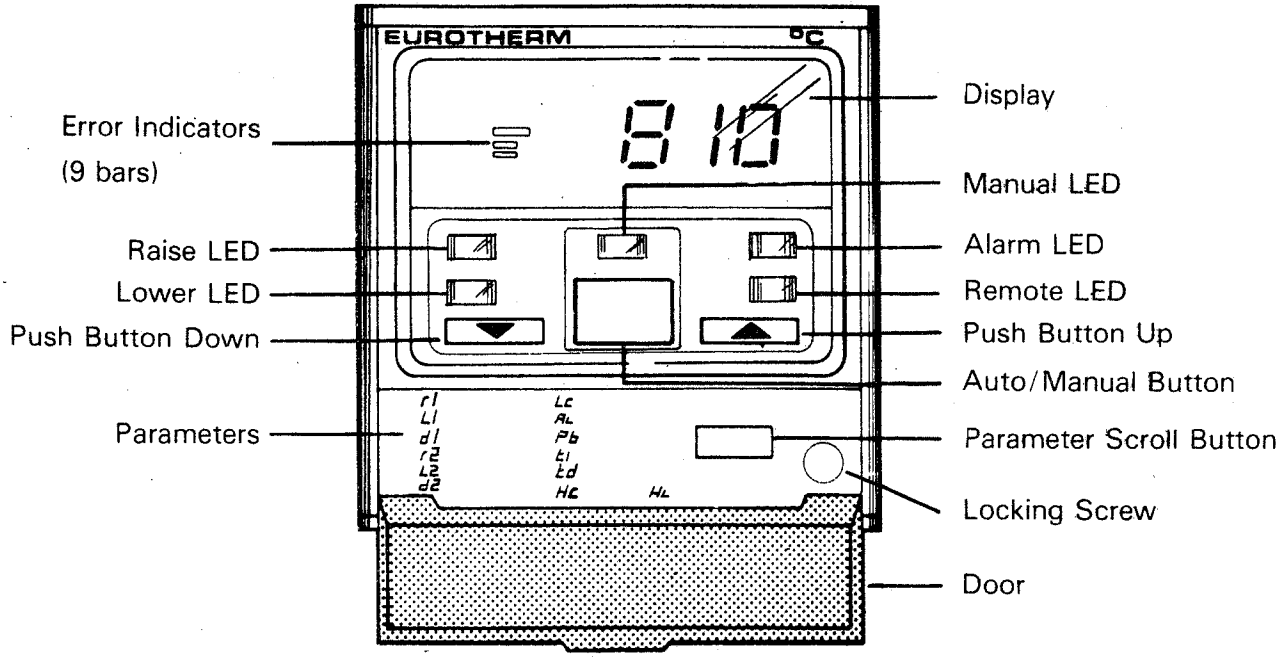
EUROTHERM

MICROPROCESSOR BASED MOTOR VALVE CONTROLLER TYPE 810

INSTALLATION AND OPERATING INSTRUCTIONS



INSTRUMENT DESPATCHED WITH PARAMETER SCROLL BUTTON DISABLED

CONTENTS

Ordering Information

You are welcome to order by description or by code below which is a useful check list.

Basic Product

	Code
Motor Valve Controller	810

Outputs

	Heat	Cool
Dual Relays (2A 240V)	178•	178•
Dual Triacs (1A 264V)	078•	078•

• Can be fitted to heat or cool channel but not both

Inputs The input code consists of three digits

First digit · Second and third digits

Scale	Code	Type	Range	Code
Deg C	0	Iron/Constantan J	-210C to 1200C	01
Deg F	1	Iron/Constantan DIN	-200C to 900C	02
Deg K	2	Ni Cr/Ni Al K	-265C to 1372C	03
Volts	4	Cu/Con T	-250C to 400C	04
mA	5	Pt 13% Rh/Pt R	50C to 1767C	05
mV	7	Pt 10% Rh/Pt S	50C to 1767C	06
Ohms	8	Pt 30% Rh/Pt 6% Rh B	100C to 1820C	08
		W/W 26% Re (Engelhard)	-70C to 2000C	09
		Ni Cr/Con E	-270C to 1000C	12
		W 5% Re/W 26% Re (Hoskins)	0C to 2500C	24
		Platinel II	-100C to 1370C	28
		W/W 26% Re (Hoskins)	0C to 2010C	29
		Linear inputs See note below	— to —	42
		Rt 100 at 0°C	-250C to 1050C	70

e.g. 003 Deg C Type K

Note: Linear inputs have 4, 5 or 7 as prefex
E.g. 701(0,10) = linear input 0 — 10mV
following type J linearising curve.

Scale Ranges

Standard ranges	Code	Standard ranges	Code	Standard ranges	Code
-500 to +500	607	0—200	612	0—1200	618
-250 to +750	628	0—300	613	0—1500	625
-250 to +250	608	0—400	614	0—1600	619
-125 to +125	609	0—500	624	0—2000	620
-100 to +400	627	0—600	615	0—2400	621
-100 to +300	626	0—800	616	0—3000	622
0—50.0	610	0—1000	617	0—4000	623
0—100.0	611				
0—100	630				

Note: For display ranges not shown, quote code 699 followed by the magnitude, e.g. 699 (0;750) to only one decimal place.

Options

	Code
Screw terminals (Fastons standard)	09
No cold junction compensation (50°C ext. ref.)	72
No cold junction compensation (0°C ext. ref.)	11
Downscale thermocouple break action	24
Fascia units not equal to input units (specify blank or units)	29
Retransmission of measured value (0—10V unisolated)	60
Retransmission of measured value (0—5V unisolated)	61
Setpoint stop (lower)	712••
Setpoint stop (upper)	713••
Setpoint track in manual (bumpless)	70
Local/remote setpoint unisolated, Remote setpoint — see additional features table below	

•• setting required

Additional Features Table

	Facility 1st digit	Input 2nd digit	Selection 3rd digit
0	—	0—5V	—
1	—	1—5V	—
2	—	0—10V	—
3	—	0—10mA	—
4	Local Remote	0—20mA	—
5	Remote Setpoint	4—20mA	—
6	—	-5V to +5V	Rear
7	—	Potentiometer	—
8	—	—	No selection
9	—	—	—

Notes: 1. These facilities are mutually exclusive.
2. If Local/Remote required only codes 4X6 are permissible. (X is any valid number).
3. If Remote Setpoint is required only codes 5X8 are permissible. (X is any valid number).

Supply Voltage

	Code
110, 220, 120, 240 ±10% 50/60Hz	10, 12, 24, 13

Alarm

Configurations — the alarm codes consist of three digits

Number	1st digit	2nd digit	3rd digit
0	—	—	—
1	Band	Non latching	—
2	Deviation high	—	De-energised alarm
3	Deviation low	—	—
4	Full scale high	—	—
5	Full scale low	—	—

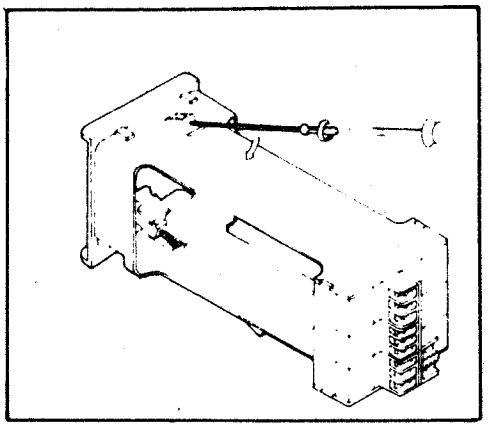
Notes: 1. Only one alarm available.
2. If no alarm is coded instrument is fitted with alarm 412.
3. Deviation alarms are limited to 50 units.

Ordering Code

Basic product	Heat Output	Cool Output	Input	Scale range	Supply voltage	Alarm 1	Alarm 2	Options	End
810	–	–	–	–	–	–	–	–	00

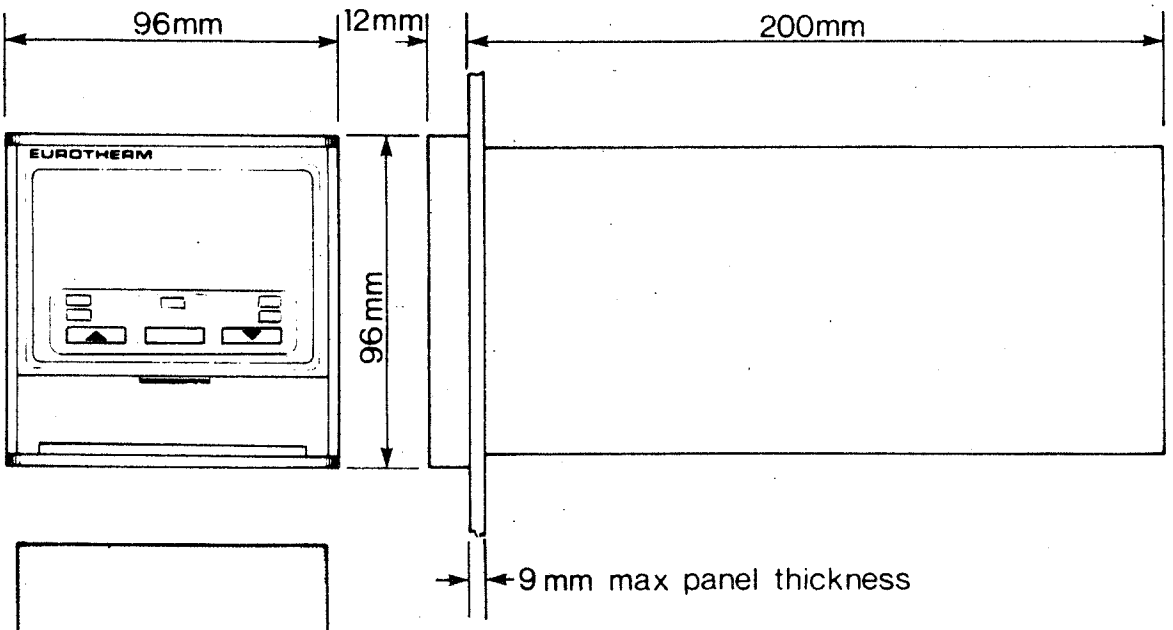
INSTALLATION

The instrument plugs into a panel-mounting sleeve which requires a DIN size 92 by 92mm cut-out as illustrated. Remove the instrument from the sleeve by opening the front panel door and with a screwdriver turn the screw, in the bottom right-hand corner, counter clockwise. The instrument will start to withdraw from the sleeve and once the screw has been turned to its furthest extent the instrument can be withdrawn by hand Remove the top and bottom mounting clamps from the sleeve by gently levering outwards and easing downwards inside the sleeve. Insert the sleeve through the cut-out via the front of the panel. Fit the mounting clamps in the slots from inside the sleeve and from the rear of the mounting panel tighten with a screwdriver.



By hand ease the instrument into the sleeve to its furthest extent. With a screwdriver turn the screw in the bottom right-hand corner clockwise until tight. The instrument will be pulled completely into the sleeve, engaging the rear terminals and be fully secured.

DIMENSIONAL DETAILS

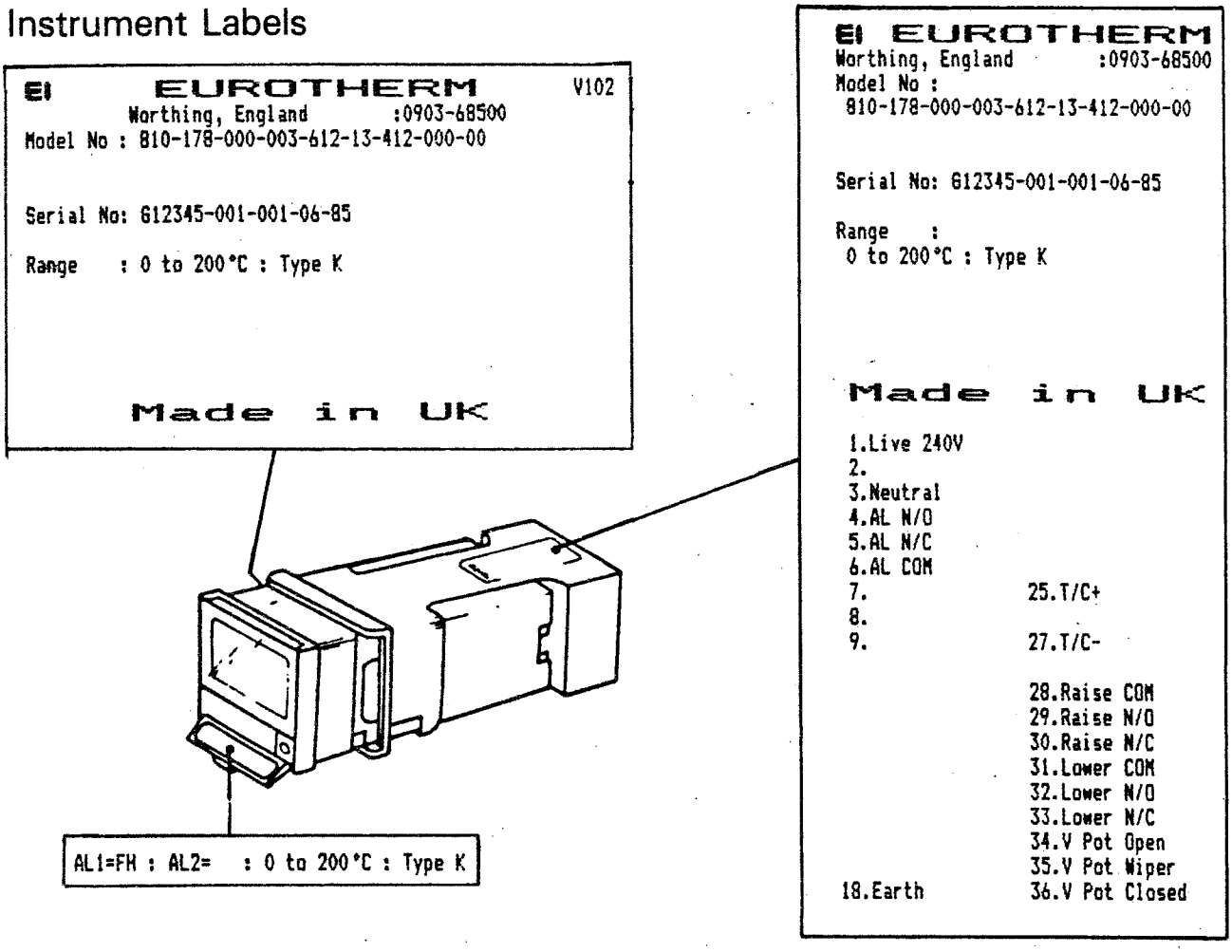


Panel cut-out
92×92 +0·8 -0 mm

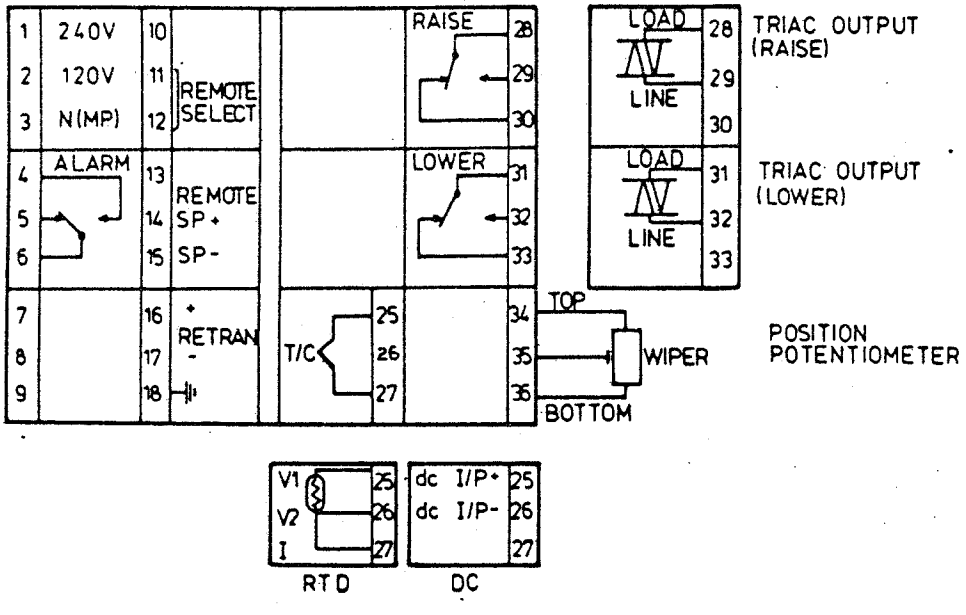
CONNECTIONS AND WIRING

Electrical connections are made via 3-way terminal blocks on the rear of the instrument. All connections are low current and a 16/0.20 mm wire size is adequate. Labels on the instrument and sleeve indicate the specific connections for the instrument.

Instrument Labels



Rear Connections



Supply

1	240V
2	120V
3	N(MP)

Power supply for the instrument is connected to terminals 1, 2 and 3. Neutral to terminal 3 and either 200/220/240V to terminal 1 or 100/110/120V to terminal 2. The ground connection is made to terminal 18.

18	Earth

Instrument Earth

Inputs

Thermocouple

25	T/C +
27	T/C –

Thermocouple connections are made to terminals 25 and 27, positive lead to 25 and negative lead to 27. Compensating cable of the correct type must be connected in the correct polarity. To check compensating lead polarity lift the leads of the thermocouple, twist them together and apply heat to the junction. The digital readout value should increase.

An open circuit thermocouple normally causes the digital value to move upscale, the lower output is energised until the scale blanks and outputs are inhibited. For process where a raise action is required until outputs are inhibited, option 24 is specified.

Error indications show direction of break protection and when the upper/lower limit of scale is reached the display blanks.

Resistance Thermometer

25	RT (V1)
26	RT (V2)
27	RT (I)

Platinum resistance three wire thermometers are connected to terminals 25, 26 and 27. Connect the single connection side of the bulb to terminal 25 and the double connection to terminals 26 and 27.

Millivolts Signals

25	DC I/P +
26	DC I/P –

Inputs are connected to terminals 25 and 26 as shown.

Potentiometer

34	Pot Open
35	Pot Wiper
36	Pot Closed

The motor feedback potentiometer is connected across terminals 34 and 36, with the wiper connected to terminal 35. The potentiometer value may be in the range 100 ohms to 1000 ohms. In the event of a potentiometer not being connected or a fault in the potentiometer, 'Sc' or 'Oc' is displayed and the electronic limits are no longer operative.

Outputs

Relay

28	Raise COM
29	Raise N/O
30	Raise N/C

The raise relay has its normally open, suppressed contacts between pins 28 and 29. Its function is to open the valve and is activated either automatically or by the front panel "up" button, when in manual.

31	Lower COM
32	Lower N/O
33	Lower N/C

The lower relay has its normally open, suppressed contacts between pins 31 and 32. Its function is to close the valve and is activated either automatically or by the front panel "down" button, when in manual.

Triac

28	Raise LOAD
29	Raise LINE

Triac output devices can be utilised to open and close the valve instead of relays.

31	Lower LOAD
32	Lower LINE

Notes:

1. Lower and raise outputs may be interchanged by switching switch SW1 on the output board from the normal to the inverted position.
2. Raise and lower output action is inhibited if:
   a. the potentiometer position is outside user defined limits
   b. a T/C break occurs
   c. the input signal is out of range

Alarm

4	AL N/O
5	AL N/C
6	AL COM

The instrument is fitted with an alarm relay which has a single changeover contact connected internally between terminals 4, 5 and 6. The relay is de-energised in alarm (fail safe) and contact suppression is provided between the N/C contacts and the wiper.

Options

Remote Analogue Setpoint

14	Rem S.P I/P +
15	Rem S.P I/P –

Voltage or current for remote analogue setpoint is applied to terminals 14 and 15 as shown.

13	Pot (Max)
14	Pot Wiper
15	Pot (Min

The remote analogue setpoint can be set by means of an external 10K ohm potentiometer, connected as shown to terminals 13, 14 and 15,.

11	Rem Switch
12	Rem Switch

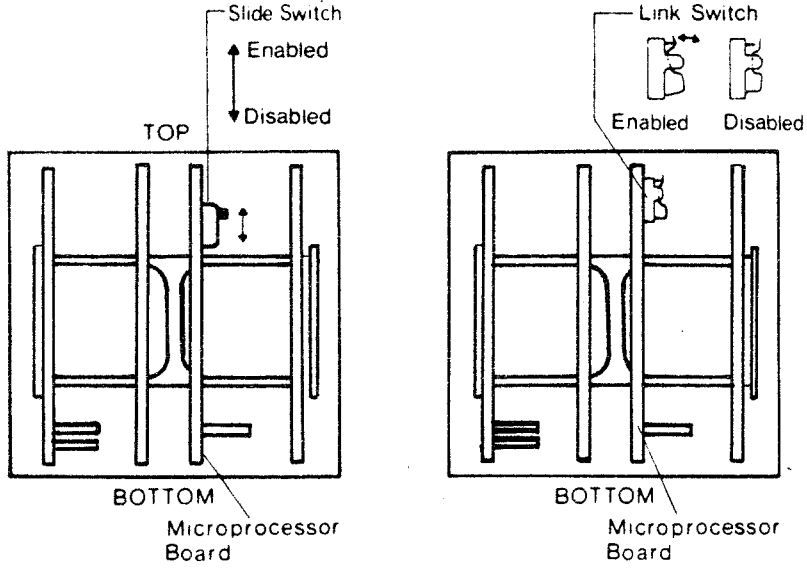
For selection of the Local/Remote facility an external latching switch should be connected between terminals 11 and 12. Closure of the switch selects the remote setpoint.

Analogue Retransmission

16	Retrans O/P +
17	Retrans O/P –

This 0-10V or 0-5V (10mA max) analogue output is available on terminals 16 and 17 as shown. It is an amplified and buffered version of the sensor input applied and is therefore not a linear function of the engineering units.

Scroll Button



REAR VIEW

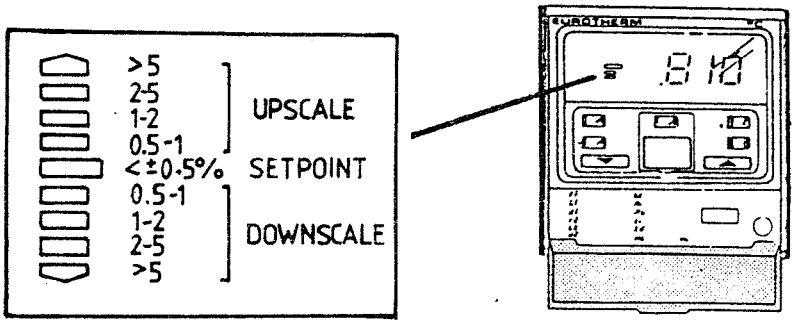
Locate the switch at the rear of the microprocessor circuit board (as shown). If a slide switch is fitted, slide the switch towards the top of the instrument to enable the scroll button. If a link switch is fitted, press down on the link and engage the hook (as shown). To disable the scroll button slide the switch towards the bottom of the instrument or disengage the link switch as appropriate.

OPERATION

Temperature Setting

When power is connected the fluorescent indicator panel will display the measured value of temperature in digital form. The nine segment bars situated to the digital readout provide error percentages of measured value with respect to setpoint. Illumination of the centre bar only indicates within 0.5% of full scale of setpoint.

The bars above and below the centre bar indicate, when illuminated, the upscale and downscale errors respectively, in increasing magnitude.



Automatic Mode (Centre LED extinguished)

In automatic mode measured value is normally displayed and operation of an UP or DOWN button causes the setpoint to be displayed, which may subsequently be altered by continuous pressing of the UP/DOWN buttons. The display automatically reverts to indicating measured value 5 seconds after the last button operation. The potentiometer position can be monitored by depressing both the UP and DOWN buttons simultaneously. The display will indicate a "P", for position, following by a value between 0 and 100 showing the percentage of the restricted travel as defined by the pre-set limits. If Oc or Sc are displayed this indicates an open or short circuit position potentiometer. Oc is displayed if no position potentiometer is fitted.

Manual Mode (Centre LED illuminates)

In manual mode measured value is normally displayed and operation of an UP or DOWN button causes the valve to be raised or lowered, the measured value still being displayed.

The potentiometer position is displayed when both UP and DOWN buttons are depressed simultaneously. The display will indicate a "P", for position, followed by a value which is a percentage of the user defined travel. The display reverts to displaying the measured value 5 seconds after the last button operation.

If the setpoint track option (option 70) is fitted then the setpoint is made equal to the measured value when the controller is placed back into automatic mode. Should this option not be fitted then the setpoint will remain unaltered.

INDICATIONS

The fluorescent indicator panel indicates measured value, setpoint and all parameters particular to the specific instrument. These include alarms, proportional band and integral time setting, approach, deadband, motor travel time and potentiometer settings.

When a parameter other than measured value or potentiometer position is being displayed, indication is provided by means of a flashing dot at the top left of the display.

The nine segment bars provide error indications of measured value with respect of the setpoint. In the event of a thermocouple break the numeric display goes blank when the maximum or minimum scale range is reached.

The ALARM LED will illuminate whenever an alarm is ON.

The potentiometer position can be monitored by depressing both the UP and DOWN buttons simultaneously. The display will indicate a "P", for position, following by a value between 0 and 100 showing the percentage of the restricted travel as defined by pre-set the limits. If Oc or Sc are displayed this indicates in open or short circuit potentiometer.

Indication of a remote setpoint on local/remote instruments is by the REMOTE LED. Closure of the switch for rear selection caused this LED to illuminate in remote and extinguish in local.

Setting Up

1. Connect up the controller, the motor and, if available, the position potentiometer.

2. If no motor position potentiometer is available then ensure that the "raise" winding has a limit switch positioned to operate at the point of travel corresponding to the required maximum valve opening. If a position potentiometer is available and the controller electronic stops are to be used then the limit switches may be positioned at the maximum permissable limit of motor travel.

The limit switch should be connected in series with the "raise" winding and should break the circuit when the limit is reached.

3. If no motor position potentiometer is available then ensure that the "lower" winding has a limit switch positioned to operate at the point of travel corresponding to the required minimum valve opening. If a position potentiometer is available and the controller electronic stops are to be used then the limit switches may be positioned at the minimum permissable limit of motor travel.

The limit switch should be connected in series with the "lower" winding and should break the circuit when the limit is reached.

4. Perform the following checks

OUTPUTS: Select manual mode. Check that the valve opens when the up or "raise" button is pressed and the raise indicator is illuminated. If a lower action occurs then the switch marked SW1 on the output board (the board with 2 relays or 2 triacs) may be changed from the norm to the inv position.

Still in manual mode check that "lower" or close valve action occurs when the down button is pressed and the "lower" indicator is illuminated.

POTENTIOMETER POSITION MONITORING: Check that while the valve is opening, the potentiometer position value is increasing. If not then both SW3 and SW4 should be altered from the "norm" to the "inv" positions.

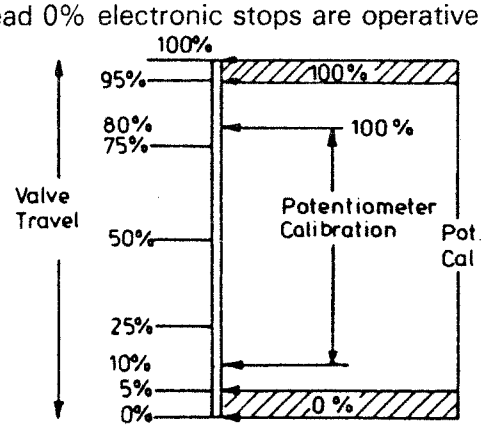
5. In the controller as supplied the valve position monitoring corresponds to the full electrical travel of the potentiometer (see note). Should it be necessary to use a restricted range of angular travel then the potentiometer calibration routine, under parameter heading PC, should be carried out.

Note: At the top and bottom ends of valve travel there is 5% deadband which always reads 100% and 0% respectively.

6. Setting up of the controller is achieved by access to the parameters through a scroll button which is located behind the front door panel. To the left of the scroll button and on the inside of the door panel are listed a series of control parameters, pertinent to that instrument. Each parameter is shown in abbreviated form. Operation of the scroll button causes the abbreviation to appear in the right hand segments of the digital flourescent indicator panel. The parameters abbreviation is replaced by the value of that parameter by a single operation of either the UP or DOWN button. Adjustment of a parameter is achieved by continuous operation of the respective UP/DOWN buttons.

If no action is taken by the operator within five seconds of the last action, the display will automatically revert to indicating the measured value.

7. POTENTIOMETER CALIBRATION PC: This calibration facility allows the travel of the motor to be limited between high and low limits defined by the operator. The motor travels from minimum to maximum (0 to 100%). A facility exists which permits adjustment of the motor minimum and maximum settings. These settings are then calibrated to equal 0 and 100%. For example it may be required to set the motor to operate between 10% and 80% of its travel. Therefore the 80% has to be calibrated to read 100% and the 10% to read 0% electronic stops are operative when these limits are reached.



To calibrate the potentiometer to the motor travel connect up the instrument as described in the wiring instructions. Scroll through until 'Pc' is displayed. Simulataneously depress the UP, DOWN and SCROLL buttons and an 'H' and a value will be displayed. This signifies the high limit value of the motor travel.

Set the high limit to read 80 by depressing the respective UP and DOWN buttons. When achieved depress both UP and DOWN buttons simultaneously to enter this setting. Once entered the display will change to ask for the low limit setting, 'L'. Set the low limit to 10 by means of the UP and DOWN buttons. When set depress both UP and DOWN buttons simulateously to enter this value. The instrument will now automatically calibrate these settings to read 0 and 100%.

8. Take a measure of the motor travel time from maximum to minimum opening. The sweep second hand of a watch is sufficiently accurate.

The motor travel time should be set to the nearest time (in secs) to the motor travel, as measured. This setting is not particularly critical.

9. The system should now be switched on as a control loop and the proportional band and intergral time should be optimised by any of the approved methods.

10. When the process has "stabilised", the error meter (or ideally a temperature recorder) should be observed to detect any cyclic fluctuation of temperature due to excessive deadband. If such fluctation occurs, the deadband should be narrowed in stages until the fluctuation level is negligible. The setting of the deadband control determines the coarseness of the valve movements. A compromise must be found between an excessively "busy" valve, and excessive load temperature fluctuations. Note that fluctuations due to excessive deadband must not be confused with oscillations due to too short a integral time or too narrow a proportional band.

11. If start-up in automatic mode is desired, then it may be used to optimise the adjustment of the approach control. For this purpose a chart recorder should be connected to record the process temperature using either the same thermocouple as the controller (by connecting in parallel) or a separate but adjacent thermocouple. The temperature versus time curve should be plotted for an automatic start-up with approach control set to maximum.

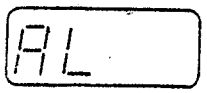
12. If temperature overshoot occurs, then the approach control should be left at maximum, and it is recommended that the integral time be increased by one position. On the other hand, if the start-up appears excessively sluggish, with the valve cutting back too early, then the warm-up may be speeded up by decreasing the approach control by one or two steps. Another warm-up curve should be plotted before making a further adjustment.
Note that if the approach control is decreased too far, then the result is likely to be a classic integral overshoot response.

13. If the process is found or is known to require a proportional band of less than 5%, then the next larger motor travel time setting should be selected. The controller then delivers longer on-pulses, which result in a proportional band range of 2.5-50%. Still narrower proportional bands may be achieved by selecting an even larger motor traverse time.

14. If the process requires a proportional band of greater than 100%, then the next shorter motor traverse time should be selected. The controller then has a proportional band adjustment range of 10-200%.

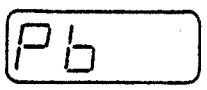
Parameters

AL-Alarm



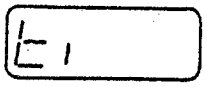
To set the limit for the alarm depress the scroll button until 'AL' is displayed. After approximately one second the digital readout will indicate the setting of the Alarm. to alter the limit to the required value depress the respective UP/DOWN buttons until the limit, top or bottom, is reached. This limit will appear in the display.
Band and full scale alarms can be set.

Pb-Proportional Band



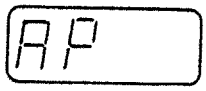
Depress the scroll button until 'Pb' is displayed. Depress the UP/DOWN buttons to set the required value. The proportional band settings are in 10 steps from 5 to 100%.
Settings selectable are 5, 7, 10, 14, 20, 28, 40, 56, 80, 100%. Values greater than 100% can be achieved by using the travel time as a Pb multiplier. For example to double the Pb the motor speed should be halved.

Ti-Integral (Secs)



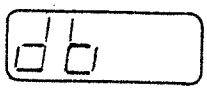
Depress the scroll button until 'ti' is displayed. Depress the respective UP/DOWN buttons to set the integral time to the required value.
Settings selectable are: 60, 120, 240, 480, 960, 1920 secs.

AP-Approach



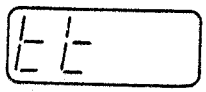
Depress the scroll button until 'AP' is displayed. This control determines the point at which cutback starts to occur so is used to optimise start-up responses. The higher the setting the later the cutback. Depress the respective UP/DOWN buttons to set the approach to the required value.
Settings selectable are: 0.25, 0.5, 0.75, 1.0, 1.25, 1.5, 2.0, 2.5, 3.0.

db-Deadband



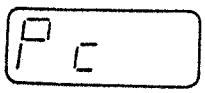
Depress the scroll button until 'db' is displayed. This allows the setting of a percentage of the measured value range, for a deadband area between motor raise and lower action.

tt-Travel Time



Depress the scroll button so that 'tt' is displayed. This control allows adjustment of actual motor travel times between the maximum and minimum settings. Depress the respective UP/DOWN buttons to set the required time.
Settings selectable are: 30, 60, 120, 240, 480 secs.

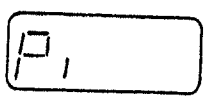
Pc-Potentiometer Calibration



Depress the scroll button until 'Pc' is displayed. To enter the potentiometer calibration routine simultaneously depress the UP DOWN and SCROLL buttons. 'H' will be displayed, signifying successful entry.
High Limit
'H' for the high limit setting will now be displayed. High limit of the motor position, as a 0 to 100% of total travel, is displayed. The value can now be set to the defined high limit position by depressing the respective UP/DOWN buttons. To enter this position depress both UP/DOWN buttons simultaneously.
Low Limit
'L' for the low limit setting will now be displayed, whose value can be set by operation of the UP/DOWN button. To enter this low limit setting depress both UP/DOWN buttons simultaneously.
The display will blank briefly as the limits are calculated and, if valid, the display will revert to indication of measured value.

Validity — The high limit must be greater than the low limit and the limits must be more than 16% of the total maximum travel apart. Failure of either causes 'Err' to be displayed and the low and high limits default to 0 and 100% respectively.
Fault — If the potentiometer has a fault condition or a position potentiometer is not connected, 'F' is displayed and entry is inhibited.

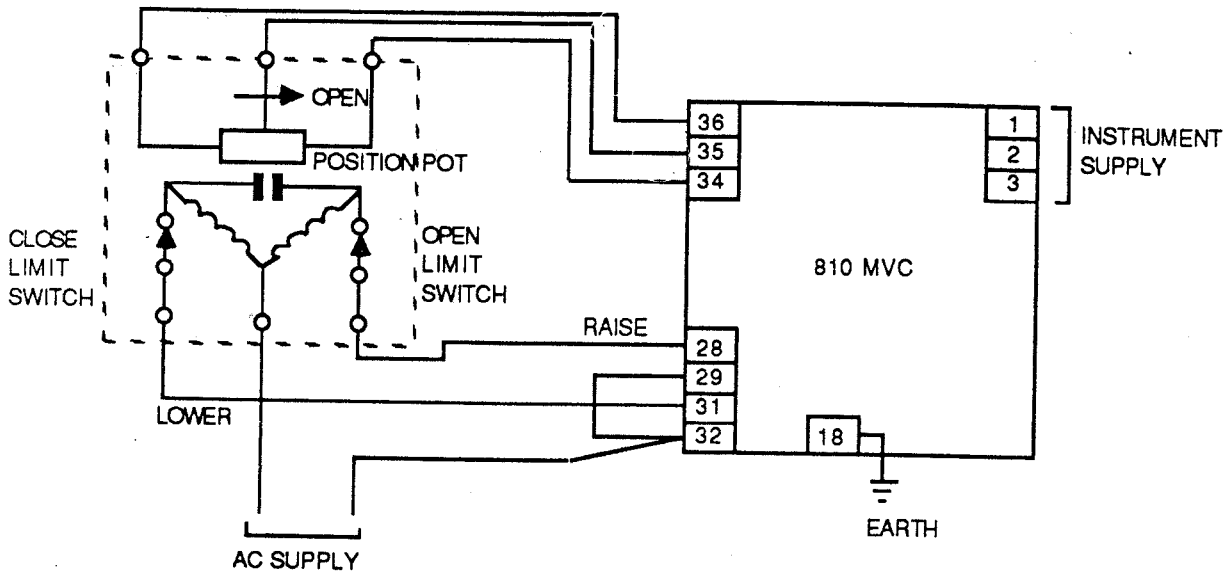
Pi-Potentiometer Inspection



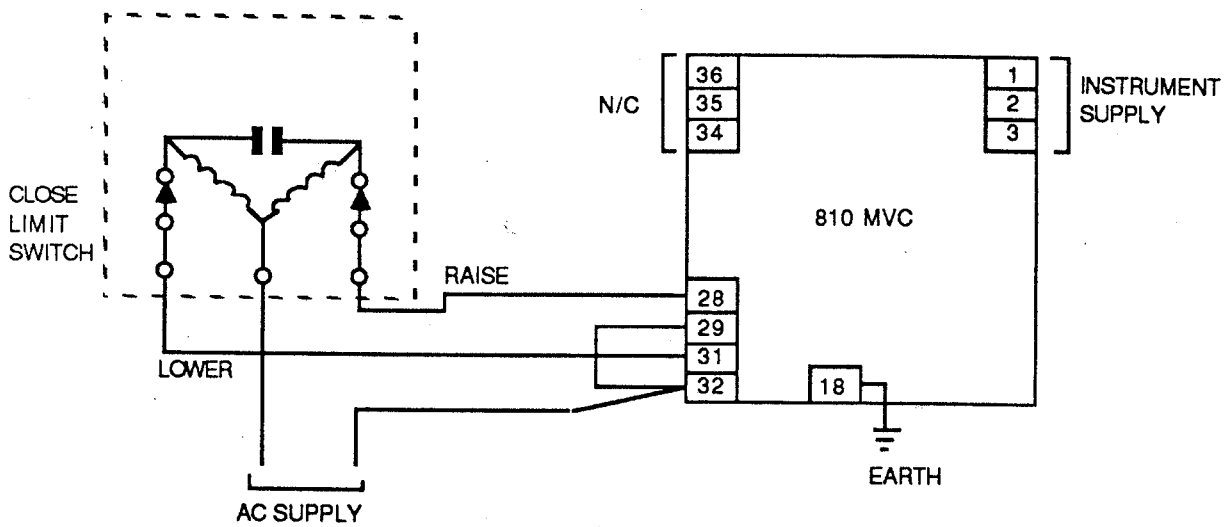
Depress the scroll button until Pi is displayed. The defined high and low potentiometer limits can be inspected by depressing the UP button to monitor the high limit and the DOWN button to monitor the low limit.

TYPICAL WIRING SCHEMATICS

Connection to motor with position potentiometer fitted.



Connection to motor without position potentiometer fitted.



Connection to motor with external raise and lower buttons acting directly on motor.