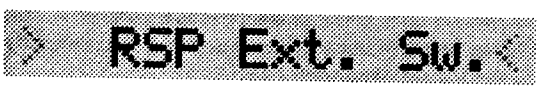
The User may then step through the available setpoint control options using the Up/Down keys:

Single setpoint (local set point only)

Two local setpoints with operator switching

Two local setpoints with switching via the Digital Input

Remote/local setpoints with operator switching. *Only if AAI fitted on non-VMD Controller or on Open Loop VMD Controller with no Valve Position Indication.*



Remote/local setpoints with switching via the Digital Input. *Only if AAI fitted on non-VMD Controller or on VMD Open Loop Controller with no Valve Position Indication.*

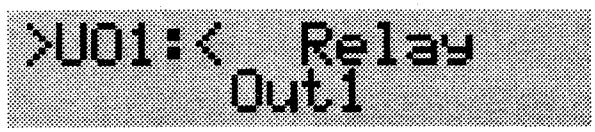
When the desired mode is displayed, the User must confirm the new selection by depressing the **ENT** key. After this confirmation, depression of the **EXIT** key will cause a return to be made to the Configuration Mode menu at the Setpoint Mode option.

If an attempt is made to leave this display without confirming a changed setting, the LCD display will be:

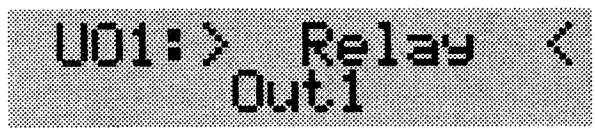
The user must make the appropriate key response before the return can be made using the **EXIT** key.

6.6 DEFINING OUTPUT USE AND TYPE

This option permits the user to define the usage and type of each universal output fitted. When this option is selected, the LCD display is initially of the form:



in which the output number field is accessible. The required output number may be selected in the normal manner (see Subsection 1.3). When the required output number has been selected, depression of the **NEXT** key will move the cursor to the Output Type field:



The user may then step through the output types using the Up/Down keys.

NOTE

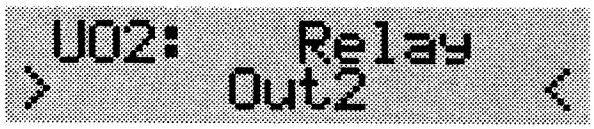
If a change is made from a relay-type output to any other output type or vice versa, it will be necessary to change link jumper settings within the Controller (see Section 7) and the LCD display will show:

This message will remain on the screen until the user has (a) released all keys, then (b) pressed the **ENT** or **EXIT** key, whereupon the next output type option will be displayed.

The available output types are:

> Relay <	Relay output
> SSR <	Solid state relay drive output
>DC 0-5 mA<	DC output: 0 - 5mA output range
>DC 0-10mA<	DC output: 0 - 10mA output range
>DC 0-20mA<	DC output: 0 - 20mA output range
>DC 4-20mA<	DC output: 4 - 20mA output range
>DC 0-5 V<	DC output: 0 - 5V output range
>DC 1-5 V<	DC output: 1 - 5V output range
>DC 0-10 V<	DC output: 0 - 10V output range

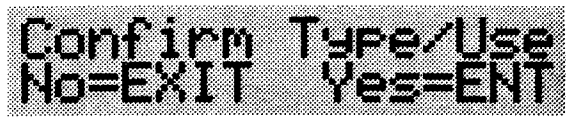
When the required output type has been selected (and confirmed with the **ENT** key), depression of the **NEXT** key will move the cursor to the Output Use field:



The user may step through the Output Use options using the Up/Down keys. When the required output use has been selected, the user may then confirm the current selection of output type and use by depressing the **ENT** key and return to the Configuration Mode menu at the Output Use/Type option by depressing the **EXIT** key. The output uses available are:

> Out1 <	Used as Output 1 (HEAT) - the only non-VMD setting available for UO1 and not available for other UOs
> VMD CW <	Used as VMD clockwise output - the only VMD setting available for UO1 and not available for other UOs
> Out2 <	Used as Output 2 (COOL)
> VMD ACW <	Used as VMD anticlockwise output - the only VMD setting available for UO2 and not available for other UOs
> Alarm Dir <	Used as direct-acting alarm output
> Alarm Rev <	Used as reverse-acting alarm output
> Retrans.SP <	Used as re-transmitted output - set point value. Only available if UOx is a DC output.
> Retrans.PV <	Used as re-transmitted output - process variable value. Only available if UOx is a DC output.
> Event <	Used as event output . Only available if Real Time Clock option is fitted.

If an attempt is made to leave a changed display without confirming the change settings, the LCD display will show:



The user must make the appropriate key response before the return can be made using the **EXIT** key.

NOTE

For **UO1**, the only possible uses are **Out1** or **VMD CW**; this *cannot* be changed directly but is dependent upon the Control Action selected (see Subsection 6.7). The use of **UO2** is automatically set to **VMD ACW** if the Control Action is selected to be VMD operation; this cannot be changed.

The various default Output Use assignments for the outputs are shown in Table 6-1. There are also inter-dependencies between Output Use and Output Type (see Table 6-2).

Table 6-1 Default Output Use Assignments

Controller Configuration	UO1	UO2	UO3	UO4
Single control output; two outputs	Output 1 (HEAT)	Alarm (direct-acting)	-	-
Dual control outputs; two outputs	Output 1 (HEAT)	Output 2 (COOL)	-	-
Single control output; four outputs	Output 1 (HEAT)	Alarm 1 (direct-acting)	Alarm 2 (direct-acting)	Alarm 3 (direct-acting)
Dual control outputs; four outputs	Output 1 (HEAT)	Output 2 (COOL)	Alarm 1 (direct-acting)	Alarm 2 (direct-acting)

Table 6-2 Output Use/Type Inter-dependencies

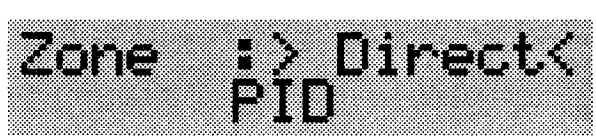
Output Use	Output Type Required
Output 1 (HEAT)	Any
Output 2 (COOL)	Any
Alarm (direct-acting or reverse-acting)	Relay/SSR only
Re-transmitted Output (SP)	DC only
Re-transmitted Output (PV)	DC only
Event	Relay/SSR only

If the output type selected is Relay, with the cursor on the Output Use field, depression of the **NEXT** key will cause the Relay Minimum Time display to appear:

This enables the minimum ON/OFF time of the relay to be set to ¼, ½, 1, 2, 4, 8 or 16 seconds. Thus, the user can limit the frequency with which the relay can be switched, thereby enhancing the lifetime of the relay. For relay alarm outputs, this parameter can be set to the default setting of 0. *NOTE: This parameter also defines a minimum limit for the Output Cycle Time parameter(s) (see Subsection 4.3.6).*

6.7 SELECTION OF CONTROL ACTION

When this option is selected, the LCD display changes to the form:

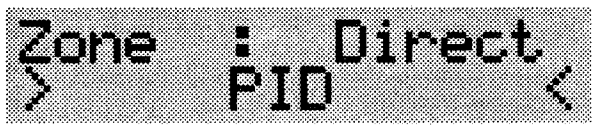


The Up/Down keys may then be used to select the output sense to be either of the two settings available:

Direct-acting

Reverse-acting

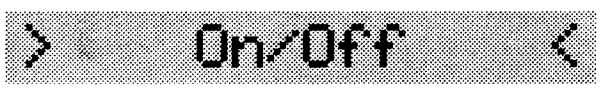
Depression of the **NEXT** key will move the selection cursor to the Control Algorithm field on the lower line:



Using the Up/Down keys, this algorithm may be set to one of the following:

PID (three-term) control

PID control on Output 1 (HEAT) and On/Off control on Output 2 (COOL)



On/Off control (no proportional band)

Open Loop VMD control. *Available only if Auxiliary Analogue Input is fitted.*

Open Loop VMD control with Valve Position Indication. *Available only if Auxiliary Analogue Input is fitted.*

Closed Loop VMD control. *Available only if Auxiliary Analogue Input is fitted.*

When the control output sense and control algorithm have been selected as required, confirm that selection by depressing the **ENT** key. If Closed Loop VMD control is selected, the LCD display will then show:

This gives the user the opportunity to select the facility by which, when a break is detected in the feedback loop, control is switched automatically to open loop VMD (whereupon Rate is set to 0, Reset is set to 5 minutes, Proportional Band is set to 10% and Motor ON Time is set to 1/10 x Motor Travel Time, by default). If the **EXIT** key is depressed, a return is made to the Configuration Mode menu at the Control Action option. If the **ENT** key is pressed, the facility is selected and the LCD display will show:

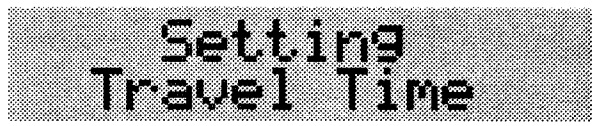
The user may then either (a) select automatic setting of the Motor Travel Time parameter value, or (b) choose to set the Motor Travel Time value manually.

NOTE

Before this choice is made, the Controller's VMD outputs must be connected to the valve motor (and valve) to be used.

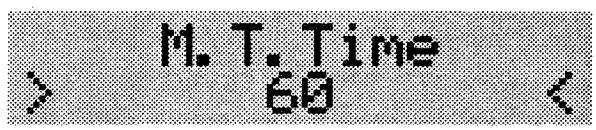
To set the Motor Travel Time value automatically, simply depress the **ENT** key. The LCD display will then show:

Depress the **ENT** key again, whereupon the LCD display will then temporarily show:



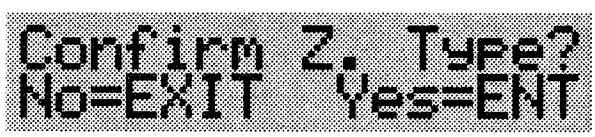
during which the Controller will cause the motor to drive the valve from one valve movement limit to the other and will measure the time taken to do so. When this is successfully completed, a return will be made to the configuration Mode menu at the Control Action option.

To set the Motor Travel Time manually, depress the **NEXT** key then the **ENT** key. The LCD display will then change to the form:



Adjust the value in the normal manner (see Subsection 1.3) as desired and then depress the **EXIT** key (to retain the original value) or the **ENT** key (to confirm the new value). A return is then made to the Configuration Mode menu at the Control Action option.

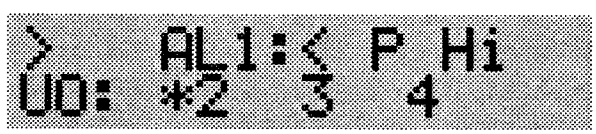
If an attempt is made to return to the Configuration Mode menu without confirming changes to either of the Output Sense or Control Algorithm parameters, the LCD display then changes to:



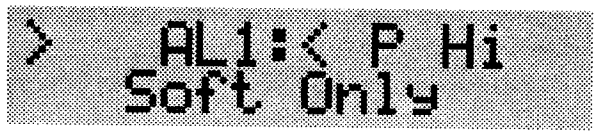
The user must make the appropriate key response before a return can be made to the Configuration Mode menu..

6.8 SELECTING ALARM TYPE

This option enables the User to define fully each alarm, by specifying the triggering condition and the output(s) associated with that alarm. The initial LCD display is of the form:

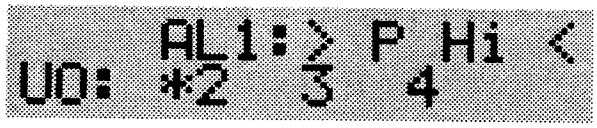


if the selected alarm is linked to any of the universal outputs, or:

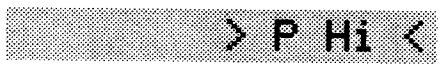


if there are no outputs which have been configured to accept linkages with the displayed alarm.

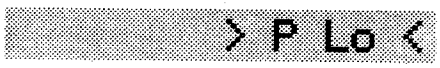
The required alarm number may be selected using the Up/Down keys. The cursor may then be moved to the Alarm Trigger Type field by depressing the **NEXT** key:



The trigger types available are:



Process High Alarm



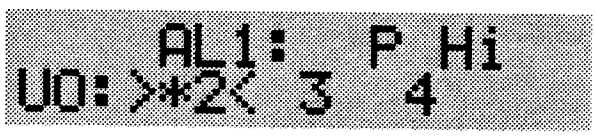
Process Low Alarm

Deviation High Alarm

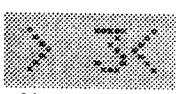
Deviation Low Alarm

Band Alarm

The user may step through these types using the Up/Down keys. The operation of the different alarm types is illustrated in Figure 6-1. When the required trigger type is displayed, depression of the **NEXT** key will move the cursor to the Output Linkage field:



Depression of the **NEXT** key (or **ALT/NEXT** keys) will step the cursor through the output numbers, which enables the User to select the output(s) to be associated with this alarm. The Up/Down keys are used to "make" or "break" each alarm linkage. The User is offered the choice of either (a) no linkage, or (b) linked (direct-acting or reverse acting, according to the alarm sense - see Subsection 6.6):



No linkage

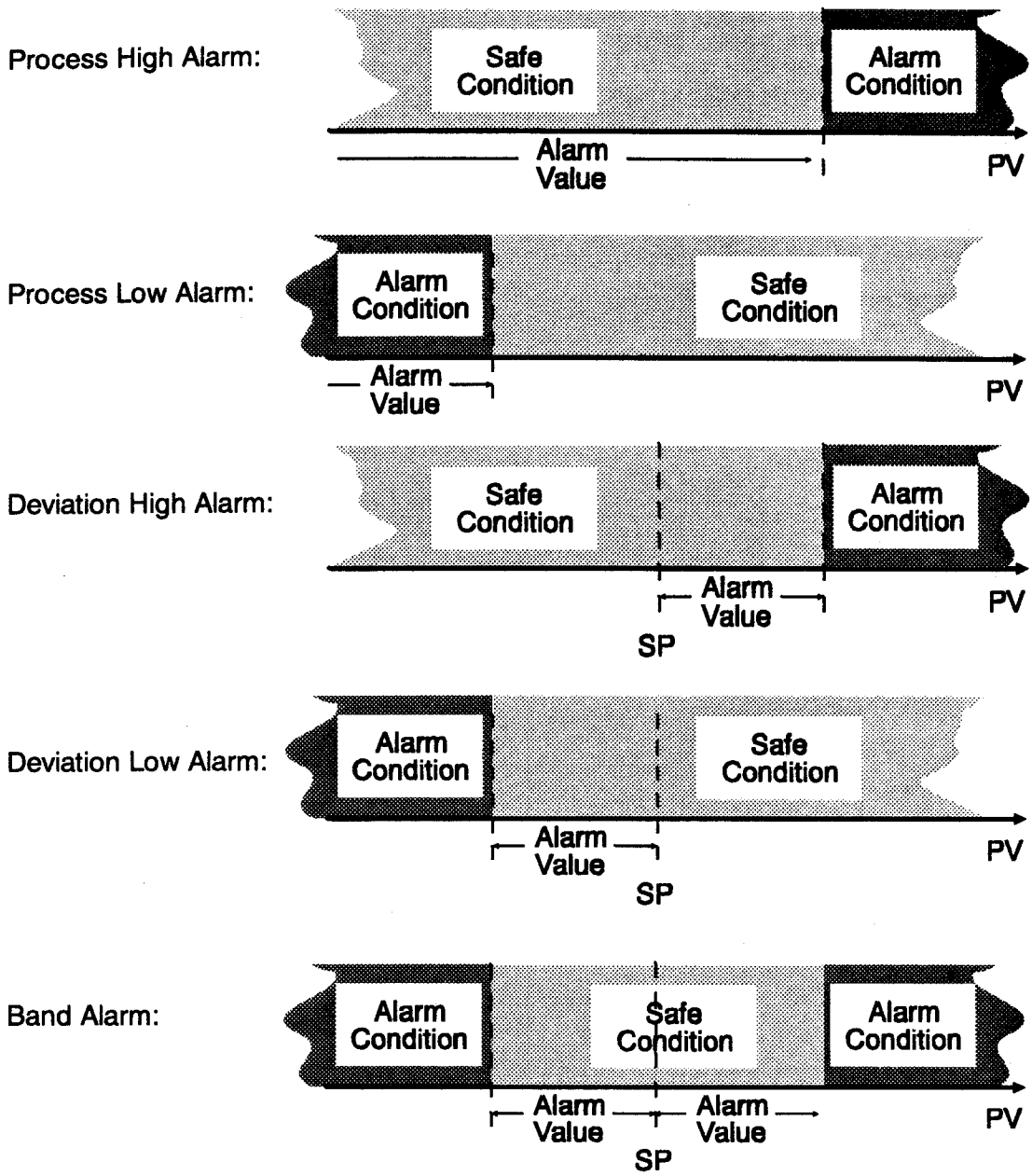
Direct-acting

Reverse-acting

NOTE

Only those outputs which have been assigned for use as alarms will appear in this field. If there are no outputs assigned for alarm use, this field will display **Soft Only**.

The operation of the different alarm types is shown in Figure 6-1.



NOTE:
Direct-acting Alarms:
Alarm condition = Output active; Safe condition = Output inactive
Reverse-acting alarms:
Alarm condition = Output inactive; Safe condition = Output active

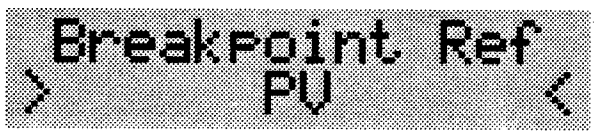
Figure 6-1 Alarm Operation

When the desired trigger type and output linkage have been selected, the User must confirm that selection by depressing the **ENT** key, whereupon the User may then move the cursor (using the **NEXT** or ALT/**NEXT** keys) to the Alarm Number field. The Alarm Number may then be changed and the procedure may be repeated for other alarms, if required. When all alarms have been defined as desired and all changes have been confirmed, depression of the **EXIT** key will cause a return to the Configuration Mode menu at the Alarm Type option. If an attempt is made to leave a specific alarm display without confirming changes in the parameters of that display, the LCD display will show:

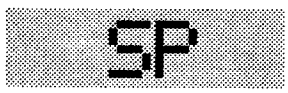
The user must make the appropriate key response before the **EXIT** key can be used to make a return.

6.9 GAIN SCHEDULING - BREAKPOINT REFERENCE PARAMETER

This option enables the User to define the source parameter to which the gain scheduling breakpoints apply. When this option is selected, the LCD display is of the form:



The User may, using the Up/Down keys, step through the following Reference Parameter options:



Breakpoints based on Set Point value

Breakpoints based on Process Variable value

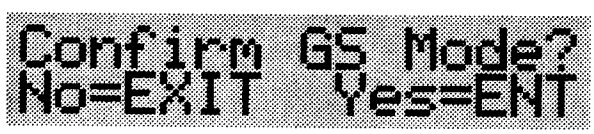
Breakpoints based on Deviation
(i.e. Process Variable – Setpoint) value

Breakpoints based on Output Power (% of OUT1) value

NOTE

The value of the reference parameter is set in Set Up Mode (see Subsection 4.3.7.1).

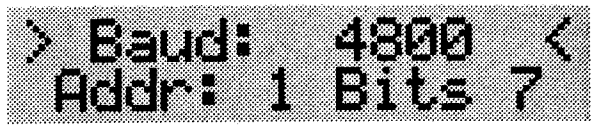
When the desired reference parameter is selected, that selection should be confirmed by depressing the **ENT** key, whereupon the **EXIT** key may be used to make a return to the Configuration Mode menu at the Breakpoint Ref option. If an attempt is made to leave this display without confirming any changes made, the LCD display will show:



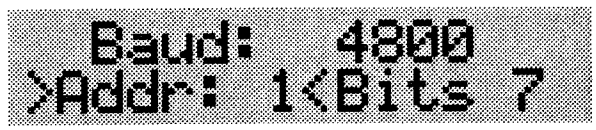
The user must make the appropriate key response before the **EXIT** key can be used to make a return.

6.10 COMMUNICATIONS

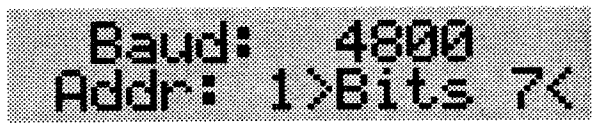
This option enables the user to define the Baud rate, parity, Controller address, number of data bits and protocol for the serial communications link. When this option is selected, the initial LCD display is of the form:



The Baud rate for communications may then be set (using the Up/Down keys) to be 4800, 9600 or 19200 Baud. When the Baud rate is set as required, depression of the **NEXT** key will move the cursor to the Address field:



whereupon the address may be set (using the Up/Down keys) to any value in the range 1 - 32. Depression of the **NEXT** key again will move the cursor to the Bits field:



where the number of bits may be set (using the Up/Down keys) to 7 or 8. (**NOTE:** If MODBUS protocol is to be selected - see below - the number of bits should be set to 7 for MODBUS ASCII protocol or 8 for MODBUS RTU protocol.) Another depression of the **NEXT** key will then cause the LCD display to change to the form:

in which the parity may be set (using the Up/Down keys) to Odd or Even. To change the displayed protocol, depress the **NEXT** key to move the cursor down to the "protocol" field and, using the Up/Down keys, select **WEST ASCII**, **MODBUS ASCII** or **MODBUS RTU**, as required; then depress the **ENT** key to confirm the selection. For details on the use of either MODBUS protocol, refer to **Application Note AN9401: MODBUS Communications Protocols for 5010 Controller** available from WEST.

When all communications parameters have been set as required, depression of the **EXIT** key will cause a return to the Configuration Mode menu at the Comms option.

6.11 CALIBRATION ADJUST

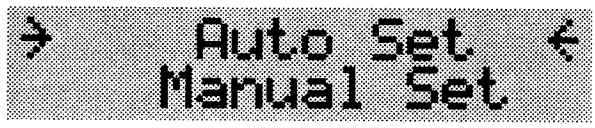
This post-factory calibration facility enables the user to make fine adjustments to the Controller's input calibration in order to match more closely the process input values, if necessary. Because the increments are small (0.005% of span), several increments may be necessary before any effect on the process variable is detected. When this option is selected, the LCD display is initially of the form:

Using the Up/Down keys, the Universal Input calibration may then be adjusted. The new calibration is confirmed for implementation by depression of the **ENT** key. Depression of the **NEXT** key will then cause the display to change to:

which enables the same operation to be performed for the Auxiliary Analogue Input. After all adjustments have been confirmed with the **ENT** key, depression of the **EXIT** key will cause a return to the Configuration Menu.

6.12 VALVE LIMITS

This option allows the valve movement limits to be defined either automatically by the Controller (for the full movement range of the valve) or manually by the user (for a portion of the full valve movement range defined at the user's discretion). When this option is selected, the initial LCD display is:



To set the limits automatically, simply depress the **ENT** key, whereupon the display will change to:

Depress the **ENT** key again, whereupon the display will change temporarily to:

during which the Controller will cause the motor to drive the valve to the limits of the valve movement, before returning to the Configuration Mode menu at the Valve Limits option. To set the limits manually, depress the **NEXT** key to move the cursor to the lower line of the display:

and then depress the **ENT** key. The LCD display will then change to:

Use the Up/Down keys to describe the desired range of movement of the valve, then depress the **ENT** key. This will result in the valve limits being confirmed and a return will be made to the Configuration Mode menu at the Valve Limits option

NOTE

If the range of movement was too small to establish valid limits for the Controller (limits must be at least 20% of the total slidewire span), the LCD display will show:

Depress the **EXIT** key to return to the Configuration Mode menu at the Valve Limits option, re-select the option and repeat the exercise using a larger range of valve movement.

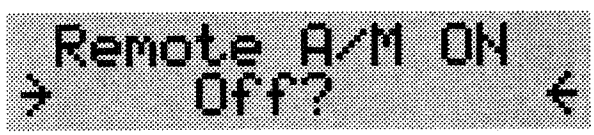
6.13 AUTO/MANUAL CONTROL MODE SWITCHING

This option is used to enable/disable external switching from Automatic control to Manual control and vice versa.

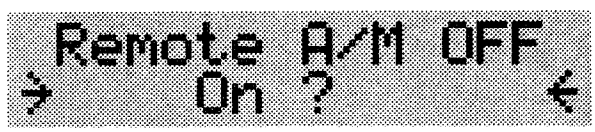
NOTE

External switching between Auto and Manual modes is operable only if the appropriate rear terminal is fitted and external setpoint switching (see Subsection 6.5) is not selected. This terminal is fitted automatically if the Controller is configured for VMD or remote setpoint operation, has a serial communications option fitted, or is equipped with universal outputs UO3 and UO4. Otherwise, this terminal must be specifically ordered (Product Code X681)

When this option is first selected the initial LCD display is either:



if remote switching of Auto/Manual mode is enabled, or:



if remote switching of Auto/Manual mode is disabled. To change the current status of this option, depress the **ENT** key; to retain the current status of this option, depress the **EXIT** key. In either case, a return is made to the Configuration Mode menu at the A/M Switching option.

6.14 EXIT FROM CONFIGURATION MODE

An exit may be made from Configuration Mode by either of two methods:

(a) Automatically: If the Controller is in Configuration Mode and no keys have been pressed for ten minutes, an automatic return is made to the Operator Mode.

(b) Manually: If the **EXIT** key is pressed repeatedly until the LCD display shows:

and then the **ENT** key is pressed, a return is made to the Operator Mode.

SECTION 7
INTERNAL LINKS AND SWITCHES

The 5010 Industrial Controller is equipped with on-board link jumpers and switches which enable the hardware to be configured to match the software configuration (see Sections 4 and 6). In order to gain access to the boards which contain these link jumpers and switches, it is necessary to remove the Options Board (if fitted) from the Controller, having first removed the Controller from its housing (see Subsection 3.3).

NOTE

If no Options Board is fitted, the link jumpers and switches are instantly accessible when the Controller is removed from its housing.

7.1 REMOVING THE OPTIONS BOARD FROM THE CONTROLLER

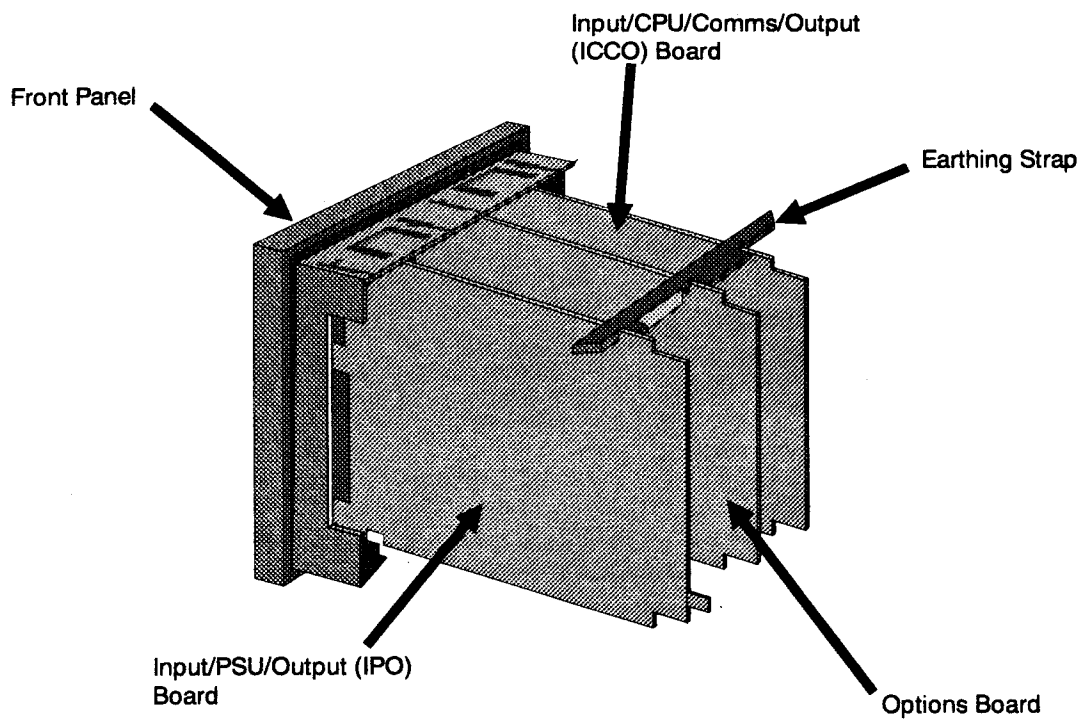


Figure 7-1 5010 Controller - Board Positions

The Controller, when removed from its housing, is as illustrated in Figure 7-1. To remove the Options Board (if fitted):

1. Remove the three screws securing the earthing strap to the top edge of each of the three Boards and remove the earthing strap.
2. Gently prise up the retaining clip on the top front corner of the Options Board, pull the top front corner of the Options Board free and withdraw the Options Board completely from the assembly (see Figure 7-2). **CAUTION:** Care should be taken to avoid damage to the components during board removal.

The link jumpers and switches are now accessible.

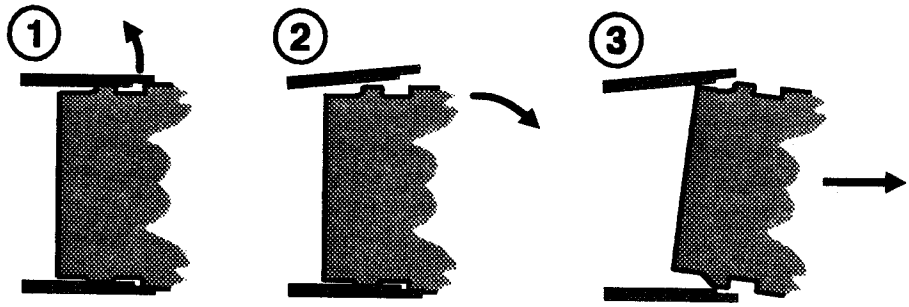


Figure 7-2 Removing a Board

7.2 UNIVERSAL INPUT TYPE AND AUXILIARY ANALOGUE INPUT TYPE

The Universal Input and Auxiliary Analogue Input circuits are configured to the required input type by use of switches on the IPO Board (see Figure 7-3 and Table 7-1).

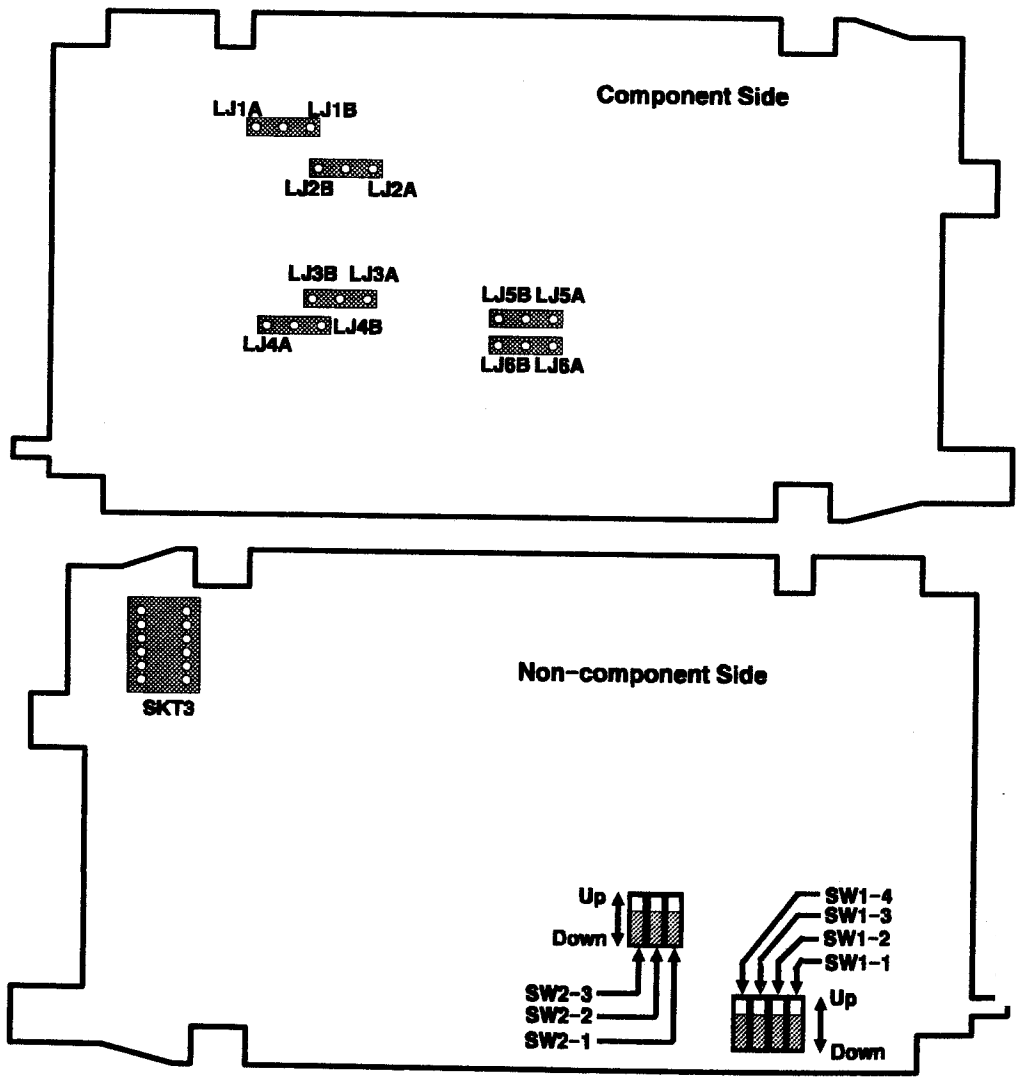


Figure 7-3 IPO Board - Link Jumpers and Switches

Table 7-1 Input Type Selection

Universal Input Type

Input Type	SW1-1	SW1-2	SW1-3	SW1-4
Thermocouple	Down	Up	Up	Down
RTD	Down	Down	Down	Down
DC Linear (mV)	Down	Up	Up	Up
DC Linear (V)	Up	Down	Down	Up
DC Linear (mA)	Up	Down	Down	Up

Auxiliary Analogue Input (AAI) Type

Input Type	SW2-1	SW2-2	SW2-3
VMD Slidewire	Down	Down	Up
DC Volts *	Up	Up	Down
DC mA *	Up	Up	Down

* Not VMD instruments.

7.3 OUTPUT TYPE

The type of output circuit used is selected by means of link jumpers on the IPO Board and the ICCO Board (see Figures 7-3 and 7-4 and Table 7-2).

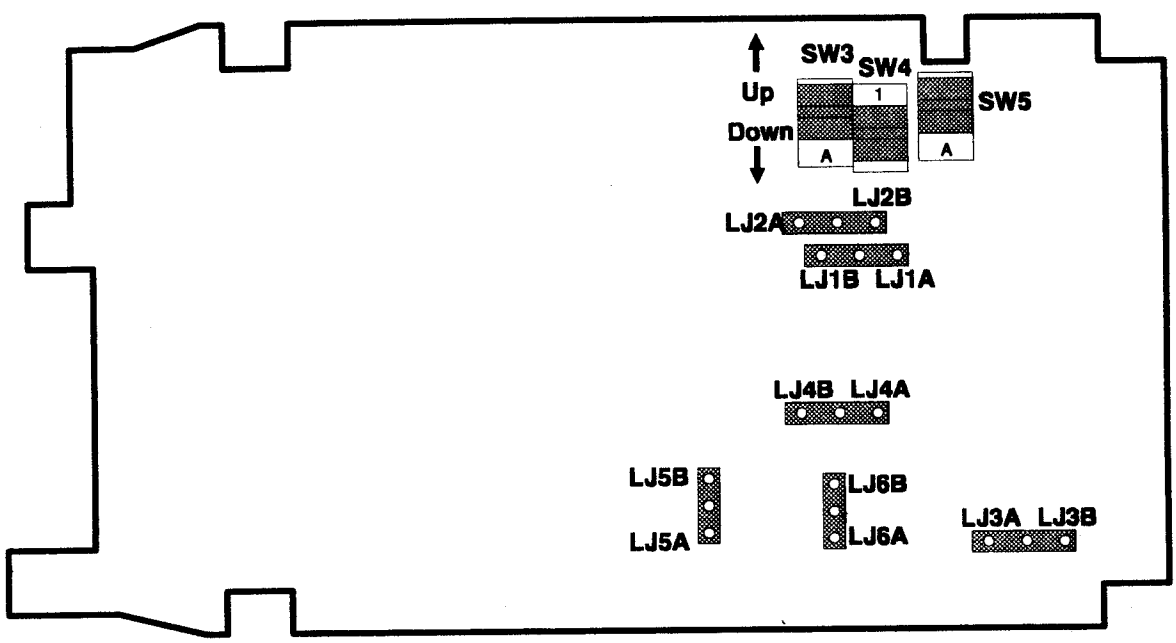


Figure 7-4 ICCO Board - Link Jumpers and Switches

Table 7-2 Output Type Selection

	IPO Board						ICCO Board					
	UO1			UO2			UO3			UO4		
Output Type	LJ1	LJ2	LJ5	LJ4	LJ3	LJ6	LJ1	LJ2	LJ5	LJ4	LJ3	LJ6
Relay	A	A	A	A	A	A	A	A	A	A	A	A
SSR	B	B	B	B	B	B	N/A	N/A	N/A	N/A	N/A	N/A
DC (mA)	B	B	A	B	B	A	B	B	A	B	B	A
DC (V)	B	B	B	B	B	B	B	B	B	B	B	B

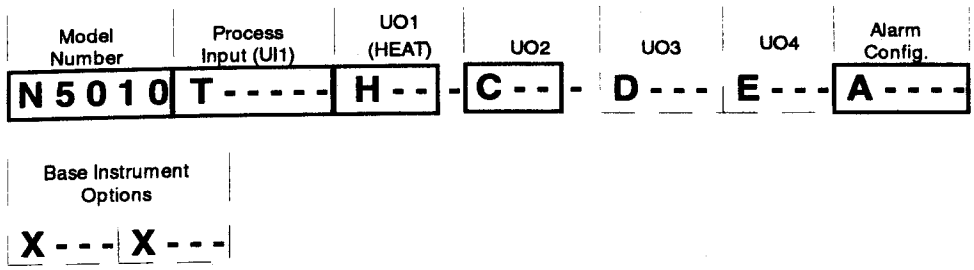
7.4 SERIAL COMMUNICATIONS PROTOCOL

Selection of the serial communications protocol required (three-wire RS232C, three-wire RS485 or five-wire RS485) is by means of three switches on the ICCO Board (see Figure 7-4 and Table 7-3).

Table 7-3 Communications Protocol Selection

Protocol Type	SW3	SW4	SW5
RS232C	Up	Up	Up
RS485 3-wire	Down	Up	Down
RS485 5-wire	Down	Down	Down

APPENDIX A
PRODUCT CODES



DISTRIBUTOR INSTRUMENTS:

MODEL NUMBER

N5010	Model 5010 Industrial Controller

DISTRIBUTOR INSTRUMENTS

Z01	Model 5010 with UI + UO1 + UO2[1] [2] ("J" Type T/C input + OUT1 + 1 Alarm)
Z02	Model 5010 with UI + UO1 + UO2 + UO3 + UO4[1] ("J" Type T/C input + OUT1 + 3 Alarms)
Z03	Model 5010 with UI + AAI + UO1 + UO2 ("J" Type T/C input + RSP input + OUT1 + 1 Alarm)
Z04	Model 5010 with UI + AAI + UO1 + UO2 + UO3 + UO4 ("J" Type T/C input + RSP input + OUT1 + 3 Alarms)
Z05	Model 5010 with UI + AAI + UO1 + UO2[2] ("J" Type T/C input + Closed Loop VMD)
Z06	Model 5010 with UI + AAI + UO1 + UO2 + UO3 + UO4) ("J" Type T/C input + Closed Loop VMD + 2 Alarms)
Z61	Model 5010 with UI + UO1 + UO2 + Comms[1] ("J" Type T/C input + OUT1 + 1 Alarm + Comms)
Z62	Model 5010 with UI + UO1 + UO2 + UO3 + UO4 + Comms[1] ("J" Type T/C input + OUT1 + 3 Alarms + Comms)
Z63	Model 5010 with UI + AAI + UO1 + UO2 + Comms ("J" Type T/C input + RSP input + OUT1 + 1 Alarm + Comms)
Z64	Model 5010 with UI + AAI + UO1 + UO2 + UO3 + UO4 + Comms ("J" Type T/C input + RSP input + OUT1 + 3 Alarms + Comms)
Z65	Model 5010 with UI + AAI + UO1 + UO2 + Comms ("J" Type T/C input + Closed Loop VMD + Comms)
Z66	Model 5010 with UI + AAI + UO1 + UO2 + UO3 + UO4 + Comms ("J" Type T/C input + Closed Loop VMD + 2 Alarms + Comms)

Distributor instruments will have the following default input/output types:

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1 Z01, Z02, Z61 and Z62 instruments cannot be re-configured for applications which require VMD output or RSP input.

2 Z01 and Z05 instruments do not include input connections for external selection of Dual Setpoint or Remote Setpoint. This can be specified by suffixing the code with X681 e.g. Z05 X681.

Process Input	–100 to 760°C J Type thermocouple (T6405)
AAI (RSP) Input	4 - 20mA DC Linear input (X051)
Universal Outputs	Relay Type (H10 or H40)
Alarms	Process High, Relay, Direct-acting
Communications	Three-wire EIA RS485 (X06)
External SP Selection	Disabled

INPUT - TYPE AND RANGE

Thermocouple

T6405	Thermocouple "J" –100 to 760°C
T6406	Thermocouple "J" –150 to 1400°F
T6407	Thermocouple "J" –100.0 to 450.0°C
T6408	Thermocouple "J" –150.0 to 840.0°F
T1417 [1]	Thermocouple "J" 0 to 450°C
T1418 [1]	Thermocouple "J" 32 to 840°F
T6805	Thermocouple "L" –100 to 760°C
T6806	Thermocouple "L" –150 to 1400°F
T6807	Thermocouple "L" –100.0 to 450.0°C
T6808	Thermocouple "L" –150.0 to 840.0°F
T6709	Thermocouple "K" –200 to 1372°C
T6710	Thermocouple "K" –328 to 2500°F
T6711	Thermocouple "K" –200.0 to 450.0°C
T6712	Thermocouple "K" –328.0 to 840.0°F
T1723 [1]	Thermocouple "K" 0 to 1372°C
T1724 [1]	Thermocouple "K" 32 to 2500°F
T6617	Thermocouple "E" –100 to 800°C
T6618	Thermocouple "E" –150 to 1472°F
T6513	Thermocouple "T" –200.0 to 400.0°C
T6514	Thermocouple "T" –328.0 to 750.0°F
T1127	Thermocouple "R" 0 to 1650°C
T1128	Thermocouple "R" 32 to 3002°F
T1227	Thermocouple "S" 0 to 1650°C
T1228	Thermocouple "S" 32 to 3002°F
T1983	Thermocouple "B" 100 to 1820°C
T1984	Thermocouple "B" 212 to 3308°F
T5111	Thermocouple "W5" 0 to 2316°C

1 Input range limited by trim adjustment

T5112	Thermocouple "W5" 32 to 4201°F
T5373	Thermocouple "N" 0 to 1300°C
T5349	Thermocouple "N" 32 to 2372°F

Three-Wire Resistance Temperature Detector (RTD)

T7215	-200 to 850°C
T7216	-328 to 1562°F
T7213	-200.0 to 400.0°C
T7214	-328.0 to 750.0°F

DC Linear

T4011	0 to 10mV
T4043	0 to 50mV
T4045	0 to 5V
T4034	1 to 5V
T4046	0 to 10V
T3039	0 to 10mA
T3013	0 to 20mA
T3014	4 to 20mA

Input Sample Rate

Standard rate is 6 samples/second

T----2	20 samples/second

OUTPUTS

Universal Output 1 (UO1 - HEAT)

H10	Relay
H50	SSR Drive
H21	DC Output - 4 to 20mA
H24	DC Output - 0 to 20mA
H25	DC Output - 0 to 10mA
H26	DC Output - 0 to 5mA
H61	DC Output - 1 to 5V
H64	DC Output - 0 to 5V
H65	DC Output - 0 to 10V
H40	Valve Motor Drive - Closed Loop
H70	Valve Motor Drive - Open Loop

Universal Output 1 Option

H--3	Direct-acting

(Universal Output 1 is normally reverse-acting)

Universal Output 2 (UO2 - COOL, Alarm or Re-transmitted Output) [1]

COOL Output:	C10	Relay
	C50	SSR Drive
	C21	DC Output - 4 to 20mA
	C24	DC Output - 0 to 20mA
	C25	DC Output - 0 to 10mA
	C26	DC Output - 0 to 5mA
	C61	DC Output - 1 to 5V
	C64	DC Output - 0 to 5V
	C65	DC Output - 0 to 10V
Alarm Output:	C70	Unconfigured alarm relay
	C71	Alarm 1, Relay, Direct-acting
	C72	Alarm 2, Relay, Direct-acting
	C73	Alarm 3, Relay, Direct-acting
	C74	Alarm 4, Relay, Direct-acting
	C75	Alarms 1 & 2, Relay, Direct-acting
	C76	Alarms 1 & 3, Relay, Direct-acting
	C77	Alarms 1 & 4, Relay, Direct-acting
	C78	Alarms 2 & 3, Relay, Direct-acting
	C79	Alarms 3 & 4, Relay, Direct-acting
	C81	Alarm 1, Relay, Reverse-acting
	C82	Alarm 2, Relay, Reverse-acting
	C83	Alarm 3, Relay, Reverse-acting
	C84	Alarm 4, Relay, Reverse-acting
	C85	Alarms 1 & 2, Relay, Reverse-acting
	C86	Alarms 1 & 3, Relay, Reverse-acting
	C87	Alarms 1 & 4, Relay, Reverse-acting
	C88	Alarms 2 & 3, Relay, Reverse-acting
	C89	Alarms 3 & 4, Relay, Reverse-acting
Event Output	C90	Event Output, Relay
	C91	Event Output, SSR Drive

3 Universal Output 2 (UO") is not available if either VMD option (H40 or H70) has been selected for OUT 1 (HEAT)

Re-Transmitted Output:	C211	Re-transmitted PV - 4 to 20mA
	C241	Re-transmitted PV - 0 to 20mA
	C251	Re-transmitted PV - 0 to 10mA
	C261	Re-transmitted PV - 0 to 5mA
	C611	Re-transmitted PV - 1 to 5V
	C641	Re-transmitted PV - 0 to 5V
	C651	Re-transmitted PV - 0 to 10V
	C212	Re-transmitted SP - 4 to 20mA
	C242	Re-transmitted SP - 0 to 20mA
	C252	Re-transmitted SP - 0 to 10mA
	C262	Re-transmitted SP - 0 to 5mA
	C612	Re-transmitted SP - 1 to 5V
	C642	Re-transmitted SP - 0 to 5V
	C652	Re-transmitted SP - 0 to 10V

Universal Output 3 (UO3 - Alarm or Re-transmitted Output)

Alarm Output:	D70	Unconfigured alarm relay
	D71	Alarm 1, Relay, Direct-acting
	D72	Alarm 2, Relay, Direct-acting
	D73	Alarm 3, Relay, Direct-acting
	D74	Alarm 4, Relay, Direct-acting
	D75	Alarms 1 & 2, Relay, Direct-acting
	D76	Alarms 1 & 3, Relay, Direct-acting
	D77	Alarms 1 & 4, Relay, Direct-acting
	D78	Alarms 2 & 3, Relay, Direct-acting
	D79	Alarms 3 & 4, Relay, Direct-acting
	D81	Alarm 1, Relay, Reverse-acting
	D82	Alarm 2, Relay, Reverse-acting
	D83	Alarm 3, Relay, Reverse-acting
	D84	Alarm 4, Relay, Reverse-acting
	D85	Alarms 1 & 2, Relay, Reverse-acting
	D86	Alarms 1 & 3, Relay, Reverse-acting
	D87	Alarms 1 & 4, Relay, Reverse-acting
	D88	Alarms 2 & 3, Relay, Reverse-acting
	D89	Alarms 3 & 4, Relay, Reverse-acting
Event Output	D90	Event Output, Relay
	D91	Event Output, SSR Drive

Re-Transmitted Output:	D211	Re-transmitted PV - 4 to 20mA
	D241	Re-transmitted PV - 0 to 20mA
	D251	Re-transmitted PV - 0 to 10mA
	D261	Re-transmitted PV - 0 to 5mA
	D611	Re-transmitted PV - 1 to 5V
	D641	Re-transmitted PV - 0 to 5V
	D651	Re-transmitted PV - 0 to 10V
	D212	Re-transmitted SP - 4 to 20mA
	D242	Re-transmitted SP - 0 to 20mA
	D252	Re-transmitted SP - 0 to 10mA
	D262	Re-transmitted SP - 0 to 5mA
	D612	Re-transmitted SP - 1 to 5V
	D642	Re-transmitted SP - 0 to 5V
	D652	Re-transmitted SP - 0 to 10V

Universal Output 4 (UO4 - Alarm or Re-transmitted Output)

Alarm Output:	E70	Unconfigured alarm relay
	E71	Alarm 1, Relay, Direct-acting
	E72	Alarm 2, Relay, Direct-acting
	E73	Alarm 3, Relay, Direct-acting
	E74	Alarm 4, Relay, Direct-acting
	E75	Alarms 1 & 2, Relay, Direct-acting
	E76	Alarms 1 & 3, Relay, Direct-acting
	E77	Alarms 1 & 4, Relay, Direct-acting
	E78	Alarms 2 & 3, Relay, Direct-acting
	E79	Alarms 3 & 4, Relay, Direct-acting
	E81	Alarm 1, Relay, Reverse-acting
	E82	Alarm 2, Relay, Reverse-acting
	E83	Alarm 3, Relay, Reverse-acting
	E84	Alarm 4, Relay, Reverse-acting
	E85	Alarms 1 & 2, Relay, Reverse-acting
	E86	Alarms 1 & 3, Relay, Reverse-acting
	E87	Alarms 1 & 4, Relay, Reverse-acting
	E88	Alarms 2 & 3, Relay, Reverse-acting
	E89	Alarms 3 & 4, Relay, Reverse-acting
Event Output	E90	Event Output, Relay
	E91	Event Output, SSR Drive

Re-Transmitted Output:	E211	Re-transmitted PV - 4 to 20mA
	E241	Re-transmitted PV - 0 to 20mA
	E251	Re-transmitted PV - 0 to 10mA
	E261	Re-transmitted PV - 0 to 5mA
	E611	Re-transmitted PV - 1 to 5V
	E641	Re-transmitted PV - 0 to 5V
	E651	Re-transmitted PV - 0 to 10V
	E212	Re-transmitted SP - 4 to 20mA
	E242	Re-transmitted SP - 0 to 20mA
	E252	Re-transmitted SP - 0 to 10mA
	E262	Re-transmitted SP - 0 to 5mA
	E612	Re-transmitted SP - 1 to 5V
	E642	Re-transmitted SP - 0 to 5V
	E652	Re-transmitted SP - 0 to 10V

Internal Alarm Configuration [1]

A0---	Internal Alarm 1 not configured
A1---	Internal Alarm 1 - Process High
A2---	Internal Alarm 1 - Process Low
A3---	Internal Alarm 1 - Deviation High
A4---	Internal Alarm 1 - Deviation Low
A5---	Internal Alarm 1 - Band
A-0--	Internal Alarm 2 not configured
A-1--	Internal Alarm 2 - Process High
A-2--	Internal Alarm 2 - Process Low
A-3--	Internal Alarm 2 - Deviation High
A-4--	Internal Alarm 2 - Deviation Low
A-5--	Internal Alarm 2 - Band
A--0-	Internal Alarm 3 not configured
A--1-	Internal Alarm 3 - Process High
A--2-	Internal Alarm 3 - Process Low
A--3-	Internal Alarm 3 - Deviation High
A--4-	Internal Alarm 3 - Deviation Low
A--5-	Internal Alarm 3 - Band

1 The internal alarms are four "soft" alarms which may be connected to Universal Outputs. One or two alarms can be assigned to a single output.

A---0	Internal Alarm 4 not configured
A---1	Internal Alarm 4 - Process High
A---2	Internal Alarm 4 - Process Low
A---3	Internal Alarm 4 - Deviation High
A---4	Internal Alarm 4 - Deviation Low
A---5	Internal Alarm 4 - Band

BASE INSTRUMENT OPTIONS

X05-	Remote Setpoint Input - 4 to 20mA
X37-	Remote Setpoint Input - 0 to 20mA
X03-	Remote Setpoint Input - 0 to 10mA
X38-	Remote Setpoint Input - 1 to 5V
X04-	Remote Setpoint Input - 0 to 5V
X36-	Remote Setpoint Input - 0 to 10V
X--0	Remote Setpoint - Internal Selection [1]
X--1	Remote Setpoint - External Selection [1]
X681	External Switching for Dual Setpoint
X06	Three-wire EIA RS485 Serial Communications
X07	Five-wire EIA RS485 Serial Communications
X83	EIA RS232C Serial Communications
X84	Real Time Clock
X85	External selection of Auto/Manual mode
X15	German display
X16	French display

NOTE

Instruments with the following inputs/outputs may not include input connections for external selection of Dual or Remote Setpoint (X681):

UI + UO1 + UO2 (+ X00)

UI + AAI + UO1 + UO2 (+ X00)

An additional terminal block (Order Code M9999 A09468) may be fitted to provide the appropriate connections.

1 The Remote Setpoint option is not available if VMD Output (H40 or H70 with Valve Position Indication) has been selected for OUT1.

APPENDIX B
PRODUCT SPECIFICATION

UNIVERSAL INPUTS

General

Maximum per Controller:	One
Input sample rate:	6/second or 20/second, selectable
Digital input filter:	Time constant selectable from front panel (0 to 100 seconds)
Input resolution:	Dependent upon selected sample rate - 14-bit (6/second) 12-bit (20/second)
Input impedance:	Greater than 100MΩ resistive (except for mA and V inputs)
Isolation:	Universal Input 1 and Auxiliary Analogue Input are not isolated from each other but are isolated from all other inputs and outputs.

Thermocouple

Input Range: Range selectable from front panel from:

"J"	–100 to 760°C (–150 to 1400°F)
"J"	–100.0 to 450.0°C (–150.0 to 840.0°F)
"J"	0 to 450°C (32 to 840°F)
"L"	–100 to 760°C (–150 to 1400°F)
"L"	–100.0 to 450.0°C (–)150.0 to 840.0°F)
"K"	–200 to 1372°C (–328 to 2500°F)
"K"	–200.0 to 450.0°C (–328.0 to 840.0°F)
"K"	0 to 1372°C (32 to 2500°F)
"E"	–100 to 800°C (–150 to 1472°F)
"T"	–200.0 to 400.0°C (–328.0 to 750.0°F)
"R"	0 to 1650°C (32 to 3002°F)
"S"	0 to 1650°C (32 to 3002°F)
"B"	100 to 1820°C (212 to 3308°F)
"W5"	0 to 2316°C (32 to 4201°F)
"N"	0 to 1300°C (32 to 2372°F)

Range Maximum Trim:	Bounded by minimum span allowed (see below) and Range Maximum (see ranges above)
Range Minimum Trim:	Bounded by Range Minimum (see above ranges) and minimum span allowed (see below).
Minimum Span Allowed:	25% of base range (see ranges above) for each range.
Calibration:	Complies with BS4937, NBS125 and IEC584.
Characterisation Method:	Linearisation implemented in product firmware.
Cold Junction Compensation:	By internal sensor; requires no calibration.
Sensor Break Detection:	Break detected within 2 seconds.

Resistance Temperature Detector (RTD)

Input Range:	Selectable from front panel: −200 to 850°C (−328 to 1562°F) −200.0 to 400.0°C (−328.0 to 750.0°F)
Range Maximum Trim:	Bounded by minimum scan allowed (see below) and absolute Range Maximum (see ranges above)
Range Minimum Trim:	Bounded by absolute Range Minimum (see above ranges) and minimum span allowed (see below).
Minimum Span Allowed:	25% of fundamental span (see ranges above) for each range.
Type and Connection:	Three-wire Pt100.
Calibration:	Complies with BS1904 and DIN43760
Lead Compensation:	Automatic scheme.
RTD Sensor Current:	250μA nominal
Sensor Break Detection:	Break detected within 2 seconds. Any combination of lead breakage will cause predictable outcome.
Characterisation Method:	Linearisation implemented in product firmware.

DC Linear

Input Range:	Selectable from front panel: 0 to 10mV (R_{in} > 100MΩ) 0 to 50mV (R_{in} > 100MΩ) 0 to 5V (R_{in} > 100kΩ) 1 to 5V (R_{in} > 100kΩ) 0 to 10V (R_{in} > 100kΩ) 0 to 10mA (R_{in} < 5Ω) 0 to 20mA (R_{in} < 5Ω) 4 to 20mA (R_{in} < 5Ω)
Range Maximum:	Bound by −9999 and 9999. Decimal point is as required (0.001, 0.01, 0.1 or none).
Range Minimum:	Bound by −9999 and 9999. Decimal point is as for Range Maximum.
Input Break Detection:	Break detected within 2 seconds (applicable only to the 4 - 20mA and 1 - 5V input ranges).

Auxiliary Input

Type:	Potentiometer (VMD slidewire) input or DC linear input with one of the following ranges: 4 - 20mA 0 - 20mA 0 - 10mA 1 - 5V 0 - 5V 0 - 10V
Maximum Contact Resistance:	50Ω
Minimum Leakage resistance:	500Ω

UNIVERSAL OUTPUTS

General

Maximum per Controller:	Four
Types:	Configurable as Relay, SSR Drive or Analogue (DC linear) output.

Relay

Contact Type:	Single pole changeover (SPCO)
Rating:	2A resistive at 120/240V AC
Life:	10^6 operations at rated voltage/current.
Isolation:	Inherent.
Minimum ON Time:	0.25 seconds.

SSR Drive/TTL

Drive Capability:	SSR - 4.5V DC into 250Ω minimum. TTL - Fan-out of 1 for standard TTL
Isolation:	Universal Outputs 1 & 2 are not isolated from each other but are isolated from all other inputs/outputs. Universal Outputs 3 & 4 are not isolated from each other but are isolated from all other inputs/outputs.

Analogue (DC Linear)

Resolution:	10-bit
Update Rate:	Every control algorithm execution.
Output Range:	Selectable from: 0 - 5mA (R_{LOAD} = 2kΩ max.) 0 - 10mA (R_{LOAD} = 1kΩ max.) 0 - 20mA (R_{LOAD} = 500Ω max.) 4 - 20mA (R_{LOAD} = 500Ω max.) 0 - 5V (R_{LOAD} = 250Ω min.) 1 - 5V (R_{LOAD} = 250Ω min.) 0 - 10V (R_{LOAD} = 500Ω min.)
Isolation:	Universal Outputs 1 & 2 are not isolated from each other but are isolated from all other inputs/outputs. Universal Outputs 3 & 4 are not isolated from each other but are isolated from all other inputs/outputs.
Range Selection Method:	Link jumpers + front panel selection.

LOOP CONTROL

Tuning Types:	Pre-Tune, Self-Tune and Gain Scheduling.
Pre-Tune:	Non-repetitive tuning algorithm which can be evoked either automatically on power-up or by request from the front panel.
Self-Tune:	Uses current values of P, I and D parameters as a basis for optimising the control algorithm during operation.
Gain Scheduling:	Up to six sets of pre-programmed P, I and D parameters are automatically entered into the three-term control algorithm at pre-determined levels of process variable, setpoint, deviation (process variable – setpoint) or output power.

Proportional Bands:	0.5 - 999.9% of span at 0.1% resolution.
Integral (Reset) Time:	OFF, 1 second to 99 minutes 59 seconds.
Derivative (Rate) Time:	0 (OFF) to 99 minutes 59 seconds.
Manual Reset:	Added to each control algorithm execution. Settable in the range 0 - 100% (single control output) or –100% - 100% (dual control output).
Deadband/Overlap:	Settable in the range + 20% to –20% of (PB1 + PB2)
Auto/Manual Control:	User-selectable with "bumpless" transfer.
Automatic Safety Feature:	On sensor break, output power is set to a pre-defined level within 2 seconds.
Cycle Time:	Selectable in the range 0.25 seconds - 512 seconds. Resolution in binary steps. Cycle time for relay output is restricted to 2 seconds minimum.
Setpoint Range:	Bounded by Setpoint Minimum and Setpoint Maximum parameters.
Setpoint Maximum:	Bounded by Setpoint and Range Maximum.
Setpoint Minimum:	Bounded by Range Minimum and Setpoint.
Dual Setpoint plus Ramp:	Ramp rate selectable in the ranges 1 - 9999 LSDs per hour and infinite. Number displayed has same decimal point position as selected input range.

ALARM CONTROL

Maximum Number of Alarms:	Four "soft" alarms.
Maximum Number of Outputs Available:	Up to three outputs may be used for alarm purposes.
Alarm Combinations:	Simple logical OR combinations of alarms are permitted.

REAL TIME CLOCK OPTION

Minimum operating time without power:	7 days (assuming back-up facility fully-charged)
Minimum initial charge period:	5 hours
Number of events:	8
Types of event action:	1. Set Setpoint 1 value to SPMax or SPMin. 2. Select Setpoint 1/Local Setpoint or Setpoint 2/Remote Setpoint as current setpoint. 3. Place Controller in "Sleep" state or wake Controller from "Sleep" state. 4. Activate or de-activate Universal Output 2, 3 or 4.
Alarm Inhibit Timer:	00:00 - 24:00 (hours:minutes)
Event Trigger Timing:	1. Once only on a specified date/time 2. Daily - on one or more days of the week at a specified time. 3. Weekly - on one day of the week only at a specified time

On power-Up or on waking from the "Sleep" state, the Controller will always restore the most-recent valid state, even in cases where power is accidentally lost.

PERFORMANCE

Reference Conditions:

Generally as BS5558.

Ambient Temperature:	20°C ± 2°C
Relative Humidity:	60 - 70% non-condensing.
Supply Voltage:	240V AC, 50Hz ± 1% or 60Hz ± 1%
Source Resistance:	< 10Ω (Thermocouple)
Lead Resistance:	< 0.1Ω/lead balanced (Pt100)

Performance Under Reference Conditions:

Common Mode Rejection:	> 120dB at 50/60Hz, giving negligible effect at up to 264V 50/60Hz.
Series Mode Rejection:	> 40dB at 50/60Hz. 200% of span (at 50/60Hz) causes negligible effect when applied at 10% or 90% of span points.

Inputs - DC Linear

Measurement Accuracy: ± 0.1% of span ± 1 LSD (± 0.5% of span ± 1LSD for 10mV range).

Inputs - Thermocouple

Measurement Accuracy: ± 0.1% of span ± 1 LSD.

Linearisation Accuracy: Better than ± 0.05°C at any point (any 0.1°C resolution range).
Better than ± 0.2°C at any point (any 1°C resolution range).

Cold Junction Compensation: Better than ± 0.4°C.

Span Trim: Span can be trimmed to 25% of full span.

Inputs - RTD

Measurement Accuracy: ± 0.1% of span ± 1 LSD.

Linearisation Accuracy: Better than ± 0.05°C at any point (any 0.1°C resolution range)
Better than ± 0.2°C at any point (any 1°C resolution range)

Span Trim: Span can be trimmed to 25% of full span.

Outputs - DC (Analogue)

Re-transmitted Output	Accuracy	Regulation/Compliance
0 - 5mA	± 1% of full scale (into 250Ω load)	2% (0 - 2kΩ)
0 - 10mA	± 0.25% of full scale (into 250Ω load)	1% (0 - 1kΩ)
0 - 20mA	± 0.25% of full scale (into 250Ω load)	0.6% (0 - 500Ω)
4 - 20mA	± 0.25% of full scale (into 250Ω load)	0.6% (0 - 500Ω)
0 - 5V	± 0.5% of full scale (into 5kΩ load)	0.3% (∞ - 250Ω)
1 - 5V	± 0.5% of full scale (into 5kΩ load)	0.3% (∞ - 250Ω)
0 - 10V	± 0.5% of full scale (into 5kΩ load)	0.2% (∞ - 500Ω)

Control Output	Accuracy	Regulation/Compliance
0 - 5.1mA	± 1% of full scale (into 250Ω load)	2% (0 - 2kΩ)
0 - 10.2mA	± 0.25% of full scale (into 250Ω load)	1% (0 - 1kΩ)
0 - 20.4mA	± 0.25% of full scale (into 250Ω load)	0.6% (0 - 500Ω)
3.68 - 20.32mA	± 0.25% of full scale (into 250Ω load)	0.6% (0 - 500Ω)
0 - 5.1V	± 0.5% of full scale (into 5kΩ load)	0.3% (∞ - 250Ω)
0.92 - 5.08V	± 0.5% of full scale (into 5kΩ load)	0.3% (∞ - 250Ω)
0 - 10.2V	± 0.5% of full scale (into 5kΩ load)	0.2% (∞ - 500Ω)

Auxiliary Input

- Potentiomer (Slidewire) Input: 80Ω - 450Ω

Operating Conditions:

Ambient Temperature (Operating): 0°C to 50°C (32°F to 122°F)

Ambiemt Temperature (Storage): –20°C to 80°C (–4°F to 176°F)

Relative Humidity: 20% to 95% (non-condensing).

Supply Voltage: 90 - 264V 50/60Hz

Source Resistance: 1000Ω maximum (Thermocouple)

Lead Resistance: 50Ω/lead maximum, balanced (Pt100)

Performance Under Operating Conditions:

Temperature Stability: 0.005% of span/°C change in ambient temperature (typical - 0.01% maximum).

Cold Junction Compensation (Thermocouple input only): Better than ± 0.5°C.

Supply Voltage Influence: Negligible.

RH Influence: Negligible.

Sensor Resistance Influence:

Thermocouple - 100Ω: < 0.1% of span error

1000Ω: < 0.5% of span error

RTD (Pt100), 50Ω/lead: < 0.5% of span error

ENVIRONMENTAL

EMI Susceptibility: Designed to meet EN55101.

EMI Emissions: Designed to meet EN55022 (BS6527).

Safety Considerations: Designed to comply with IEC348 (BS4743) in as far as is applicable.

Supply Voltage: 90 - 264V AC 50/60Hz

Power Consumption: TBA

Front Panel Sealing: To IP65.

PHYSICAL

Dimensions

Depth: 160mm (6.25 inches)

Front: 96mm x 96mm (1/4 DIN); 103mm x 103mm with IP65 gasket.

Mounting: Plug-in with panel-mounting sleeve.
Panel cut-out (92 + 0.8 -0)mm x (92 + 0.8 -0)mm

Terminals: Clamp type with integral screw.

Weight: 0.8kg (1.76 lb).

APPENDIX C
EXCEPTION MESSAGES

The Exception Messages which may be displayed by the Controller and (where applicable) the corrective actions to be taken are as follows:

Exception Message	Corrective Action
	INSTRUMENT ERROR. Thermocouple cold junction compensation is inoperative. Refer to supplier.
	The input type for the Universal Input has been changed. Ensure that the input type selected (in Configuration Mode - see Subsection 6.2) is compatible with the switch settings on the IPO Board (see Subsection 7.2).
	The input type for the Auxiliary Analogue Input has been changed. Ensure that the input type selected (in Configuration Mode - see Subsection 6.2) is compatible with the switch settings on the IPO Board (see Subsection 7.2).
	The instrument is configured to use hardware which is no longer fitted.
	The output type for Universal Output 1 has been changed. Ensure that the output type selected (in Configuration Mode - see Subsection 6.6) is compatible with the link jumper settings on the IPO Board (see Subsection 7.3).
	The output type for Universal Output 2 has been changed. Ensure that the output type selected (in Configuration Mode - see Subsection 6.6) is compatible with the link jumper settings on the IPO Board (see Subsection 7.3).
	The output type for Universal Output 3 has been changed. Ensure that the output type selected (in Configuration Mode - see Subsection 6.6) is compatible with the link jumper settings on the ICCO Board (see Subsection 7.3).
	The output type for Universal Output 4 has been changed. Ensure that the output type selected (in Configuration Mode - see Subsection 6.6) is compatible with the link jumper settings on the ICCO Board (see Subsection 7.3).

Exception Message	Corrective Action
Error 05: C Cal. Defaulted	INSTRUMENT ERROR. Calibration constants on the ICCO Board have been set to their default values, possibly owing to an instrument malfunction. To clear the message, enter Set Up Mode or Configuration Mode and alter a parameter setting. Refer to supplier for remedial action.
Error 05: P Cal. Defaulted	INSTRUMENT ERROR. Calibration constants on the IPO Board have been set to their default values, possibly owing to an instrument malfunction. To clear the message, enter Set Up Mode or Configuration Mode and alter a parameter setting. Refer to supplier for remedial action.
Error 05: Config Defaulted	Configuration Mode and Set Up Mode parameters have been defaulted, possibly owing to an instrument malfunction. Enter Configuration Mode or Set Up Mode and change a parameter setting/value. If this fault persists, consult supplier.
Error 05: Setup Defaulted	Set Up Mode parameters have been defaulted, possibly owing to an instrument malfunction. Enter Set Up Mode and change a parameter setting/value. If this fault persists, consult supplier.
Error 05: Instr. Defaulted	Some of the instrument's data has been defaulted, possibly owing to an instrument malfunction. Instrument calibration may be effected. To clear the message, enter Set Up Mode or Configuration Mode and alter a parameter setting. Refer to supplier for remedial action.
Error 06: AAI CL VMD → OL	A break has occurred on one of the lines from the slidewire input during closed loop VMD operation and the user has selected "Open Loop on Break" during configuration; consequently, the Controller has re-configured itself to open loop VMD operation. This condition will persist until the break has been repaired and the Controller has been re-configured to closed loop VMD operation.
Error 07: Clock Clock Fault	A fault has occurred whilst reading the Real Time Clock.

Alphabetic Index

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