818

CONTROLLER/ PROGRAMMER

CE

EUROTHERM CONTROLS

Operating instructions

WARNING

STANDARD PRECAUTIONS TO BE TAKEN WHEN USING TEMPERATURE CONTROLLERS.

When designing any control systems it is essential to consider what will happen if any individual part of the system malfunctions.'

In a temperature control application, for example, the danger is that for some reason the heating system remains permanently switched on.

This could happen if:

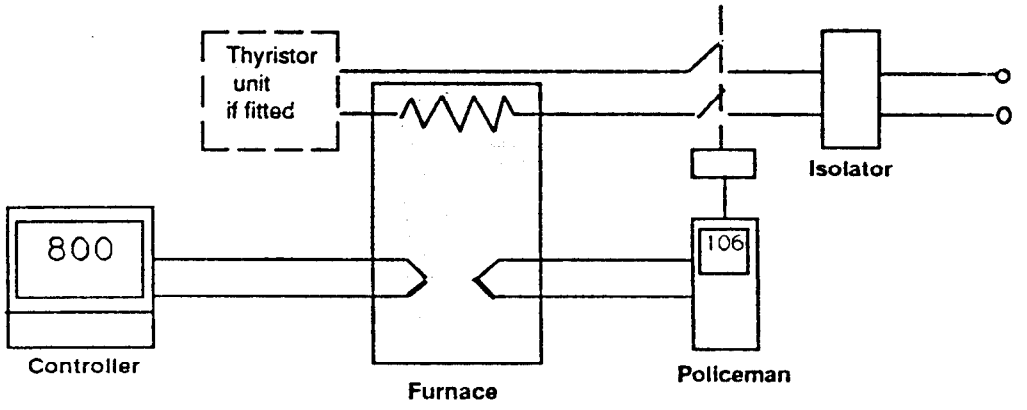
1. Thermocouple or sensor becomes "detached" from the system i.e. is no longer measuring the actual temperature achieved.
2. Thermocouple or thermocouple wiring becomes short circuited.
3. Component failure within the controller in such a way as to leave the output switched on.
4. Microprocessor or software failure in a system.
5. Failure of valve movement or valve linkage.
6. Remote setpoint to controller is faulty.
7. Operation by unauthorised personnel.
   eg. (a) Controller left in Manual with high output power set.
   (b) Setpoint set too high.
8. Any lack of maintenance in serviceable parts.

.....and many other unforeseen situations.

If leaving the heater on all the time can cause damage either to the plant itself or its contents, then an independent protection device must be provided.

The best form of protection is a completely independent 'policeman'. This is a separate overtemperature alarm with its own thermocouple or sensor and, on alarm will pull out the main contactor or shut off the valve to ensure the plant' s safety.

e.g.



A suitable policeman is the Eurotherm 106 overtemperature alarm.
Note that an alarm relay in the controller is not sufficient protection for all eventualities.

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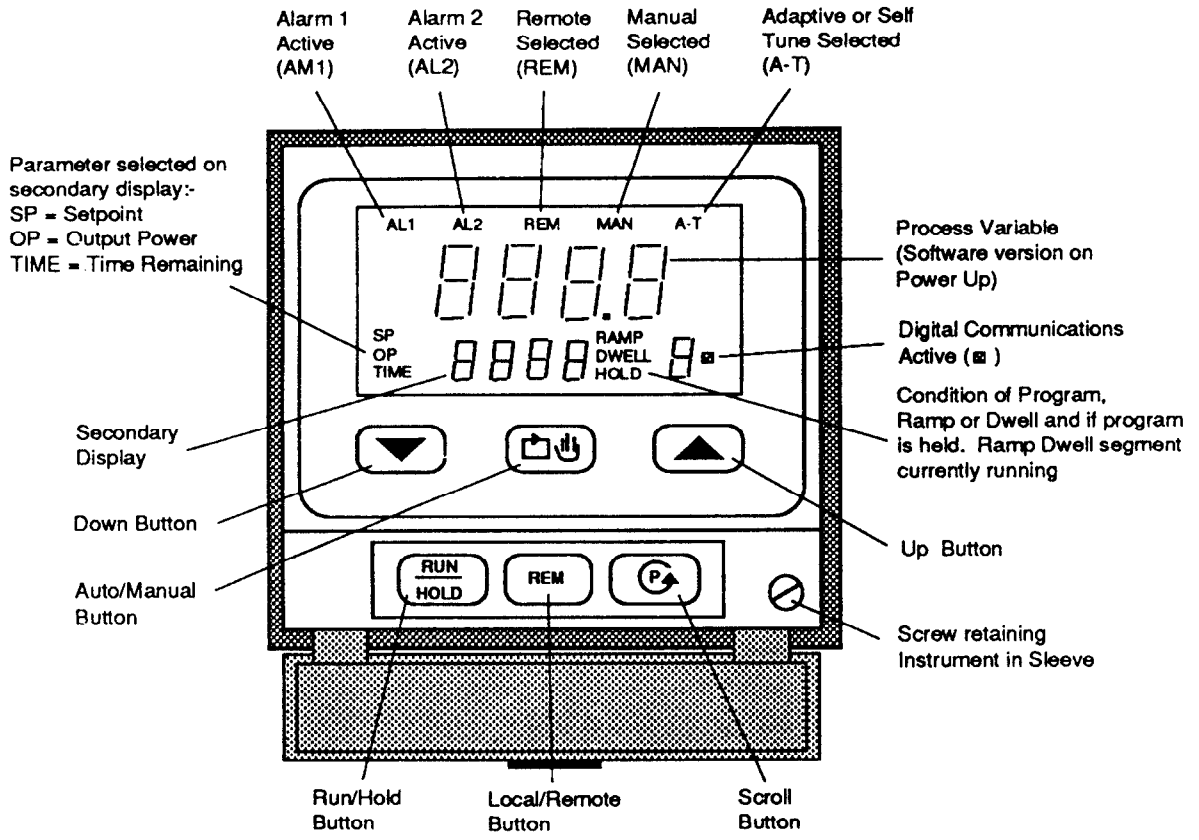
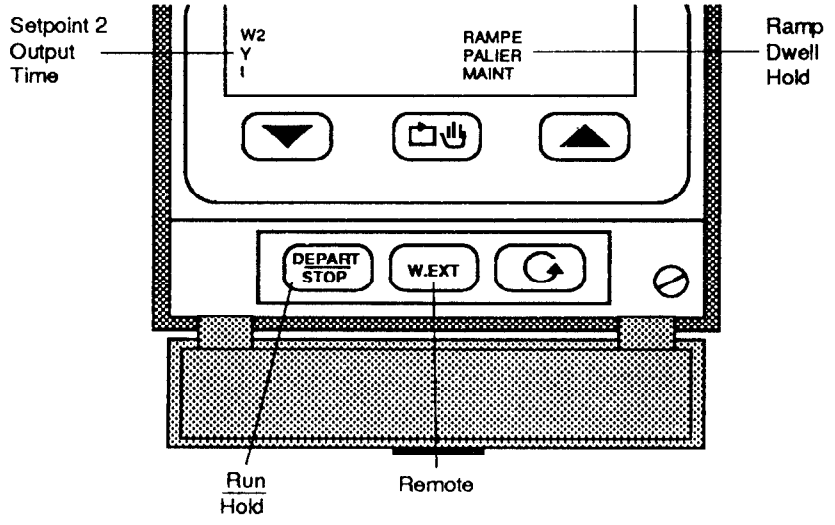
818 CONTROLS & INDICATIONS



FRENCH DISPLAY



Section 1.0 - Introduction and General Operation

The 818 controller is a flexible instrument, accepting a wide range of plug-in modules for communication, alarms and outputs. A vast range of facilities may be configured in software.

The instrument is provided in one of the following models:-

818S	-	Standard controller with manually adjusted setpoint and analogue or digital communications.
818VP	-	Motor Valve Positioning controller.
818P	-	Programmed setpoint version with up to 8 ramp / dwell combinations.
818P4	-	Multiprogrammed programmer with either 4 or
818P15	-	15 programmes of up to 8 ramp / dwell combinations.

Outputs:
Models may have one or two output channels for controlling measured values approaching setpoint from above or below setpoint . eg heat / cool. Alternatively the 818VP uses a raise / lower action to control motorised valves.

Inputs:
A large number of input linearisations are programmed into the instrument including thermocouples, resistance thermometer and certain radiation pyrometers, including emissivity adjustment. Linear d.c. inputs above 50mV require an atenuator and current inputs require a shunt across the rear input terminals.

All instrument features (Tune, Manual, Remote, Programme, Ramp etc) will need to be configured to operate. See section 3.0.
Full configuration details are available by applying for an 818 engineering book, HA021452 through your local Eurotherm sales office or engineer. See the rear cover of this booklet.

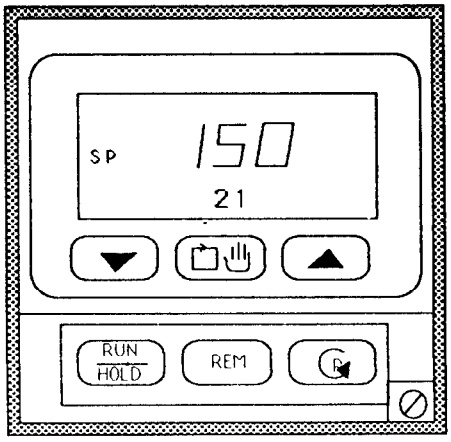
1.1 Software Versions

When switched on the controller momentarily shows the installed software version number. The upper display then displays the current value of the process variable.

Note: 'Or' in the upper display indicates the process variable is out of range. eg open circuit sensor or zero input on an elevated range.
Or' in the lower display indicates an out of range condition for the second input. e.g. remote setpoint or pot position.

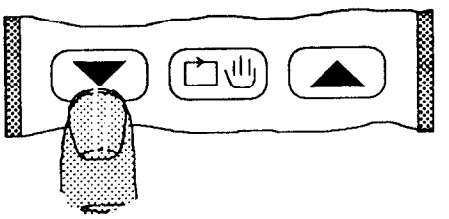
1.2 Setpoint Changes

On switch on the lower display shows either SP or OP depending on display at switch off.



This may be adjusted, using the '△' or '▽' buttons.
Short presses step the setpoint by single units.
long presses accelerate the display for large changes.

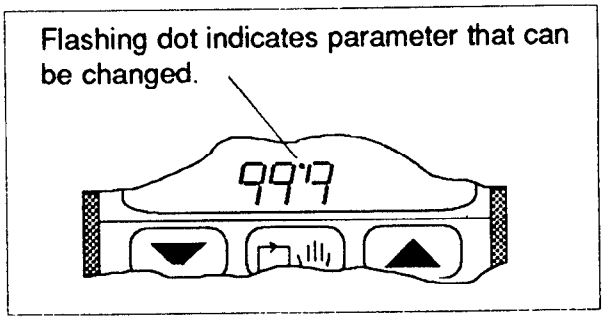
CHANGING VALUES



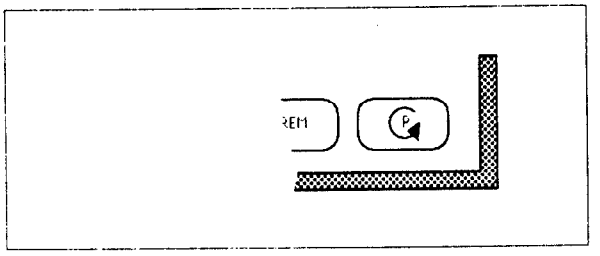
Keep button depressed until close to final value then depress and release button rapidly until final value is displayed.

The flashing dot indicates that the setpoint being displayed can be changed.

Note: The setpoint can be varied (within the setpoint limits) only if neither keylock nor parameter security switch are set.



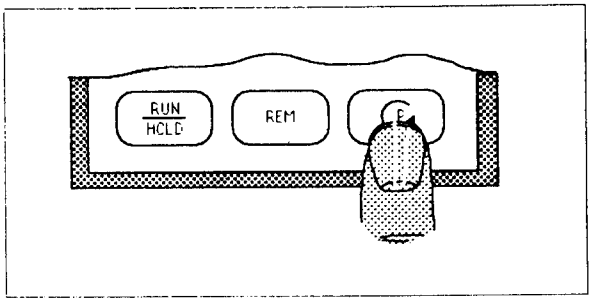
1.3 Scroll Button



1.4 Short Scroll

Short presses of this button will scroll the lower display between setpoint and output power.

Note 1: In ramp, or programmer versions there may be a third parameter 'TIME', the time remaining in that segment.



Note 2: In valve positioner versions scrolling to output the potentiometer position will be displayed in % (if the position potentiometer option is fitted).

Valve positioner output activity is indicated by '⌐¬' (up) and '└┘' (down) symbols.

1.5 Long Scroll

Holding the scroll button depressed causes the lower display to scroll through the short scroll (see section 1.4) and then proceed into the long scroll. The long scroll contains the following sections if configured ;-

i) Programmer/Ramp values

ii) All setpoints

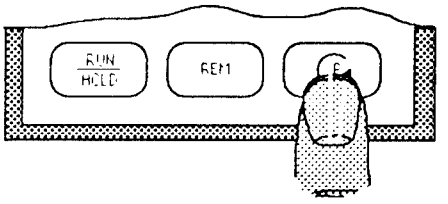
iii) Self & Adaptive Tune selection

iv) Alarm settings

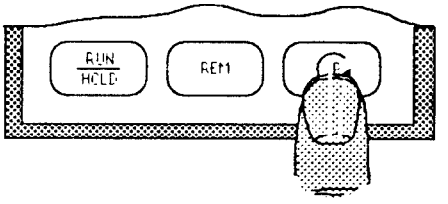
v) P.I.D. commissioning values

For full details of the long scroll list see section 2.0.

ADJUSTING COMMISSIONING VALUES

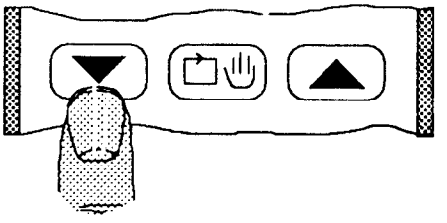


Hold the button depressed while the short scroll is displayed.



As soon as the first mnemonic of the main scroll is displayed, release the button and depress the button repeatedly single stepping through until the desired parameter is displayed.

When the required parameter is reached its value can be displayed by pressing either the '△' or '▽' buttons.
The flashing dot indicates that the parameter can be changed.



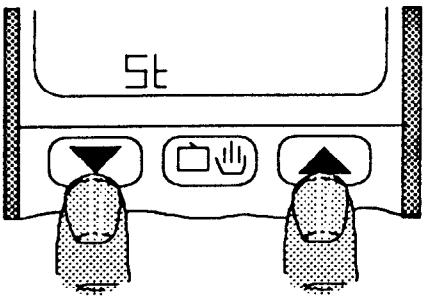
To view the value of any parameter press either the up or down buttons whilst viewing the parameter mnemonics.

1.6 Self & Adaptive Tune

These are selected by using the long scroll to reach the required mnemonics; -
St for Self Tune
At for Adaptive Tune
SAt for Self & Adaptive Tune

See 2.2.2 for full details of using tuners.

When the required mnemonic is displayed, the function can be selected by pressing the '△' and '▽' buttons together. To de-select this function, re-scroll to the parameter and press both buttons again.



Depress both the up and down buttons together.
Note: 'St' will disengage once the self tune sequence is completed. 'At' remains engaged until de-selected by the operator.

1.7 Auto/Manual

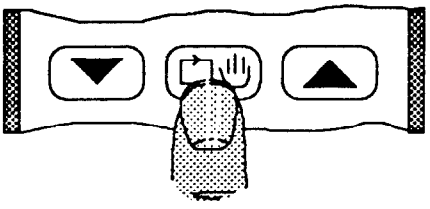
Each press of the button will toggle between auto and manual. When manual is selected the lower display is forced to indicate the output power.

For VP '⌜' raise and '⌞' lower symbols are shown in response to key press. If a feedback pot is fitted a value 0-100 gives position as a % of calibrated pot travel.

Caution: Pot limits are overidden in manual.

Note: In MANUAL the instrument is NOT controlling so ensure that the power output is set at a safe level.

AUTO-MANUAL



Each depression of this button will switch between Auto and Manual.

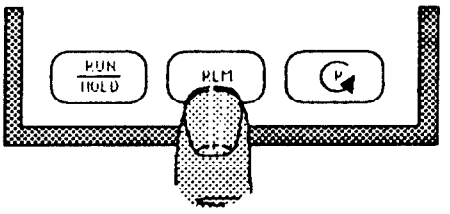
Illuminated when Manual Active

1.8 Local/Remote

Remote is selected by a single press of the remote button, REM. The next press will return the controller to local.

Note: Remote cannot be selected when a programme or ramp is operating.

REMOTE-LOCAL



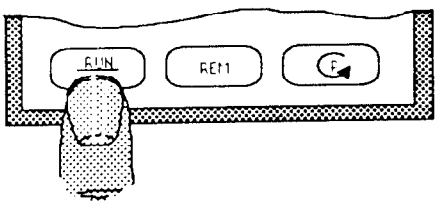
Each depression of this button will switch between Local and Remote

The legend illuminates when Remote S/P or Remote + Local Trim or Local S/P + Remote Trim is selected.

1.9 Ramps

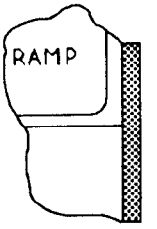
Depressing the **RUN/HOLD** button once will enable the ramp function, When a ramp is running the legend **RAMP** will be illuminated.
At the conclusion of a ramp an ,E, legend will be displayed.
The setpoint SP on the short scroll cannot be changed if **RAMP** is engaged.
To change the target setpoint, scroll to **SP1** on the long scroll.

STARTING A RAMP

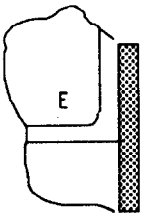


A single depession of this button will start the ramp.

For instruments configured for ramp function.

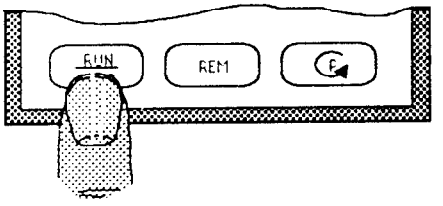


The conclusion of a running ramp will be indicated by an 'E' being displayed. It remains engaged and any further changes to the setpoint will be aproached at the ramp rate.



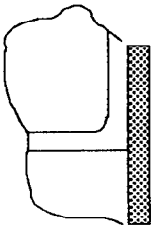
TO DISENGAGE A RUNNING RAMP

A running or completed ramp can be disengaged by depressing the RUN/HOLD button a second time. The right hand lower part of the screen will blank to indicate that this function is disabled.



Depress and release the button once.

The lower right hand corner of the display will blank.

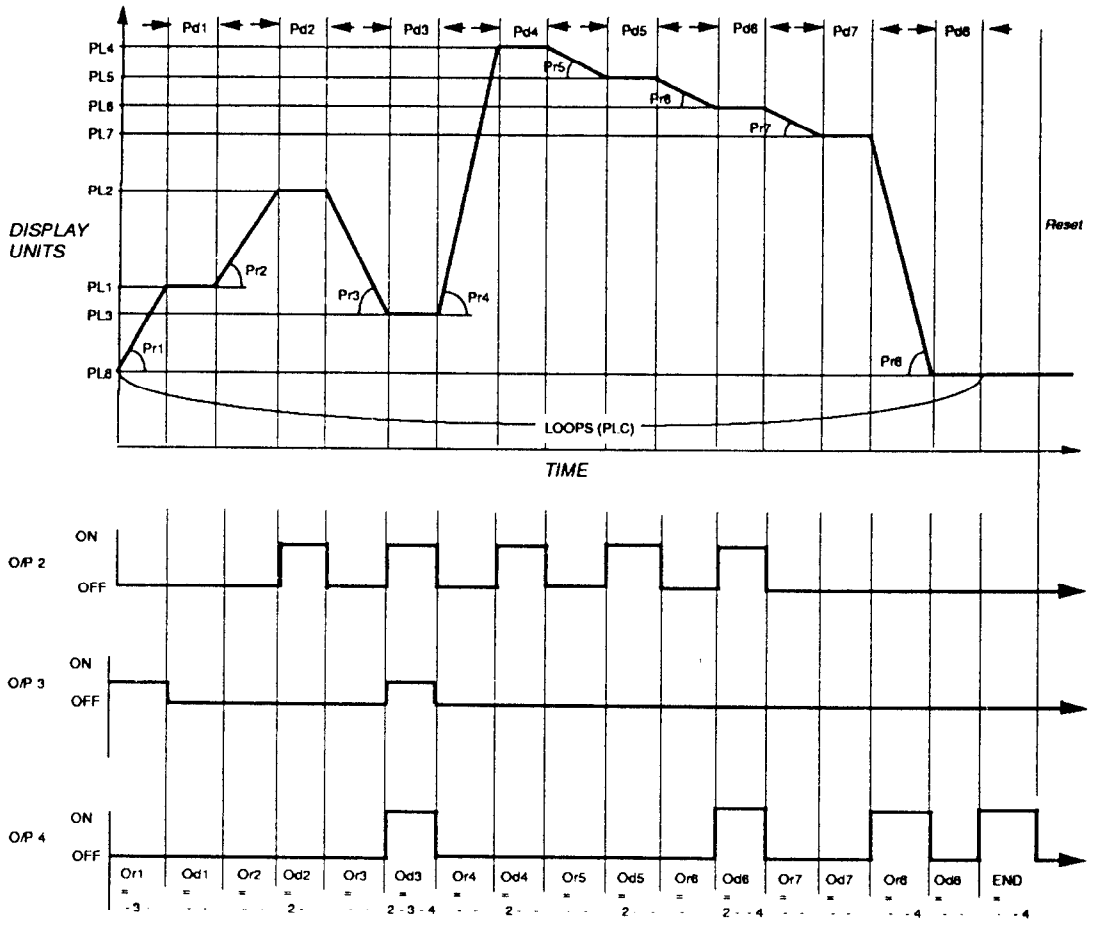


1.10 Programme Entry (Models 818P / 4 / 15)

Two levels of programming facillities exist.

The 818P consists of 8 ramp/level combinations with the ability to repeat (loop) the entered programme a maximum of 999 times as shown in the diagram below. Either or both the alarm outputs, and for heat only instruments output 2, can be switched for each segment of the programme , as shown below.

The 818P4(15) multiprogrammer may have four (or fifteen) seperate programmes of 8 ramp/level combinations with the ability to loop 999 times. Programmes may continue to the next programme allowing, effectively, a programme with upto 32 (or 120) ramp/ level combinations or continually cycle.



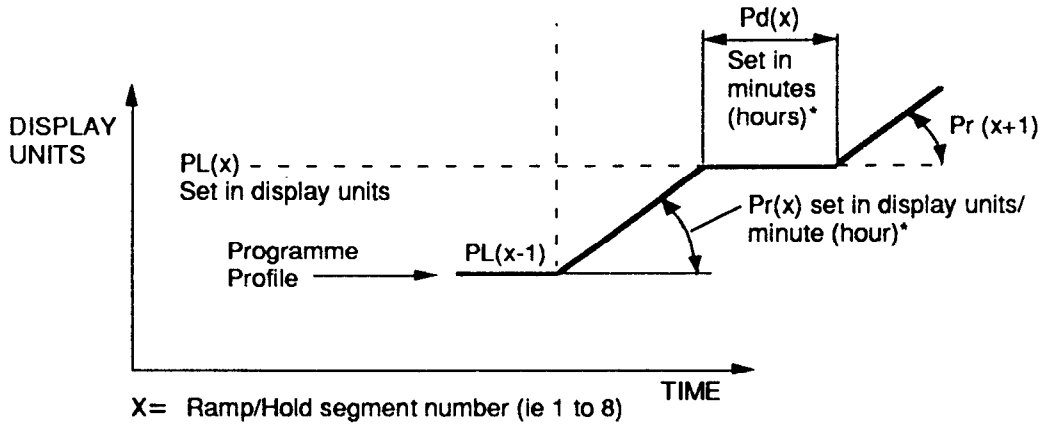
Pr (#) = RAMP rate
Pd (#) = DWELL time
PL (#) = dwell LEVEL

Option
- Or (#) = O/P for ramp
- Od (#) = O/P for dwell
- End = O/P for end

(#) Segment No.

Basic 'Programme module' (ramp/level) Entry

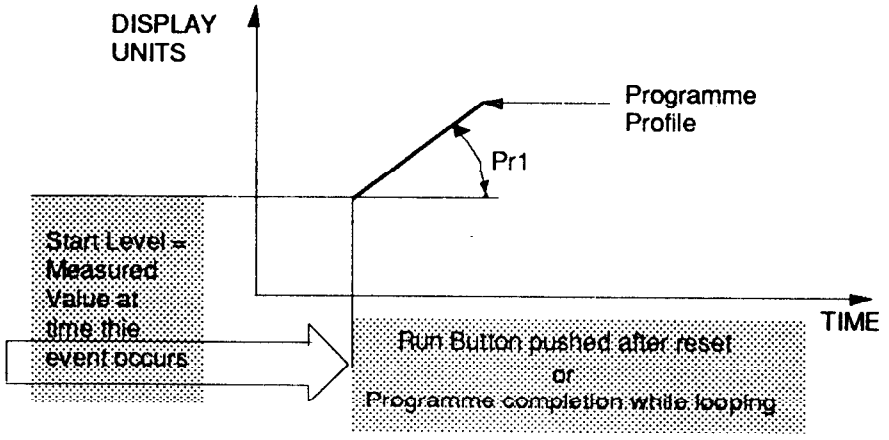
		Or(x) =	Od(x) =
Output 2 Relay	Energised	2 - -	2 - -
	De-energised	- -	- -
Output 3 (Alarm 1) Relay	Energised	- 3 -	- 3 -
	De-energised	- -	- -
Output 4 (Alarm 2) Relay	Energised	- - 4	- - 4
	De-energised	- -	- -



X= Ramp/Hold segment number (ie 1 to 8)
*= Ordering Code Dependent

Starting Level for first Ramp (Servo)

If the first ramp Pr1 is set to a ramp value and not 'StEP' the setpoint will start ramping from the measured value when the ramp/programme is run.
to start from a defined temperature set Pr1 to 'StEP' and enter 'PL1'. Use 'Pr2' to define the first ramp rate.

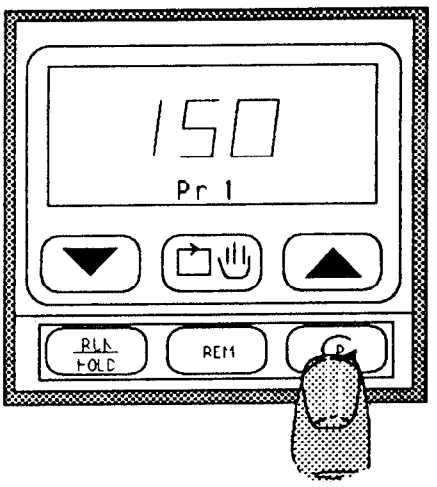


Note: Programme parameters can only be changed whilst the instrument is in the reset or hold condition and neither keylock nor the parameter security switch are set.

ENTERING RAMP RATE Pr (x)

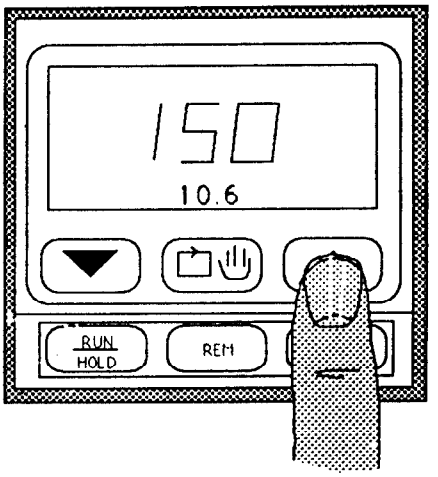
Enter the long scroll by holding the 'Ⓟ' button depressed whilst the display runs through the short scroll. Release the button as soon as the first parameter in the long scroll appears.

For 818P the first parameter is Pr1.
For 818P4 (or 818P15) the first parameter is Pnr1 (programme number).
The '△' and '▽' buttons can be used to select a programme from 1 to 4 (or 1 to 15). Pressing the 'Ⓟ' button will now cause the Pr1 parameter to appear and programming may continue as for the 818P.



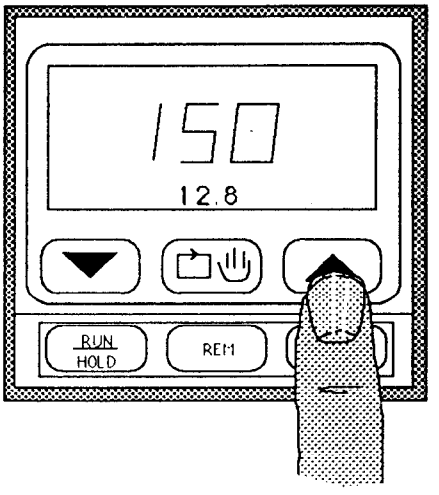
Hold the scroll button depressed until Pr1 is displayed

Press and release either the '△' or '▽' button to reveal the current value of Pr1 (Ramp 1 rate).
For example 10.6 display units per minute (hour)*.



Press and release the '△' or '▽' button to reveal current value of Pr1.

Press the '△' or '▽' buttons to adjust the ramp rate to the desired value.



Adjust the value by pressing the '△' or '▽' buttons.

* Ordering Code dependant.

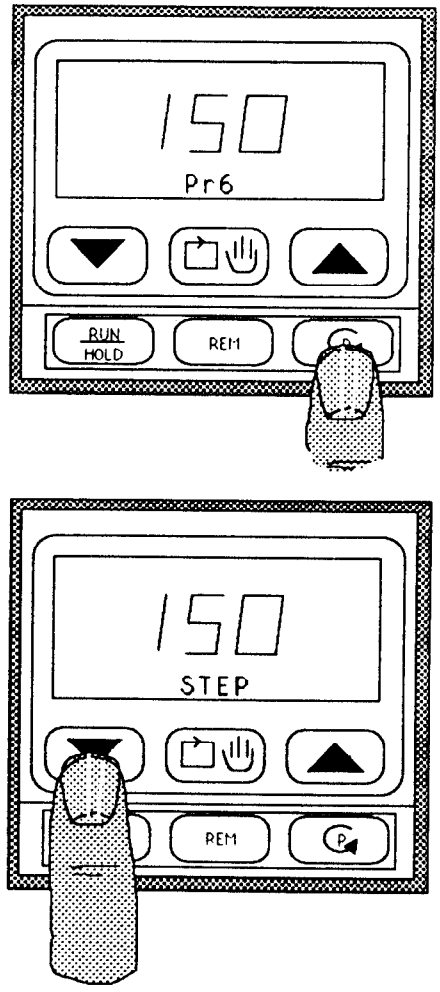
All other ramp rates, i.e. Pr 2-8, can be adjusted in a similar fashion. These can be found by pressing and releasing the 'P' button whilst in the long scroll until the relevant mnemonic is displayed.

Scrolling the value of any ramp rate down below zero will reveal three other options:

END - to terminate the programme at the end of the previous segment.

STEP - Immediate jump of setpoint from original value to the new value

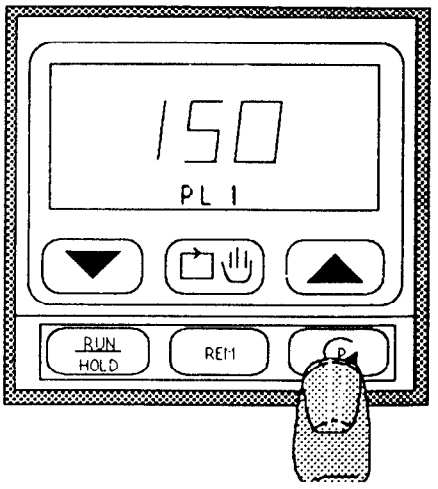
NONE - The ramp segment is omitted.



Scrolling a ramp rate (Prx) below zero gives END, STEP and NONE.

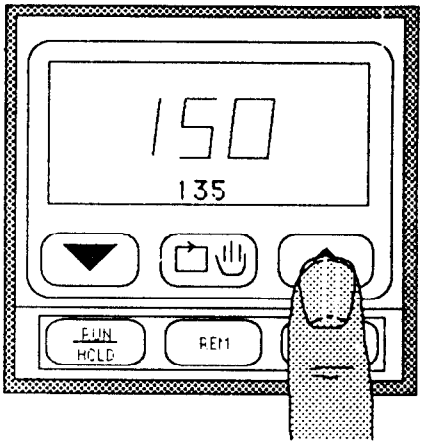
ENTERING A LEVEL PL (x)

Enter the long scroll by holding the 'P' button depressed whilst the instrument runs through the short scroll.
Then release the button as soon as the mnemonics Pr1 appears. Pressing and releasing the 'P' button again will reveal the mnemonic 'PL1' (first level) on lower display.



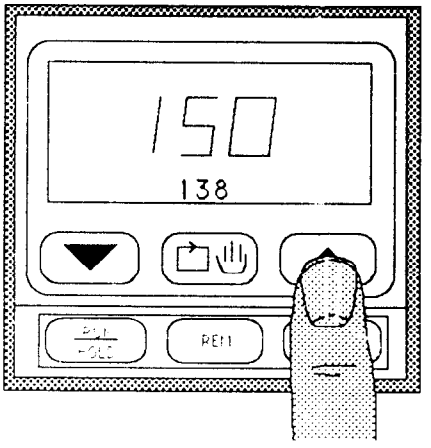
Hold the 'P' button, depressed until Pr1 is displayed then press and release the 'P' button to reveal PL1.

Press and release the '△' or '▽' button to reveal the current value of PL1. In the example 135 display units.



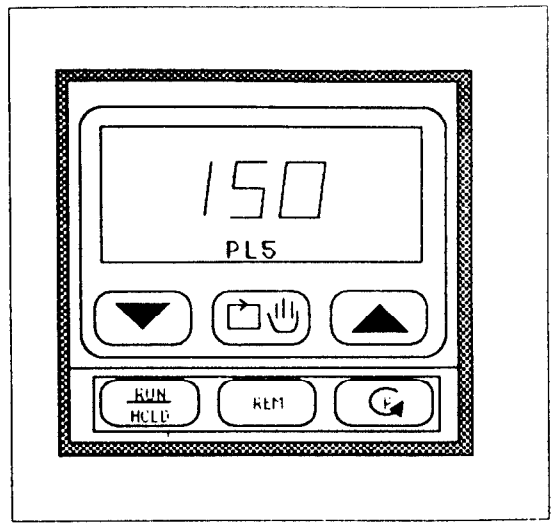
Press the '△' or '▽' button to reveal the value of PL1.

Press the '△' or '▽' buttons to adjust the level to the desired value.



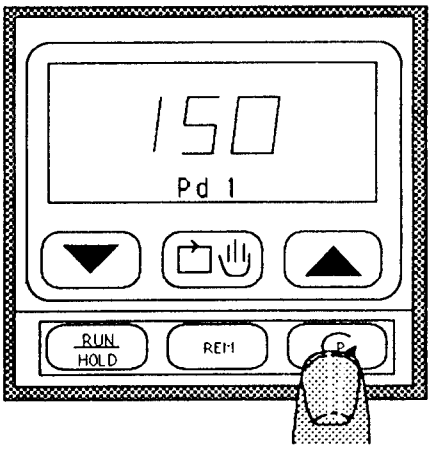
Adjust the value by pressing the '△' or '▽' button.

Other levels, i.e. PL2-8 can be adjusted in a similar fashion. These can be found by pressing and releasing the 'Ⓟ' button until the relevant mnemonic is displayed.



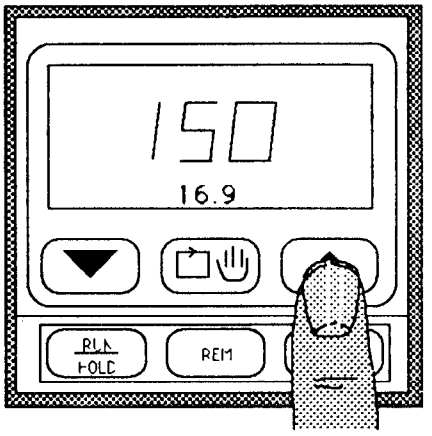
ENTERING A DWELL TIME Pd (x)

Enter the long scroll by holding the '(P)' button depressed whilst the instrument runs through the short scroll. Then release the button. This gives the mnemonic Pr1. Press and release the '(P)' button until the mnemonic Pd1 (first dwell) is lower display.



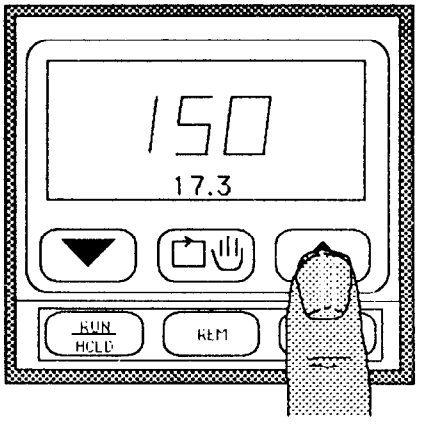
Hold the '(P)' button depressed until Pr1 is displayed. Release the button. Press and release the '(P)' button until Pd1 is displayed.

Press and release the '△' or '▽' button to reveal the current value of Pd1. In the example 16.9 minutes (hours)*.



Press and release the '△' or '▽' button to reveal the value of Pd1.

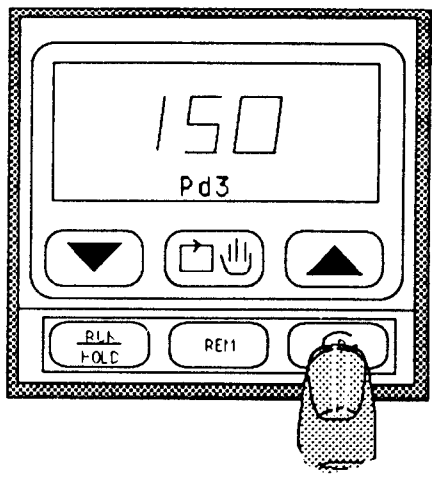
Press the '△' or '▽' buttons to adjust the time to the desired value.



Adjust the value by pressing the '△' or '▽' button.

*Ordering Code dependant

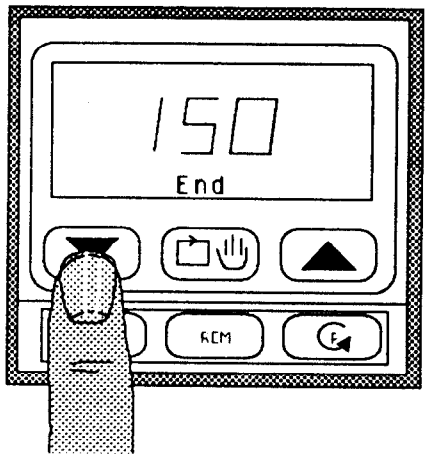
Other dwell times, i.e. Pd 2-8 can be adjusted in a similar fashion. These can be found by pressing and releasing the 'Ⓟ' button whilst in the long scroll, until the relevant mnemonic is displayed.



Press and release the 'Ⓟ' button until desired mnemonic is displayed.

Scroll the value of any time down to below 0.0 will reveal.

END - The programme will terminate at the end of the previous segment.



Scrolling a dwell time (Pdx) below zero gives END.

PROGRAMME CONTROL OF OUTPUTS

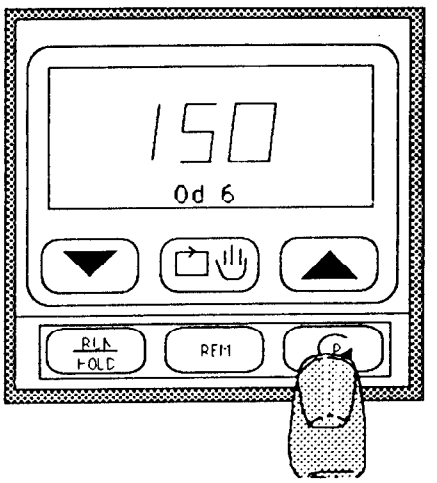
Note: The outputs can be changed whilst the programme is running.

Enter the long scroll by holding the 'Ⓟ' button depressing whilst the instrument runs through the short scroll. Then as soon as the first long scroll parameter appears, release the button. Press and release the 'Ⓟ' button until the required mnemonic is displayed.

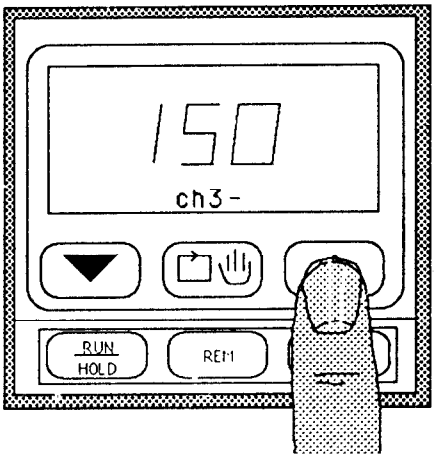
Or (x) = Output state during ramp number x

Od (x) = Output state during dwell number x

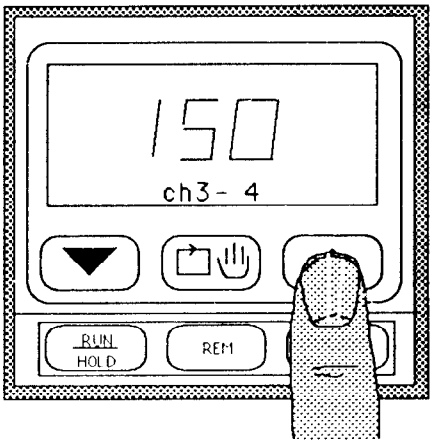
End = Relay state during end state and before reset is enabled. During reset relays are de-energised.



Press and hold the 'Ⓟ' button to enter long scroll. Press and release the 'Ⓟ' button until required mnemonic is displayed.



Press and release the '△' or '▽' buttons to reveal the current value.



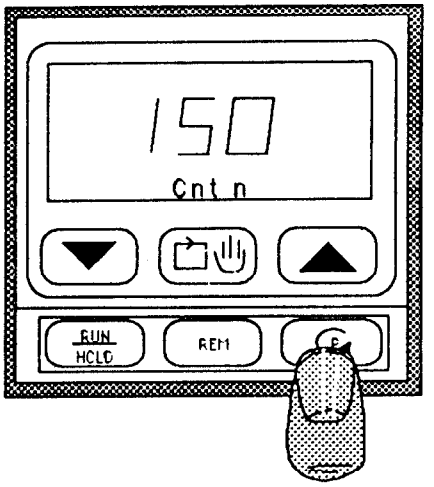
Adjust the value by pressing the '△' or '▽' button.

Press and release either the '△' or '▽' button to reveal the current state of the output relays in that segment of the programme. In the example this would be in segment dwell 6.

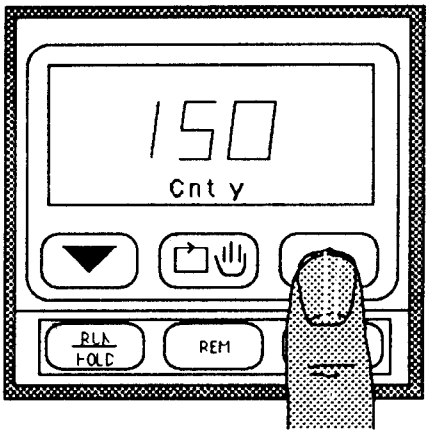
Repeatedly press and release either the '△' or '▽' buttons to reset the condition of the output relays as:-

Outputs				
-	-			all outputs denergised
2	-		-	output 2 energised
2	-	3	-	outputs 2 and 3 energised
-			4	output 4 energised
2	-		4	outputs 2 and 4 energised
-		3	4	outputs 3 and 4 energised
2	-	3	4	outputs 2,3 and 4 energised

Linking Programmes (Models 818P4 and 818P15 only)
Enter the mains scroll by holding the 'Ⓟ' buttons depressed whilst the instrument runs through the short scroll, then release the button.
Press and release the 'Ⓟ' button, single stepping through the mnemonics until 'Cnt n' is displayed.



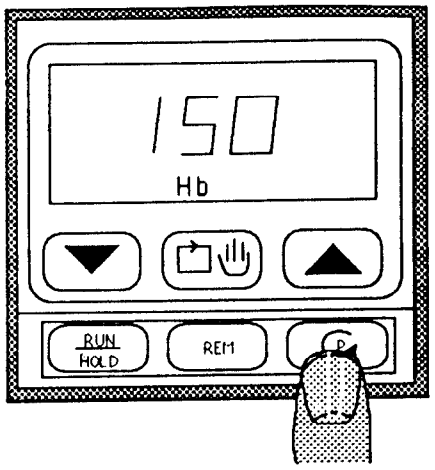
Press and release the '△' and '▽' buttons to toggle between 'Cnt y' (continue) and 'Cnt n' (no continue).



The effect of selecting 'Cnt y' is to continue the programme to the next programme number. i.e. If at the end of programme number 3 we select 'Cnt y' when programme 3 is complete, programme 4 will run automatically.
Setting continue at the end of programme 4 will initiate the start of programme 1.
Each programme will complete the selected number of loops before continuing; (see later).

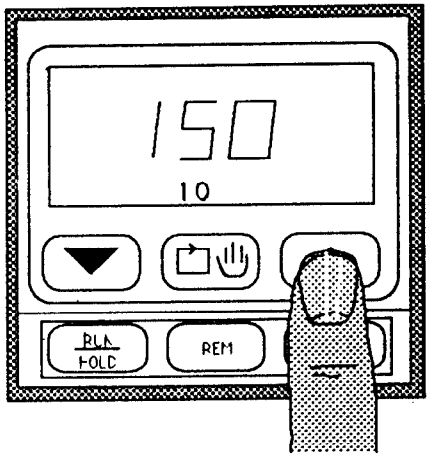
SETTING HOLDBACK (Hb)

To prevent a programme continuing if the measured value falls too far below or rises above the programme or ramp setpoint, holdback may be configured to operate for deviation high, low or band.
If the hold back feature has been configured it is set by the following procedure:
Enter the main scroll by holding the 'Ⓟ' button depressed whilst the instrument runs through the short scroll. Then release the button. Press and release the 'Ⓟ' button, single stepping through the mnemonic until Hb is displayed.



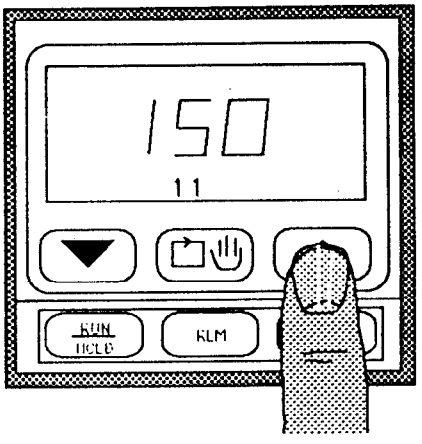
Press and hold the 'Ⓟ' button until Pr1 is revealed. Press and release the 'Ⓟ' button until Hb is displayed.

Press and release the '△' or '▽' buttons to reveal the current value of holdback.



Press and release either the '△' or '▽' button.

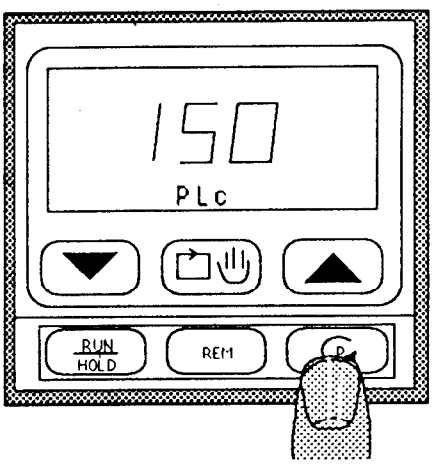
Press either the '△' or the '▽' buttons to adjust the value of holdback which is in display units.



Adjust the value by pressing the '△' or ▽ button.

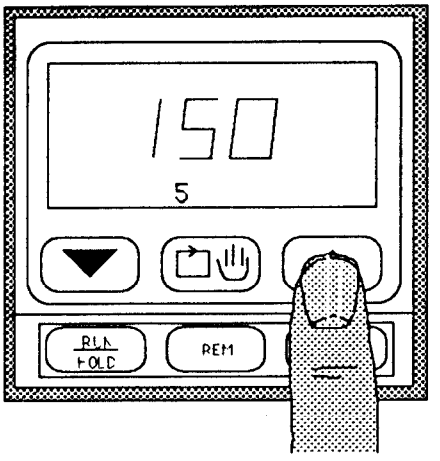
SETTING LOOP COUNT (PLC)

Enter the main scroll by holding the 'P' button depressed whilst the instrument runs through the short scroll. Then release the button. Press and release the 'P' button, single stepping through the mnemonics until PLc is displayed.



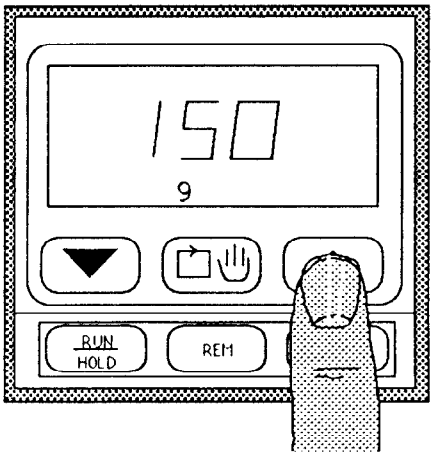
Press and hold the 'P' button until Prl is revealed. Press and release the 'P' button until PLc is displayed.

Press and release the '△' or '▽' buttons to reveal the current setting of loop count PLc.



Press and release the '△' or '▽' button to reveal the current value.

Press either the '△' or '▽' buttons to adjust the loop count value.



Adjust the value by pressing the '△' or '▽' button.

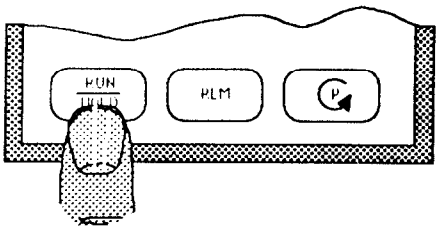
1.11 Running Programmes (Models 818P / 4 / 15)

Depressing the RUN/HOLD button once will start the programme.

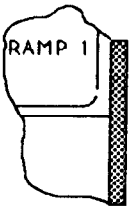
As soon as a programme starts the legend RAMP 1 will be illuminated. This legend will change as the programmeme progresses:
RAMP 1
DWELL 1
RAMP 2
DWELL 2
RAMP 3 etc.
At the conclusion of a programme an 'E' legend will be displayed.

A programme may be started by pressing the RUN/HOLD button when the 'E' legend is being displayed.

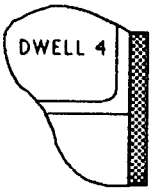
STARTING A PROGRAMME



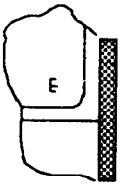
A single depression of this button will start the programme.



For 818P instruments configured for Programme functions.



While the programme is running the current segment number and type is displayed.



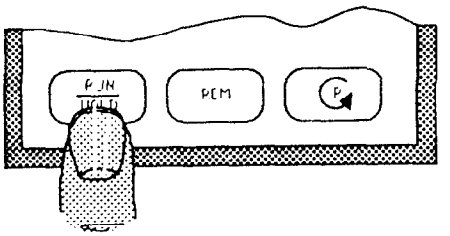
The conclusion of a running programme will be indicated by an 'E' being displayed.

HOLDING A RUNNING PROGRAMME

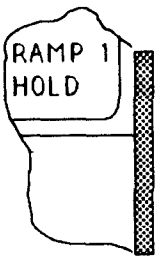
Depessing the Run/Hold button a second time, while the programme is running, will cause the programme to be held. This will be indicated by the 'HOLD' legend being illuminated.

A further depression of this button will cause the programme to continue running.

Note: The programme will automatically be placed into hold, if the holdback feature becomes active.
If configured this feature is activated should the process deviate too far from setpoint. Either the 'RAMP' or 'DWELL' legend will flash when holdback is active.



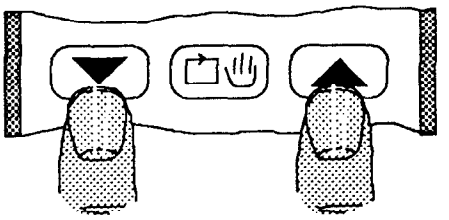
On models 818P/4/15 models configured as a programmer a single depression of this button will enable hold. Further depressions of this button will switch the HOLD 'OFF' and 'ON'.



TO RESET A RUNNING PROGRAMME

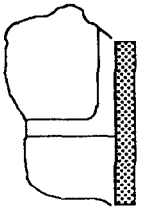
A running or completed programme can be reset by depessing the '△' and '▽' buttons together.
The reset condition will be indicated by the bottom right hand corner of the screen blanking.
Under these conditions the controller will be running on either setpoint 1 or 2 or remote.

Note : Ensure SP1 or SP2 is set to a safe level before resetting the programme.



Depress both the up and down buttons together.

The lower right hand corner of the display will blank.



1.12 Alarms

Outputs 3 and 4 may be configured as full scale high , full scale low or deviation alarms. Full scale alarms are activated when the measured value goes either higher or lower than the alarm setting. Deviation alarms are activated when the measured value exceeds a deviation band above and below setpoint. In alarm the indicators AL1 and AL2 flash.

If no relays are fitted the AL1 and AL2 indicators on the display will still flash if the alarm limits are exceeded. (Soft alarms).

Alarm hysteresis can be set from 0.1 to 10%.

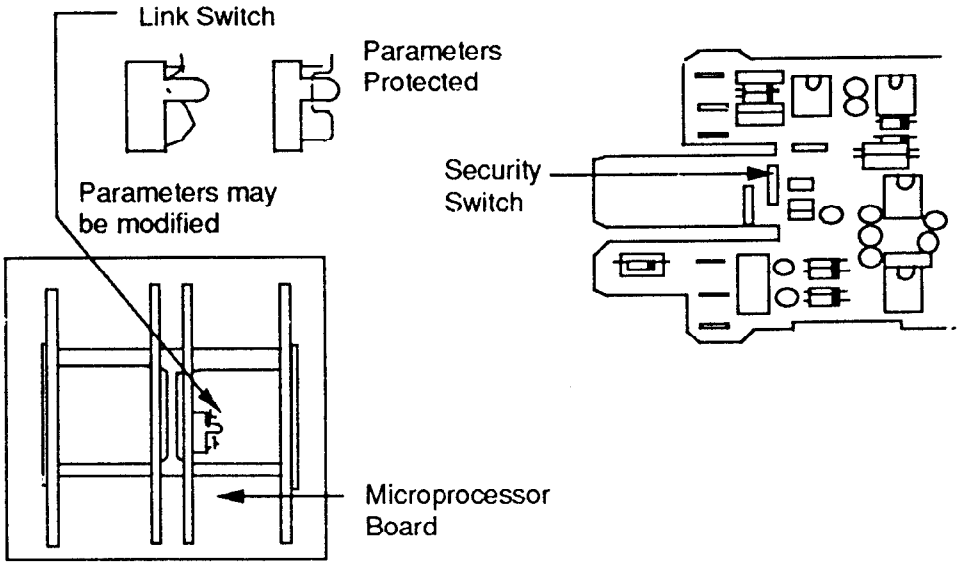
For 818P models outputs 2, 3 and 4 may alternatively be configured to be controlled during each segment of the programme.

1.13 Security

There are three forms of security available on this instrument to prevent its unauthorised use.

a) Keylock enabled by either digital input or digital communications

b) Parameter modification enabled by Security Switch or digital input



Parameter Modification Enable Switch

By operation of a switch on the microprocessor board (see diagram) the adjustment of certain parameters can be disabled. as selected in configuration. (see section 3.0) (see also 818 Engineers book).

c) Parameter Disabled some of the instruments functions can be disabled completely or made available as digital input only within the configuration. The functions that can be inhabited in this way are;-

Auto/Manual
Remote/Local
Run/Hold
Reset
Self Tune
Adaptive Tune
setpoint 2
Ramp

For more information, refer to the 818 engineers book.

Section 2.0 - Commissioning

2.1 Factory Default Values

The instrument leaves the factory with commissioning values installed suitable for many typical applications.

Table 1 Factory setting of commissioning values in a P.I.D. controller

Parameter	Mnemonic on Secondary Display	Factory Set Value	Customer Changes to Factory Setting
Setpoint	SP	25°C	
Output	OP	-	
Ramp Function Rate	Pr	Max	
Output for Ramp	Or	ch -	
Output for End	END	ch -	
Main Setpoint (internal)	SP1	25°C	
Second Setpoint	SP2	25°C	
Local Setpoint	LSP	Mid-span	
Remote Setpoint	rSP	-	
Self Tune	St	Disabled	
Adaptive Tune	At	Disabled	
Self + Adaptive tune	SAt	Disabled	
Adap' Tune Trig'r Point	Atr		
Alarm 1	AL1	Dev = 1	
Alarm 2	AL2	Full scale High = display max. Full scale Low = display min	
Proportional Band	Pb	5.0%	
Integral time	ti	300 secs	
Manual reset	rES	0%	
Derivative time	td	60 secs	
Propband (2)	Pb2	0%	
Integral time (2)	ti2	300	
Manual reset (2)	rES2		
Derivative time (2)	td2		
Relative Cool Gain (2)	Cr2		
Cutback low	cbl	Off	
Cutback high	cbh	Off	
Output 1 limit	Hl	100%	
Remote output limit (Applicable to output 1)	RL		
Output 1 cycle time	Hc	10.0 secs	
Relative cool	Cr	1.0	
Output 2 limit	CL	0 or -100%	
Remote Output limit (Applicable to output 2)	RL		
Output 2 cycle time	Cc	10.0 secs	
Output 1 cycle time 2 (Output 2 hardware driven from output 1)	Hc2	10.0 secs	
Output 1/2 deadband	db	0	
Emissivity	ES	1.00 for PYR 0.00 for others	
Sensor break power	Sbr	0%	

Parameters in ***italics*** are only included in listing if applicable

Table 2 Factory setting of additional commissioning values applicable to a valve positioner (see table 1).

Parameter	Mnemonic	Factory Value	Customer
Proportional band	Pb	10%	
Integral time	ti	300 secs	
Manual reset	rES	0%	
Derivative time	td	60 secs	
Travel time	tt	60 secs	
Travel time down	ttd	60 secs	
Minimum on time	ot	0.1 sec	
Valve update time	Ut	0.1 sec	
Cutback low	cbl	off	
Cutback high	cbh	off	
Pot min. limit	PL	0%	
Pot max. limit	Ph	100%	

Parameters in ***italics*** are only included in listing if applicable

You are advised to record any change made to the factory setting above.
In the unlikely event of the instrument being returned to a service centre for repairs it can be then sent back reset to its required values.

2.2 PID Controller

On loops where these values are not suitable, identified by the measured value oscillating or recovering sluggishly from a disturbance, the commissioning values will have to be modified by one of the three following methods:-

1) Self Tune
2) Adaptive Tune
3) Manual Tune

2.2.1 Self Tune

Note: Self-Tune is sometimes known as Auto Tune.
The self-tuner is one-shot algorithm which automatically tunes the instrument control parameters to suit new process loop conditions.

Note: During self tune the controller will apply either full heat power or zero power or, if fitted full cool power during this sequence. Tuning at reduced power is possible by reducing 'HL' and/or 'CL' to the power required.

For best results:-

a) The process value should be steady before commencing self tune.
b) Use the usual start up situation

Tuning with derivative or integral initially turned off will result in a PI or PD control after self tune.
Self tune is initiated, by scrolling through to 'St' on the lower display and then simultaneously pressing both the raise and lower buttons.
The 'A-T' indicator is then illuminated, and the lower display indicates the setpoint at which the self tune sequence will occur.

After selection the **'SP'** indicator will flash for 1 minute during which time the setpoint may be changed, if it is required to retune at a new setpoint either above or below the process value indicated on the upper display.
At the end of the minute the **'SP'** indicator will stop flashing, indicating that the setpoint can no longer be changed. The **'A-T'** indicator will start flashing and continue to flash until the self-tune has completed.
On completion the following parameters will be automatically adjusted.

Parameters modified by the Self Tune Routine

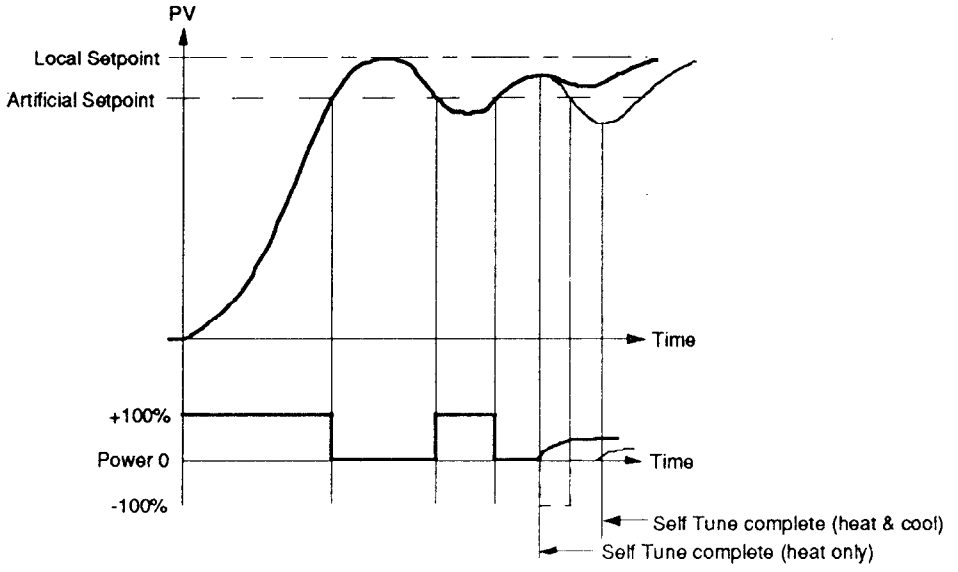
Parameter	Mnemonic
Proportional Band	Pb
Integral time	ti
Derivative time	td
Cutback low	cb l*
Cutback high	cbh *
Heat Cycle time	Hc **
Cool Cycle time	Cc **
Relative Cool Gain	Cr **

* Only one of these parameters is modified by this routine and then only if the measured value was more than 5% of span away from the setpoint at the commencement of the self tune routine. If the measured value was initiallylower than setpoint, cbl is modified, and if higher cbh is modified.

** All or some of these parameters may be missing from the commissioning list, in which case they will not be set by this routine.

Note: Whilst self tune is active the above parameters cannot be altered. Once the self tune sequence is completed the flashing 'A-T' legend turns off.

Typical Self Tune Sequence



For more information on self tune ask for the 818 engineers book.

2.2.2 Adaptive Tune

Adaptive tune is a background algorithm which continuously monitors the error signal (PV-SP) and analyses the loop response during process disturbances.
If the algorithm recognises an oscillatory or under damped response it then recalculates the P, I and D parameters.

The value of error signal required to activate adaptive tune is called Adaptive Tune trigger point (**Atr**). This point is set automatically by the controller but may be manually readjusted in the range 0.1 to 25% of span. (minimum of 1°C on temperature ranges).
Adaptive tune should be used in the following cases:-

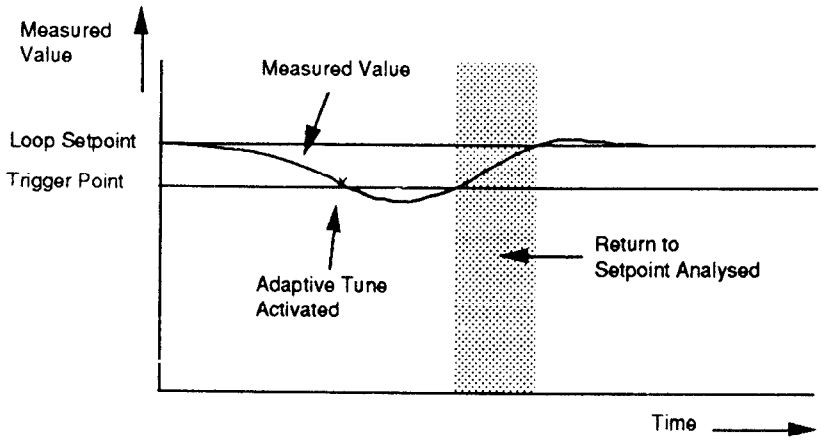
1) Processes that require frequent parameter variations as a result of load, setpoint or other changing conditions.
2) Process that cannot tolerate the on/off sequence required for the self tune

Adaptive tune should not be used in the following cases:-

1) On processes that experience regular external disturbances that could mislead adaptive tune.
2) On highly interactive multiloop applications. However; moderately interactive loops such as multi zone extruders should give no problem.

Adaptive tune is initiated by scrolling through to '**At**' on the lower display and then simultaneously pressing both the raise and lower buttons.
The 'A-T' indicator will illuminate and will remain illuminated until adaptive-tune is switched off by again scrolling through to '**At**' on the lower display and repeating the dual button press.

Typical Adaptive Tune Sequence



Whilst adaptive tune is selected the Pb, ti and td parameters cannot be changed manually.
For more information on adaptive tune ask for the 818 Engineers book.

2.2.3 Self and Adaptive Tune

This is selected by using the mnemonic '**SAt**' on the lower display which starts the controller off in self tune mode and when complete automatically initialises adaptive tune. This is indicated on the front of the controller by the 'A-T' indication changing from flashing during self tune to steady illumination during adaptive tune.

2.2.4 Manual Tune

The loop parameters can be set manually using the Ziegler-Nichols method.
At normal running temperatures with the **'ti'** and **'td'** switched off, the proportional band (**Pb**) should be reduced until the system just goes unstable. This is best observed by looking at the output power.
The values required to give stable control can be calculated using the value of *proportional band that just made the system unstable (XP1)* and the period of oscillation (T) in the following table:-

FINAL CONTROL LOOP TYPE	SETPOINT OF CONTROLLER PARAMETERS FOR CRITICAL DAMPING		
	PROPORTIONAL BAND (Pb)	INTEGRAL TIME CONSTANT (ti)	DERIVATIVE TIME CONSTANT (td)
P PROPORTIONAL ONLY	2.XP1	-	-
P+I PROPORTIONAL PLUS INTEGRAL	2.2XP1	0.8T	-
P.I.D. THREE TERM	1.67XP1	0.5T	0.12T

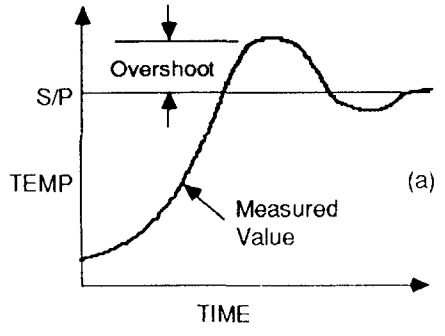
Controller parameters calculated by the Ziegler-Nicholls method

CUTBACK

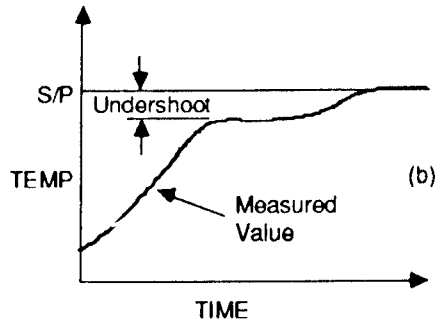
The above method sets the control parameters for optimum steady state control.
Two extra parameters **'cbl'** and **'cbh'** are used to control the overshoot and undershoot that normally occurs when the measured value approaches setpoint from a large offset.
If the start up conditions are not satisfactory with the parameters set as above, **'cbl'** and **'cbh'** should be set as follows.

*Set the low and high cutback values (**'cbl** and **cbh'**) to one proportional band width;*
e.g. cbl = cbh = $\frac{XP(\%)}{100}$ x instrument span

If the start up conditions produce unacceptable overshoot or undershoot **'cbl'** and **'cbh'** should be modified as follows:



In the example shown 'cbl' should be set to
(a) cbl = $\frac{Xp(\%)}{100}$ x span + overshoot



(b) cbl = $\frac{Xp(\%)}{100}$ x span - undershoot

'cbh' can be set in a similar manner for situations where the measured value approaches setpoint from above.

The cutback values are always set in engineering units. They define the point where the power starts "cutting back" from its maximum or minimum value as the process variable approaches the setpoint.

2.3 Valve Positioner Controller (Software version 4.00 or later)

The instrument leaves the factory with commissioning values installed, suitable for many typical applications, (see table 2).
On loops where these values are not suitable, identified by the measured value oscillating or recovering sluggishly from a disturbance, the commissioning values will have to be modified by one of the three following methods:-

1) Self Tune
2) Adaptive Tune
3) Manual Tune

In all cases the first step is to commission valve parameters.

2.3.1 Commissioning Valve Parameters

Measure the valve travel time, while the valve is being raised from the lower limit to its top limit, and enter this as the 'tt' parameter value. If the valve has significantly different travel times depending on the direction it is being driven, then asymmetric valve operation may be configured and the 'ttd' parameter may be set to match the 'down' travel time of the valve.
Measure, or read from the valve motor specification, the minimum on-time for a pulse to move the valve and enter the 'ot' parameter value. Minimum on-time is limited within the controller to a maximum of 10% of the travel time (tt). Larger values of 'ot' would result in oscillation due to this limiting the resolution of output position. The minimum on time should not be set lower than the minimum response time of the valve.
Set the VP update time, 'ut' to its minimum value, (0.1 sec) if a reasonable value is not known.
After tuning PID parameters 'ut' may be adjusted if excessive valve activity is noted due to process noise. The VP update time can be increased up to one quarter of the derivative time, without effecting the previous tuning. If the level of the valve activity is still higher than acceptable (this is not very likely) then the update time should be left at this value, derivative should be turned off and the instrument retuned. This will result in more sluggish PI control, with minimum valve activity. Large values of VP update time decrease the activity, but also increase the amplitude of hunting round setpoint.

2.3.2 Self-Tune (VP)

Self-tune (Auto-tune) can be used to tune the PID and cutback parameters as for a standard 818 PID controller, once the travel time and minimum on time have been correctly set up, (see section 2.2.1) Gross errors in setting of the travel time cannot be compensated by the auto-tuner, and will result in incorrect propband settings.
Setting the travel time too high will result in the loop gain being proportionately too high, and vice versa.

Note that output limits HL and CL are not available to VP applications, however pot limits Ph and PL are available to limit valve operation.

After tuning, check the control performance and the amount of activity of the valve.
Typically, the auto-tuned PID values will give a derivative time of approximately half the motor travel time, when the valve dynamics are significant in the loop. If valve activity is significant trim 'ut' as described in 2.3.1.

2.3.3 Adaptive Tune (VP)

Adaptive tuning may be enabled, as the standard PID, controller, (section 2.2.2). It may be necessary to set a slightly higher value of adaptive trigger point (Atr) in order to prevent adaptive action on hunting which will occur with larger values of minimum on time or VP update time.

2.3.4 Manual Tuning (VP)

Commissioning the VP loop may be achieved manually, in which case the Zieler Nichols method described in section 2.2.4 should be used.

2.3.5 Position Potentiometer Calibration

(Model 818VP with postion potentiometer option only)
The calibration of the valve positioner potentiometer should be carried out with the instrument wired as below, to the valve motor it is going to control. Calibration is achieved in the configuration mode as follows.

1) Remove the instrument from its sleeve and close the lower of the two switches on the rear of the microprocessor board. (see paragraph 3.1)

2) Replace the instrument in its sleeve and switch 'on'.

3) The upper display will now read 'CONF' and the lower display will read 'C1'.

4) Press the scroll button repeatedly until the mnemonic 'PcL' is displayed.

5) Use the raise and lower buttons to drive the motor to the position representing the minimum valve opening required.

6) Push the manual button to enter this value.

7) Press the scroll button to index on to the mnemonic 'Pch'.

8) Use the raise and lower buttons to drive the motor to the position representing the maximum valve opening required.

9) Push the manual button to enter this value.

10) Push the scroll button again to index on to the mnemonic 'Clr'.

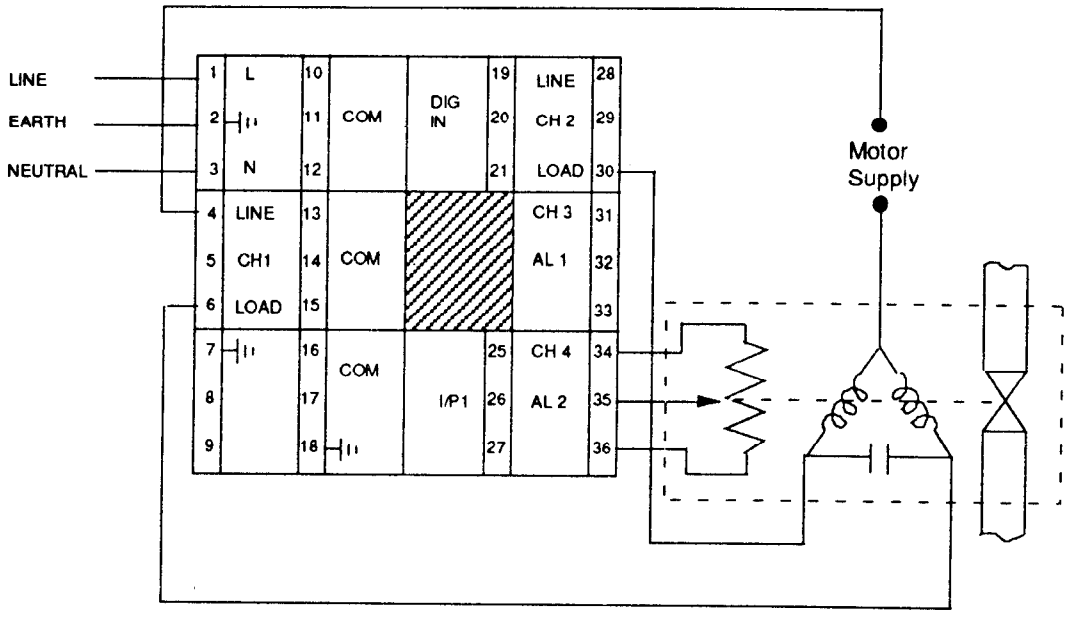
11) Press the raise and lower buttons together.

Note: Failure to carry out this part of the procedure will cause an error message to be displayed when returning to user mode.

12) Remove the instrument from its sleeve and open circuit the lower of the two switches on the rear of the micro board (See paragraph 3.1)

13) Replace the instrument into its sleeve.

This calibration procedure rescales the potentiometer, under the mnemonic 'op' making the maximum and minimum selected position now equal to 100% and 0% respectively.
In auto control the valve movement is limited to these or the potentiometer limit values if these are set closer.



Connections for PcL and Pch calibration procedure.

2.3.6 Potentiometer Limits

Calibration of potentiometer is achieved as described in 2.3.5.
Travel of the valve positioning motor may be limited by use of the parameters PL (low pot limit) and Ph (high pot limit).

The drive to output close is removed when the pot position is less than PL, and drive to output open is removed when Ph is exceeded.

Note: in the case of a faulty potentiometer pot limits are ignored. Limits are also ignored in manual.

Position pot limits must NOT therefore, be used as safety limits - this should be accomplished by adjusting the mechanical stop on the motorised valve.

The position pot limits are enabled both in automatic control mode and while tuning. These may be used to reduce the maximum valve excursion while self-tuning is active.

The limits cannot be changed while self-tune is active.

2.4 Response to Broken Sensors

Sensor break output power, (Sbr) may be set to a value between 0 and 100% (+/- 100% for heat/cool instruments). This will define the output condition in the event of an input sensor break. 'Or' is displayed in the upper display and output is set to the value defined in 'Sbr'.

Note: Input types that have potential dividers or current burden resistors will not detect broken sensor.

For 818VP sensor break output, (Sbr) may be set to a value of either 0 or 100% to define output condition in the event of an input sensor break. 'Or is displayed in the upper display. For 'Sbr' = 0 the 'lower' output will be continuously active. For 'Sbr' =100 the 'raise' output will be continuously active. (Assuming direct output action is configured). Pot limits will operate if a pot input is configured.
For a VP with position potentiometer a short or open pot will indicate 'or' in the lower display. VP control action is not affected.

Note: Max and min pot limits are ignored during position potentiometer fault.

Section 3.0 - Configuration

The 818 controller is microprocessor based and therefore most of the changes to the input, outputs, alarms and options are performed in software (configuration). Some of these software changes are also accomplished by hardware (printed circuit board or switch link) changes.

Changes to the configuration are under the security of a hardware switch. However, configuration can be read without operating the switch and whilst the instrument is still controlling. To enter the read only mode of the configuration, scroll down through the long scroll until the mnemonic 'Sbr' appears on the display. With the scroll button still depressed also depress the down button. The first of the configuration mnemonic 'C1' will appear on the lower display. To reveal the numerical value of 'C1'depress either the up or down button.

The scroll button will index through the configuration mnemonics. Use the up or down button to reveal the numerical value of any mnemonic.
Values or mnemonics in the configuration list will time out in the same way as the long scroll.
A complete list of the configuration mnemonics with their function is given below.

MNEMONIC	FUNCTION
C1	Input, CJC, units and ti+td times
C2	VP, PID or on/off, outputs and power feedback
C3	Alarm definitions
C4	Digital inputs,ADC and security definition
C5	Communications
C6	Controller options
C7	Communications type and input output
C8	Programmer options
idn	Output hardware definition
dsL	Low limit of display range
dsh	High limit of display range
SPL	Low limit of main setpoint
SPh	High limit of main setpoint
S2L	Low limit of second setpoint
S2h	High limit of second setpoint
Ah1	Alarm hysteresis AL1
Ah2	Alarm hysteresis AL2
Add	Instrument address
C1L	Low calibration of output 1 when analogue
C1h	High calibration of output 1 when anaolgue
C2L	Low calibration of output 2 when analogue
C2h	High calibration of output 2 when analogue
C3L	Low calibration of output 3 (alarm 1) when analogue retransmission.
C3h	High calibration of output 3 (alarm 1) when analogue retransmission.
r0L	Low calibration of analogue comms output
r0h	High calibration of analogue comms output
rrL	Low limit of retransmission output (Eng units)
rrh	High limit of retransmission output (Eng units)
riL	Low limit of remote analogue input (Eng units)
rih	High limit of remote analogue input (Eng units)i8*

MNEMONIC	FUNCTION
i8*	These paramenters are associated with calibration and no attempt should be made to alter them without first referring to maintenance manual HA020172
i20*	
i50*	
tr*	
cJc*	
rtL*	
rth*	
IcL*	
Ich*	
PcL*	Motor position potentiometer input calibration (VP only)
Pch*	
CLr*	Clears error flags and sets system

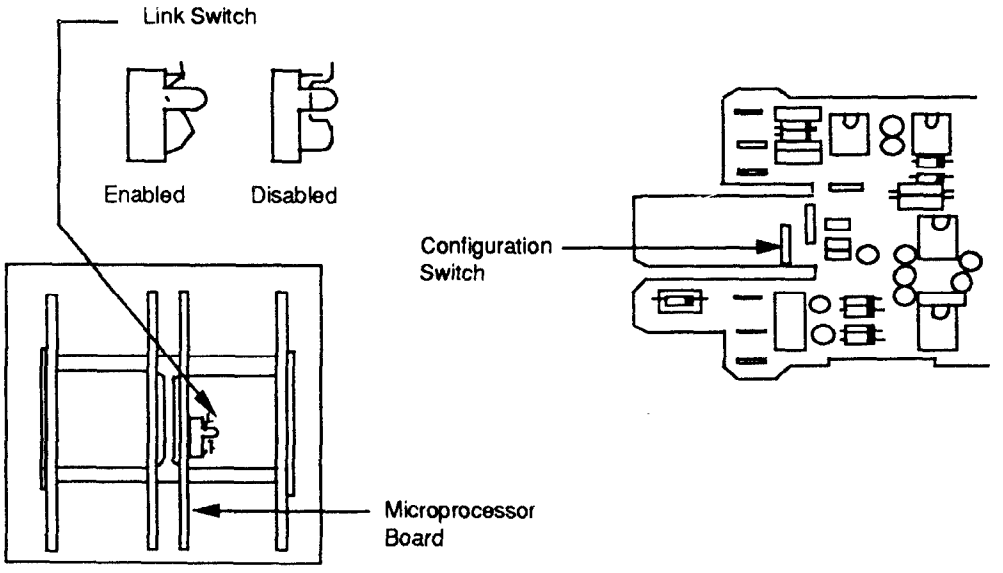
*These mnemonics above are not included in the read only configuration scroll list.

3.1 Configuration Changes (General Operating Procedure)

To change the configuration, of an instrument it is essential that this procedure is followed exactly. If in any doubt, contact your local Eurotherm engineer.

1.Switch off power to the instrument and remove it from its sleeve.

2.Enable the configuration switch as shown



Note: This operation can be simplified by using a configuration key, part no JB022111, in which case it is not necessary to remove the instrument from its sleeve, only to turn the power off while the key is being inserted.

3.Return the instrument to its sleeve and switch on the power.

Note: In this mode the instrument no longer controls, the control outputs being disabled.

4.The upper display now reads CONF and the lower display the first configuration mnemonic C1.
The up or down buttons enable the current value to be shown and it may be adjusted as required.

Note: The value of C1 to C8 appears in the form of a 4 character number referred to as 'ABCD'.
a) There is no 'time out' in this mode, the parameter will remain on the display until the scroll button is pressed again.
b) If an invalid code is entered an 'E' will be displayed and the same parameter will remain on the display for correction.
c) If one digit of a configuration word is to be changed, say C, it is essential that the other three, A, B and D are remembered as they will have to be re-entered.

5. The scroll button enables other configuration parameters to be selected and they may be adjusted as above. The RUN/HOLD button operates as a reverse scroll button but it does not auto-repeat.

6. If any output modules or communications boards have been added or changed then scroll to the parameter 'Idn' and press the up and down buttons together.

Note: This is essential to secure the new hardware arrangement in the instrument.

7. When the necessary changes have been made scroll to the last parameter 'CLr' and press both the up and down buttons together.

Note: This is essential to secure the new configuration in the instrument.

8. Switch off the instrument, remove from the sleeve and open the configuration switch. (See 2 above).

9. Replace the instrument in the sleeve and power up for normal operation.

3.2 Hardware Changes (General Operating Procedure)

1. Remove the instrument from its sleeve.

2. Place the instrument face down on a flat surface.

3. Release the catches of the board retainer by inserting a screwdriver into the slots of the square cut out on each side of the instrument.

4. Push in towards the centre of the instrument and with the board retainers depressed slide them towards the rear.

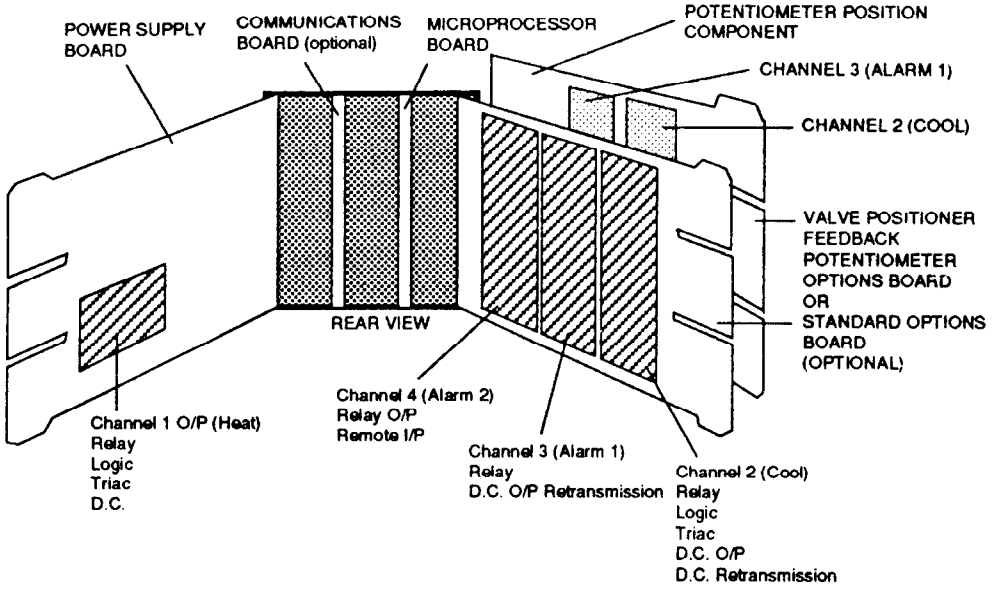
5. The side cheeks can now be removed by hinging them about the edge nearest the bezel.

6. Once released the retainer can be slid off of the rear of the printed circuit boards by hand.

Note: The retainer is handed. When reassembling the instrument ensure that the connector on the retainer aligns with the stakes on the boards.

7. The daughter board to be removed can be withdrawn by pulling away from the bezel while pushing the remaining daughter boards into the bezel.

8. The diagram below shows the location of the various output modules and the communications boards in the instrument. If any of these boards are changed it is necessary to enter configuration as described in 3.1 above, scroll to 'idn' and push the up and down buttons together. Then scroll on to the mnemonic 'CLr' and again push the up and down button together.



Note: It is possible to read what boards are fitted in an instrument by reading parameter 'Idn' as described in 3.1 above and referring to this table.
Idn='ABCD'

Digit	Function
A	Output 4 (alarm 2) or valve position potentiometer Circuit
B	Output 3 (alarm 1)
C	Output 2 (cool)
D	Output 1 (heat)

A, B, C, D will be set to the number corresponding to the output type fitted as shown in the table below.

Code Number	Function
0	none
1	relay
2	logic
3	triac
4	DC output or retransmission
5	Remote Input
6	V.P. Potentiometer input

9. To reassemble the unit carry out the above procedure in reverse, ensuring that the bright metal strip on the side cheeks are positioned at the bottom of the instrument.

3.3 Configuration Parameters

INPUTS AND UNITS (C1) = 'ABCD'

(A)	=	0	internal CJC		
	=	1	external 0°C	CAL TRIM IN µV's	**C.J.C. and Trim**
	=	2	external 45°C		
	=	3	external 50°C		
	=	4	internal CJC		
	=	5	external 0°C	CAL TRIM IN ENG UNITS	
	=	6	external 45°C		
	=	7	external 50°C		

(B)	=	0	'°C' ti and td in secs	
	=	1	'°F' ti and td in secs	
	=	2	'°K' ti and td in secs	**UNITS**
	=	3	'°C' ti and td in mins	
	=	4	'°F' ti and td in mins	
	=	5	'K' ti and td in mins	

(CD)	=	00	J	(01)	
	=	01	J DIN	(02)	
	=	02	K	(03)	
	=	03	T	(04)	
	=	04	R	(05)	
	=	05	S	(06)	
	=	06	B	(08)	
	=	07	W/W26ENG	(09)	
	=	08	W5/W26ENG	(11)	
	=	09	E	(12)	
	=	10	P10/40RHS	(23)	**INPUT**
	=	11	C	(24)	**TYPE**
	=	12	R20/40RH	(25)	
	=	13	Platinel 11	(28)	
	=	14	W/W26%Re	(29)	
	=	15	Ni/Ni8%Moly	(33)	
	=	16	W3/W25HER	(35)	
	=	17	W5/W26BOC	(38)	
	=	18	Nisil	(45)	
	=	19	DT1	(62)	
	=	20	DT1/Z1680	(63)	
	=	21	Q003	(51)	
	=	22	RO23	(64)	
	=	23	RO26 or K 35-2-3	(54)	
	=	24	Q004	(48)	
	=	25	RT100	(70)	
	=	26	linear to 8mV		
	=	27	linear to 20mV		
	=	28	linear to 50mV		
	=	29	linear to 8mV(20% offset)		
	=	30	linear to 20mV(20% offset)		
	=	31	linear to 50mV(20% offset)		
	=	32	square root	(92)	
	=	33	square root (20% offset)	(92)	
	=	34	linear - 8 to + 8mV		
	=	35	IVD1	(61)	
	=	36	FP/GP 10	(82)	
	=	37	FP/GP 11	(83)	
	=	38	FP/GP 12	(84)	
	=	39	FP/GP 20	(85)	
	=	40	FP/GP 21	(86)	*Eurotherm input code (XX)*

PID AND OUTPUTS (C2) = 'ABCD'

(A)	=	0	output 1 and output 2 separate	derivative
	=	1	output 2 equals output 1*	error driven
	=	2	output 1 and output 2 separate	derivative
	=	3	output 2 equals output 1*	PV driven

* Not available on V.P. version

(B)	=	0	no power feedback reverse acting
	=	1	power feedback reverse acting
	=	2	no power feedback direct acting
	=	3	power feedback direct acting

(C)	=	0	output 1- normal output 2- normal (PID) *output 1- raise, output 2- lower*
	=	1	output 1- normal output 2- inverted (PID) *output 1- raise, output 2- lower*
	=	2	output 1- inverted output 2- normal (PID) *output 1- lower, output 2- raise*
	=	3	output 1- inverted output 2- inverted (PID) *output 1- lower, output 2- raise*
	=	4	output 1 - raise, output 2 - lower *assymetric valve*
	=	5	output 1 - lower, output 2 raise *assymetric valve*

(D)	=	0	PID heat	no cool
	=	1	PID heat	PID cool (linear)
	=	2	PID heat	PID cool (non-linear)
	=	3	PID heat	ON/OFF cool
	=	4	ON/OFF heat	ON/OFF cool
	=	5	ON/OFF heat	no cool
	=	*6*	*valve positioner*	
	=	*7*	*valve positioner with position potentiometer*	
	=	8	PID heat	OP 2 dig out. Control via prog.

Items in italics applicable to valve positioner model only.

ALARM DEFINITION (C3) = 'ABCD'

Proportional Band

(A)	=	0	prop band in percent	Single set of commissioning values
	=	1	prop band in display units	
	=	2	prop band in percent	Dual set of commissioning values
	=	3	prop band in display units	

Commissioning value set includes; PID, Man, Reset, Rel Cool Gain and Approach

Alarm 1

(B)	=	0	no alarm 1(retransmission possible on output 3)
	=	1	DH (deviation high)
	=	2	DL (deviation low)
	=	3	DB (deviation band)
	=	4	FSH (full scale high)
	=	5	FSL (full scale low)
	=	6*	digital output (programme segment drive)
	=	7	digital output (control via comms)

* 818P/4/15 only

Alarm 2

(C)	=	0	no alarm 2 (remote input possible on channel 4)
	=	1	DH (deviation high)
	=	2	DL (deviation low)
	=	3	DB (deviation band)
	=	4	FSH (full scale high)
	=	5	FSL (full scale low)
	=	6*	digital output (programme segment drive)
	=	7	digital output (control via comms)

* 818P/4/15 only

Alarm Relay States

(D)	=	0	A1 and A2 de-energised in alarm
	=	1	A1 de-energised, A2 energised in alarm
	=	2	A1 energised, A2 de-energised in alarm
	=	3	A1 and A2 energised in alarm

DIGITAL INPUT ADC & SECURITY DEFINITION (C4) = 'ABCD'

Supply Frequency and Digital Input 2

(A) = 0 50Hz +/-2Hz supply & 60Hz +/- 0.3Hz supply (default)
= 1 60Hz +/-2Hz supply
= 2 * 50Hz +/-2Hz and dig in 2 = PID 2 / PID 1
= 3 * 60Hz +/-2Hz and dig in 2 = PID 2 / PID 1
= 4 * 50Hz +/-2Hz and dig in 2 = prog. no. monitor/step
= 5 * 60Hz +/-2Hz and dig in 2 = prog. no. monitor/step

* Digit (C) must be set to 9.

Parameter Modification Security

(B) = 0 no modification of any parameter is possible
= 1 modification of SP1, SP2 only
= 2 modification of SP1, SP2, AL1,AL2 only.
= 3 modification of SP1, SP2, and programmer or ramp rate parameters
= 4 modification of SP1,SP2,AL1, AL2 and programmer or ramp parameters
= 5 all parameters may be modified

C4(B) determines how many of the scroll parameters may be modified when the security access is selected
ie. 1) Switch on the microprocessor board is open.
2) If digital input 1 is configured, C4(D) = 7 and dig in 1 is set.

DIGITAL INPUT 2

(C) = 0 none
= 1 auto/manual
= 2 remote analogue input enable
= 3 self tune
= 4 ramp function
= 5 run/hold (programmer 818P/4/15 only)
= 6 hold/run (programmer 818P/4/15 only)
= 7 second setpoint
= 8 skip current segment
= 9 refer to digit (A)

DIGITAL INPUT 1

(D) = 0 none
= 1 auto/manual
= 2 remote analogue input enable
= 3 adaptive tune
= 4 keylock
= 5 run/reset (programmer 818P/4/15 only)
= 6 digital input 1 - up key
digital input 2 - down key (C will be ignored)
= 7 parameter modification security
= 8 skip current segment
= 9 second setpoint

In software versions previous to 4.11, C4(D) = 5 has the function reset only.

Note; if a digital comms board is fitted then Dig in 3 has the function, to release keylock after activation by dig comms.

COMMUNICATIONS (C5) = ' ABCD '

Digital Comms Speed

(A)	=	0	9600 baud
	=	1	4800 baud
	=	2	3600 baud
	=	3	2400 baud
	=	4	1200 baud
	=	5	600 baud
	=	6	300 baud

Remote Analogue Input and Second Setpoint

(B)	=	0	no remote	SP2 available
	=	1	remote + local setpoint (LSP)(front/rear)	SP2 not available
	=	2	remote + local setpoint (LSP)(rear only)	SP2 not available
	=	3	remote only(front/rear)	SP2 available
	=	4	remote only (rear only)	SP2 available
	=	5	output power limit (heat)(rear only)	SP2 available
	=	6	output power limit (cool)(rear only)	SP2 available

Sets the function of the input to the analogue communications or remote input..

Analogue Retranmission

(C)	=	0	none
	=	1	setpoint
	=	2	PV
	=	3	error
	=	4	output power
	=	5	inverted setpoint
	=	6	inverted PV
	=	7	inverted error
	=	8	inverted output power

Sets the function of the retransmission signal from either the analogue communication board or 'outputs' 2 or 3.

Remote Analogue Input Offset

(D)	=	0	analogue input without offset
	=	1	analogue input with 20% offset

CONTROLLER OPERATION (C6) = 'ABCD'

Decimal Point Position

(A)	= 0	XXXXX	pyrometer	T/C or RT	linear or square root
	= 1	XXXX.X			
	= 2	XXX.XX			
	= 3	XX.XXX			

Sets the decimal point position for both upper and lower displays

Auto Manual Selection

(B) = 0 no manual
= 1 manual front/rear
= 2 manual rear only

Setpoint Track Mode

(C) = 0 while in remote SP, hold SP1
while in manual, hold working SP
= 1 while in remote SP, hold SP1
while in manual, working SP tracks PV
= 2 while in remote SP, SP1 tracks working SP
while in manual, hold working SP
= 3 while in remote SP, SP1 track working SP
while in manual, working setpoint tracks PV

Sets the value of the working setpoint when the instrument is switched to manual and also the value of SP1 when switched to remote. These setpoints can either remain at the value manually entered (HOLD) or take the value of the working setpoint or the measured value (PV).

Communications Type

(D)	= 0	Ascii Bi-Synch communication		
	= 1	Modbus	no parity	integer only
	= 2	J-Bus	no parity	integer only
	= 3	Modbus	even parity	integer only
	= 4	J-Bus	even parity	integer only
	= 5	Modbus	no parity	full resolution
	= 6	J-Bus	no parity	full resolution
	= 7	Modbus	even parity	full resolution
	= 8	J-Bus	even parity	full resolution

COMMUNICATIONS INPUT/OUTPUT (C7) = ' ABCD'

(A) = 0 (unused)

Self and Adaptive Tune

(B) = 0 neither available
= 1 St and At available front and rear
= 2 St front and rear, At rear only
= 3 At front and rear, St rear only
= 4 St and At rear only
= 5 fast St and At available front and rear
= 6 fast St front and rear, At rear only
= 7 At front and rear, fast St rear only
= 8 fast St and At rear only

Normal tune on instruments with cool channel

Analogue Communication Retransmission type

(C) = 0 current
= 1 voltage

Communication Hardware

(D) = 0 digital
= 1 analogue

PROGRAMS AND RAMPS (C8) = 'ABCD '

(A)	=	*0*	*No Holdback*	normal resolution ramp rate
	=	1	band dev holdback	normal resolution ramp rate
	=	2	high dev holdback	normal resolution ramp rate
	=	3	low dev holdback	normal resolution ramp rate
	=	4	no holdback	high resolution ramp rate
	=	5	band dev holdback	high resolution ramp rate
	=	6	high dev holdback	high resolution ramp rate
	=	7	low dev holdback	high resolution ramp rate

Segment Times

(B)	=	*0*	*ramp in minutes*	(dwell in minutes)
	=	*1*	*ramp in hours*	(dwell in minutes)
	=	2	ramp in minutes	(dwell in hours)
	=	3	ramp in hours	(dwell in hours)

Run/Hold, Reset, Selection

(C)	=	*0*	*run/hold front/rear*	(reset front/rear)
	=	*1*	*run/hold rear only*	(reset front/rear)
	=	2	run/hold front/rear	(reset rear only)
	=	3	run/hold rear only	(reset rear only)

Controller Action

(D)	=	*0*	*no ramp or* programmer *function*	
	=	*1*	*ramp function*	
	=	2	programmer	(ramp set as a rate)
	=	3	programmer	(ramp set as time to target)
	=	4	multi programmer	(ramp set as a rate)
	=	5	muti programmer	(ramp set as time to target)

Text in italics applies to the 818S controller only.

Section 4.0 - Reference Section

4.1 Labels and Coding

Instruments are configured to the ordering code before leaving the factory. Any changes made to the configuration of the instrument should be recorded for future reference.
To establish which features are included in the instrument the ordering code on the side cover of the instrument may be interpreted using the coding chart shown.

818 Controller Coding

	Input	Output 1	Output 2	Alarm 1	Alarm 2	Comms Type	Comms Funct.	Option
818S								

Inputs

		Code
Thermocouple	(1)	TC
Resistance Thermometer	(2)	RTD
0-20mA		0mA20
4-20mA		4mA20
0-5V	(3)	0V5
1-5V		1V5
1-10V		1V10
-8mV + 8mV		8mV8
Pyrometer	(4)	PYR

Note:
In the input coding, only curves where the numbers in parenthesis match the numbers above are available.

Outputs

	Output 1 Prefix	Output 2 Prefix
Reverse Acting Control	R	
Direct Acting Control	D	
Control on Output 2 (Opposite action to output 1)		C
Retransmission of		
Process Variable		M
Setpoint		S
Error		E
Power		W

Note 1: For normal temperature control select Reverse Acting Control
Output 2 action opposite of output 1
Note 2: The Retransmission option is not available with Analogue Comms, or when retransmission specified in 1.

	Output 1	Output 2
Relay Linear	RLY	RLY
Relay Non Linear	-	RLYN
Relay ON/OFF	*RLYF	RLYF
Logic Linear	LGC	LGC
Logic Non Linear	-	LGCN
Logic ON/OFF	*LGCF	LGCF
Triac Linear	TRI	TRI
Triac Non Linear	-	TRIN
Triac ON/OFF	*TRIF	TRIF
No output	NONE	NONE
Isolated 0-5V	0V5	0V5
Isolated 0-10V	0V10	0V10
Isolated 1-5V	1V5	1V5
Isolated 2-10V	2V10	2V10
Isolated 0-10mA	0mA10	0mA10
Isolated 0-20mA	0mA20	0mA20
Isolated 4-20mA	4mA20	4mA20

Motor Valve Controller

Relay Output	VPR	
Triac Output	VPT	
With Feedback Pot		FB
Without Feedback Pot		NONE

Note: With MVC no Output 2 prefix is required.
With output 2 prefix M, S, E, W only dc outputs apply
ON/OFF on O/P1 restricts O/P2 to ON/OFF unless prefix M S E W

Alarms 1 and 2

Type	1st & 2nd Digit Code
None	NONE
Deviation Band	DB
Deviation High	DH
Deviation Low	DL
Full Scale High	FH
Full Scale Low	FL

Relay State in Alarm	3rd Digit Code
Energised	E
De-energised	D

Note: On Valve Positioner version using a Feedback Pot. (FB in output 2) Alarm 2 must be 'NONE"

Type	Code
0-20mA	0mA20
4-20mA	4mA20
0-5V	0V5
0-10V	0V10
1-5V	1V5
2-10V	2V10

Alarm 1 Retransmission	Prefix to Code
Process Variable	M
Setpoint	S
Error	E
Power	W

Alarm 2 Remote Input	Prefix to Code
Remote Setpoint	X
Remote Trim	T
Remote S/P with Local Trim	L
Maximum Output Power	W

Alarm channels can be used for analogue inputs/ outputs if not required for alarms.
Note: Only one retransmission output and one remote input is allowed within the controller.

Communications

Digital

Type	Code	Function	Code
None	NONE	None	NONE
Digital RS232	232	Baud Rate 9600	96
Digital RS485	485	Baud Rate 4800	48
J-Bus ® RS232	J32	Baud Rate 3600	36
J-Bus ® RS485	J85	Baud Rate 2400	24
M-Bus ®RS232	M32	Baud Rate 1200	12
M-Bus ®RS485	M85	Baud Rate 600	06
		Baud Rate 300	03

Analogue

	Input Type Prefix 1st Digit		Retran Function Prefix 1st Digit
Remote Setpoint	X	Process Variable	M
Remote Trim	T	Setpoint	S
Remote S/P with Local Trim	L	Error	E
Output maximum power	W	Power	W

Input Type	Code 2nd Digit Onwards	Retran Function	Code 2nd Digit Onwards
None	NONE	None	NONE
0-20mA	0mA20	0-20mA	0mA20
4-20mA	4mA20	4-20mA	4mA20
0-5V	0V5	0-5V	0V5
0-10V	0V10	0-10V	0V10
		1-5V	1V5
		2-10V	2V10
		-5 to + 5V	5V5

Option	Code
Faston Terminal	FN
Screw Terminal	SN
Faston 24V ac/dc	FN24
Screw 24V ac/dc	SN24

818 Controller Coding (continued)

Curve	Display Min	Display Max	Units	Dig I/P1	Dig I/P2	Software Options

Input Coding

Curve

Select from the range list shown below

	Notes	Recommended Min & Max ranges	Min Span	Code
Iron Constantan J	(1)	0C to 600C	100C	01
Fe/Konst (DIN)L	(1)	0C to 600C	100C	02
Ni Cr/Ni Al K	(1)	-250C to 1200C	125C	03
Cu/Con T	(1)	-250C to 400C	150C	04
Pt13%Rh/Pt R	(1)	0C to 1600C	600C	05
Pt10%Rh/PtS	(1)	0C to 1600C	600C	06
Pt30% Rh/Pt6% Rh B	(1)	200C to 1820C	1000C	08
W/W 26% Re	(1)	0C to 2300C	450C	09
W5%Re/W26%	(1)	0C to 2300C	500C	11
Ni Cr/Con E	(1)	0C to 780C	100C	12
Pt10% Rh/Pt40%Rh	(1)	200C to 1800C	1000C	23
W5% Re/W 26% Re C	(1)	0C to 2300C	500C	24
Pt20% Rh/Pt40% Rh	(1)	0 to 2000C	1900C	25
Platinel 11	(1)	0C to 1200C	150C	28
W/W 26% Re	(1)	0C to 2200C	500C	29
Ni/Ni 18% Molybdenum	(1)	0C to 1100C	600C	33
W3% Re/W 25% Re D	(1)	0C to 2400C	1000C	35
W/Re 5% W/Re 26%	(1)	0C to 2000C	1000C	38
Nicrosil/Nisil N	(1)	0C to 1300C	150C	45
Pt100 ohm at 0°C	(2)	-200C to 800C	50C	70
Pyrometer (Q004 Land)	*(4)	800C to 1550C	5mV	48
Pyrometer (Q003 Land)	*(4)	700C to 1400C	5mV	51
Pyrometer RO 26	*(4	100C to 500C	5mV	54
Pyrometer IVDI	*(4)	1000C to 2500C	5mV	61
Pyrometer DTI	*(4)	1200C to 2500C	5mV	62
Pyrometer DT1/10	*(4)	1500C to 3000C	5mV	63
Pyrometer RO 23	*(4)	800C to 1700C	5mV	64
Pyrometer FP/GP 10	*(4)	500C to 900C	5mV	82
Pyrometer FP/gp 11	*(4)	700C to 1300C	5mV	83
Pyrometer FP/GP 12	*(4)	1000C to 1850C	5mV	84
Pyrometer FP/GP 20	*(4)	400C to 750C	5mV	85
Pyrometer FP/GP 21	*(4)	500C to 1100C	5mV	86
Linear	(3)	-9000 to 19999	**	00
Square root	(3)		**	92

Display Min/Display Max

These should be selected from the recommended minimum and maximum ranges shown in Curve. Include decimal point position - This is especially important on linear range

Units

NONE
C
F
K
MV
V
MA
%

(Or specify up to 5 characters)

* Decimal points not available on these ranges.

** For linear inputs sensitivity must not be less than 5μVs/digit

Notes (1), (2), (3) and (4) refer to Inputs Box.

Digital Inputs

	Dig I/P1	Dig I/P 2
None	NO	NO
Auto Manual	AM	AM
Local Remote	LR	LR
Adaptive Tune	AT	-
Keylock	KL	-
DIG I/P 1 up key*	UK	
DIG I/P 2 down key*	-	DK
Parameter Security	PS	-
Self tune	-	ST
SP 2/ SP 1**	S2	S2
PID 2/PID 1	-	P2

These options must be selected together. If selected no other input is possible

** Not available with remote trim

Software Options

Function	Code
Manual Key Enabled	E
Manual Key Disabled	D

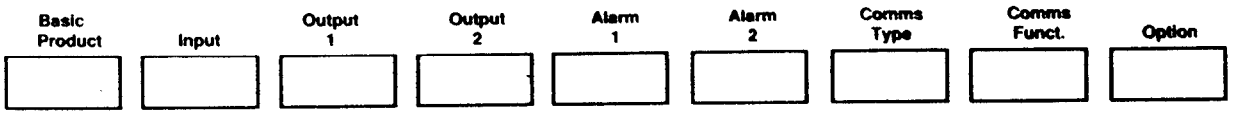
Cold Junction	Code
Non T/C Input	N
Internal Compensation	IN
External 0C Ref	0
External 45°C Ref	45
External 50°C Ref	50

Function	Code
Integral and Derivative in Secs	S
Intergral and Derivative in Mins	M
Integral and Derivative in Secs with dual PID	SS
Integral and Derivative in Mins with dual PID	MM

Function	Code
Power Feedback	P
No Power Feedback	N*

* Not available on dc or VP outputs therefore enter N.

818 Programmer Coding



Basic Product

	Code
818 Programmer	818P
818 Programmer 4	818P4
818 Programmer 15	818P15

Inputs

		Code
Thermocouple	(1)	TC
Resistance Thermometer	(2)	RTD
0-2mA		0mA20
4-20mA		4mA20
0-5V	(3)	0V5
1-5V		1V5
1-10V		0V10
-8mV + 8mV		8mV8
Pyrometer	(4)	PYR

Note:
In the input coding, only curves where the numbers in parenthesis match the numbers above are available.

Outputs

	Output 1 Prefix	Output 2 Prefix
Reverse Acting Control	R	
Direct Acting Control	D	
Control on Output 2 (Opposite action to output 1)		C
Retransmission of Process Variable		M
Setpoint		S
Error		E
Power		W
Control by programme*		PROG

Note 1: For normal temperature control select Reverse Acting Control
Output 2 action opposite of output 1

Note 2: The Retransmission option is not available with Analogue Comms, or when retransmission specified in Alarm 1.

* Not available with VP/ On/Off control

	Output 1	Output 2
Relay Linear	RLY	RLY
Relay Non Linear	-	RLYN
Relay ON/OFF	*RLYF	RLYF
Logic Linear	LGC	LGC
Logic Non Linear	-	LGCN
Logic ON/OFF	*LGCF	LGCF
Triac Linear	TRI	TRI
Triac Non Linear	-	TRIN
Triac ON/OFF	*TRIF	TRIF
No output	NONE	NONE
Isolated 0-5V	0V5	0V5
Isolated 0-10V	0V10	0V10
Isolated 1-5V	1V5	1V5
Isolated 2-10V	2V10	2V10
Isolated 0-10mA	0mA10	0mA10
Isolated 0-20mA	0mA20	0mA20
Isolated 4-20mA	4mA20	4mA20

Motor Valve Controller

Relay Output	VPR	
Triac Output	VPT	
With Feedback Pot		FB
Without Feedback Pot		NONE

Note: With MVC no Output 2 prefix is required. With output 2 prefix M, S, E, W only dc outputs apply
ON/OFF on O/P1 restricts O/P2 to ON/ OFF unless prefix M S E W

Alarms 1 and 2

Type	1st & 2nd Digit Code
None	NONE
Deviation Band	DB
Deviation High	DH
Deviation Low	DL
Full Scale High	FH
Full Scale Low	FL

Relay State in Alarm	3rd Digit Code
Energised	E
De-energised	D

Note: On Valve Positioner version using a Feedback Pot. (FB in output 2) Alarm 2 must be "NONE"

Type	Code
0-20mA	0mA20
4020mA	4mA20
0-5V	0V5
0-10V	0V10
1-5V	1V5
2-10V	2V10

Alarm 1 Retransmission	Prefix to Code
Process Variable	M
Setpoint	S
Error	E
Power	W

Alarm 2 Remote Input	Prefix to Code
Remote Setpoint	X
Remote Trim	T
Remote S/P with Local Trim	L
Maximum Output Power	W

Alarm channels can be used for analogue inputs and/or outputs if not required for alarms.
Note: Only one retransmission output and one remote input is allowed within the controller.

Communications

Digital

Type	Code	Function	Code
None	NONE	None	NONE
Digital RS232	232	Baud Rate 9600	96
Digital RS485	485	Baud Rate 4800	48
J-Bus ® RS232	J32	Baud Rate 3600	36
J-Bus ® RS485	J85	Baud Rate 2400	24
		Baud Rate 1200	12
		Baud Rate 600	06
		Baud Rate 300	03

Analogue

	Input Type Prefix 1st Digit		Retran Function Prefix 1st Digit
Remote Setpoint	X	Process Variable	M
Remote Trim	T	Setpoint	S
Remote S/P with Local Trim	L	Error	E
Output maximum power	W	Power	W

Input Type	Code 2nd Digit onwards	Retran Function	Code 2nd Digit Onwards
None	NONE	None	NONE
0-20mA	0mA20	0-2mA	0mA20
4-20mA	4mA20	4-20mA	4mA20
0-5V	0V5	0-5V	0V5
0 10V	0V10	0-10V	0V10
		1-5V	1V5
		2-10V	2V10
		-5 to + 5V	5V5

Option	Code
Faston Terminal	FN
Screw Terminal	SN
Faston 24V ac/dc	FN24
Screw 24V ac/dc	SN24

Curve	Display Min	Display Max	Units	Dig I/P1	Dig I/P2	Software Options	Ramp	Dwell	Holdback

Input Coding

Curve
Select from the range list shown below

	Notes	Recommended Min & Max ranges	Min Span	Code
Iron Constantan J	(1)	0C to 600C	100C	01
Fe/Konst (DIN)L	(1)	0C to 600C	100C	02
Ni Cr/Ni Al K	(1)	-250C to 1200C	125C	03
Cu/Con T	(1)	-250C to 400C	150C	04
Pt13%Rh/Pt R	(1)	0C to 1600C	600C	05
Pt10%Rh/PtS	(1)	0C to 1600C	600C	06
Pt30% Rh/Pt6% Rh B	(1)	200C to 1820C	1000C	08
W/W 26% Re	(1)	0C to 2300C	450C	09
W5%Re/W26%	(1)	0C to 2300C	500C	11
Ni Cr/Con E	(1)	oC to 780C	100C	12
Pt10% Rh/Pt40%Rh	(1)	200C to 1800C	1000C	23
W5% Re/W 26% Re C	(1)	0C to 2300C	500C	24
Pt20% Rh/Pt40% Rh	(1)	0 to 2000C	1900C	25
Platinel 11	(1)	0C to 1200C	150C	28
W/W 26% Re	(1)	0C to 2200C	500C	29
Ni/Ni 18% Molybdenum	(1)	0C to 1100C	600C	33
W3% Re/W 25% Re D	(1)	0C to 2400C	1000C	35
W/Re 5% W/Re 26%	(1)	0C to 2000C	1000C	38
Nicrosil/Nisil	(1)	0C to 1300C	150C	45
Pt100 ohm at 0°C	(2)	-200C to 800C	50C	70
Pyrometer (Q004 Land)	*(4)	800C to 1550C	5mV	48
Pyrometer (Q003 Land)	*(4)	700C to 1400C	5mV	51
Pyrometer RO 26	*(4	100C to 500C	5mV	54
Pyrometer IVDI	*(4)	1000C to 2500C	5mV	61
Pyrometer DTI	*(4)	1200C to 2500C	5mV	62
Pyrometer DT1/10	*(4)	1500C to 3000C	5mV	63
Pyrometer RO 23	*(4)	800C to 1700C	5mV	64
Pyrometer FP/GP 10	*(4)	500C to 900C	5mV	82
Pyrometer FP/gp 11	*(4)	700C to 1300C 5mV	83	
Pyrometer FP/GP 12	*(4)	1000C to 1850C	5mV	84
Pyrometer FP/GP 20	*(4)	400C to 750C	5mV	85
Pyrometer FP/GP 21	*(4)	500C to 1100C	5mV	86
Linear	(3)	-9000 to 19999	**	00
Suare root	(3)		**	92

Display Min/Display Max

These should be selected from the recommended minimum and maximum ranges shown in Curve. Include decimal point position - This is especially important on linear range

Units

NONE
°C
°F
K
MV
V
MA
%

(Or specify up to 5 characters)

* Decimal points not available on these ranges.
** For linear inputs sensitivity must not be less than 5μVs/digit

Notes (10, (2), (3) and (4) refer to Inputs Box.

Digital Inputs

	Dig I/P1	Dig I/P 2
None	NO	NO
Auto Manual	AM	AM
Local Remote	LR	LR
Adaptive Tune	AT	-
Keylock	KL	-
DIG I/P 1 up key*	UK	
DOG I/P 2 down key*	-	DK
Parameter Security	PS	-
Self tune	-	ST
SP 2/ SP 1**	S2	S2
Step prog. number***		SP
PID 2/PID 1	-	P2
Run/Reset	RS	-
Ramp	-	RP
Run/Hold	-	RH
Hold/Run	-	HR
Skip Segment	SS	SS

* These options must be selected together. If selected no other input is possible
** Not available with remote trim
*** Mutually exclusive with Dual PID

Software Options

Function	Code
Manual Key Enabled	E
Manual Key Disabled	D

Cold Junction	Code
Non T/C Input	N
Internal Compensation	IN
External 0C Ref 0	
External 45°C Ref 45	
External 50°C Ref 50	

Function	Code
Integral and Derivative Secs	S
Intergral and Derivative in Mins	M
Integral and Derivative in Secs with dual PID	SS
Integral and Derivative in Mins with dual PID	MM

Function	Code
Power Feedback P	
No Power Feedback	N*

* Not available on dc or VP outputs therefore enter N.

Programmer

Ramp Scale/Dwell Scale

Ramp Scale	Code
SP units per minute	MN
SP units per hour	HR
Time to target mins	MT
Time to target hours	HT

Dwell Scale	Code
Dwell in minutes	MN
Dwell in Hours	HR

Alarm Relays Driven from Programmer Segments

If alarm 1 and/or alarm 2 are not required as alarms or retransmission their oiutput stages can be driven from the segments of the program. For this feature enter 'PROG' into the required alarm field.

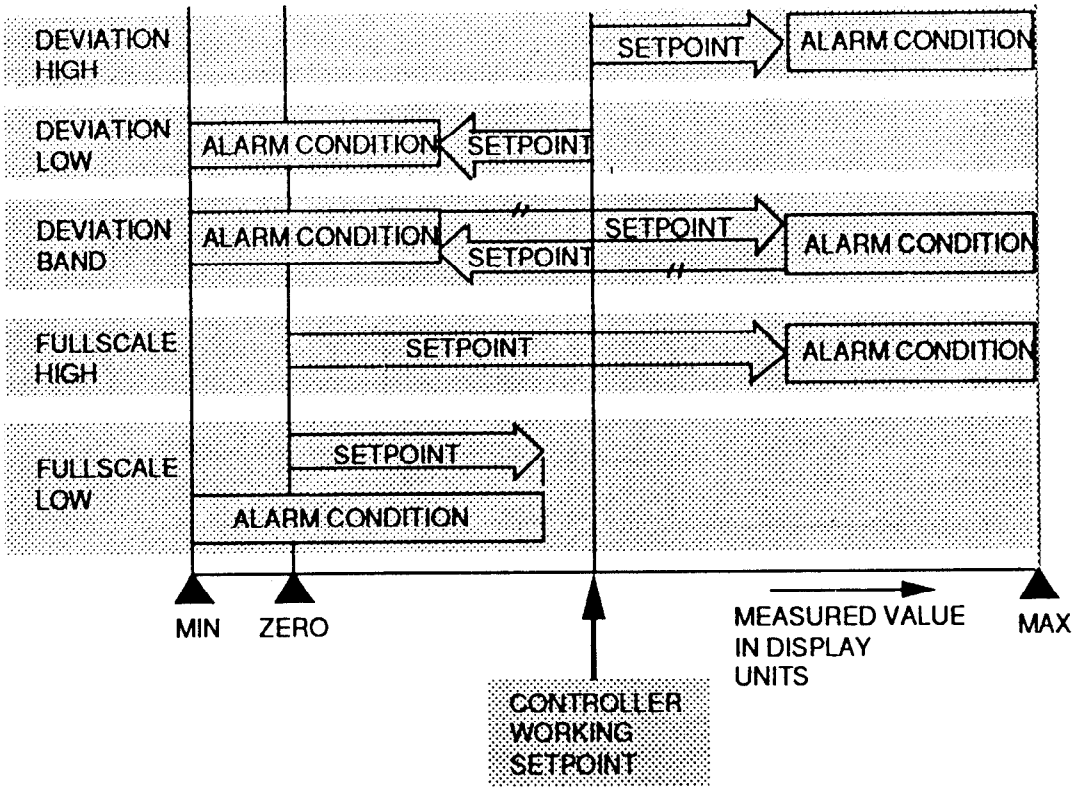
Holdback	Code
No Holdback	N
Band deviation holdback	H
High deviation holdback	U
Low deviation holdback	L

Note:
For high resolution ramp rate suffix code H, giving HH, UH or LH.

4.2 Glossary of Terms

ADAPTIVE TUNE - A facility which, when enabled, monitors the process and, if necessary, updates the proportional band, integral time and derivative time to ensure continuous optimum straight line control.

ALARM - A condition that exists if the process variable exceeds internally stored alarm setpoints.
These setpoints can be:-



AUTO/MANUAL - Alternative control conditions that can be selected within the controller.
Manual - An open loop condition, in which the power to the process is manually set and not influenced by the sensor.
Auto - A closed loop condition, in which the power to the process is automatically computed and set by the sensor output relative to the setpoint.

AUTO/REPEAT - A time saving device to scroll quickly through a list of mnemonics with a hesitation at key values.

CUTBACK ACTION - Cutback is provided to improve the large step response of PID control. When cutback is set to zero it has no effect on control action.
When the process value is below setpoint by an error value exceeding the cutback low limit, the integral accumulator is adjusted such as to maintain output at maximium. When PV becomes greater than setpoint minus cutback low, normal PID control action resumes.
A similar but inverse action occurs for cutback high. (See Integral)

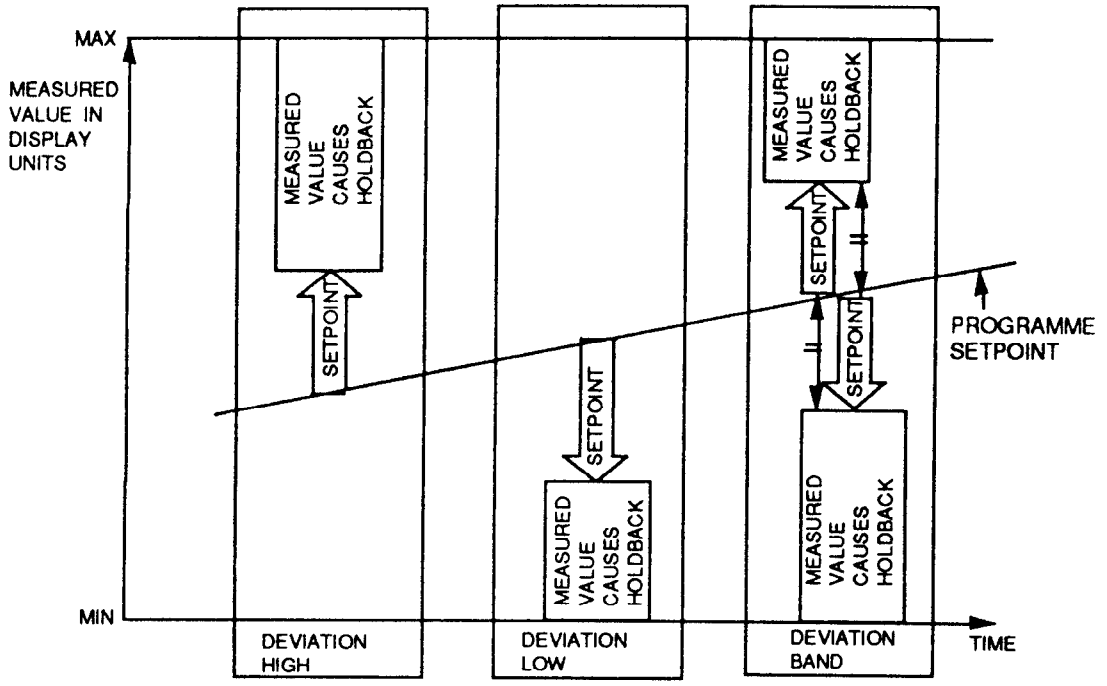
DIRECT ACTION - Control action such that the output increases as the process value increases.

DERIVATIVE ACTION Derivative action is normally used to give a fast response to changes in process value and to improve process stability.
Alternatively derivative action may be configured to act on the error signal which is useful in ramping applications.

DWELL - A time entered into a programme during which the setpoint remains constant.

HOLD - The freezing of a running programme, in time, for the duration of the condition.

HOLDBACK - A hold condition forced onto a running programme by the measured values deviation from the setpoint by more than a predetermined amount.
Holdback can be one of three types illustrated below:-



INTEGRAL ACTION - Integral action is used to achieve zero steady state control error. The product of error and proportional gain is integrated into an accumulator which is added to output signal.
A problem with integral action is that when large error signals exist for a significant period of time, such as following a large scale setpoint step, the integral accumulator assumes a very large value. The error signal must then go negative to reduce the integral accumulator. This will cause overshoot. Various steps are taken to reduce this effect when the outputs are saturated. Additionally a facility 'Cutback' is provided. (See Cutback)

KEYLOCK - A condition enabled by a digital input or digital communications that disables the operation of all push buttons.

LOCAL/REMOTE - Alternative selections of the working setpoint. Either a value stored within the controller (local) or an analogue signal brought into the controllers rear terminals (remote).

LOOP COUNT - The number of times that an entered programme is repeated automatically before the 'END' condition becomes active.

MANUAL RESET - In controllers with proportional only control, manual reset is used to provide a user defined output offset such that the controller can provide control with zero offset.

OUTPUT RELAY - Relays that are normally driven by the alarm output condition but can, as an alternative, be driven by segments of the programme.

PROGRAMME - A preset profile of the controller setpoint made up of ramps and dwells, together with the sequence of state of the output relays.

PROPORTIONAL - ACTION With proportional action the output of the instrument varies propotionally to the error between setpoint and process value. The propband is the range of process value over which this linear gain action occurs before the output saturates at maximium or minimium. This is often expressed as a percentage of the instrument span. The gain of the instrument varies inversly as the propband increases. (See Manual Reset)

RAMP - One segment of a programme where the controller setpoint moves from one level to another linearly during a fixed period of time.

RESET - An action which returns a completed or running programme to the start condition i.e. controlling on SP1, SP2 or remote S.P.

REVERSE ACTION - Control action such that the output decreases as the process value increases.

RUN - An action which starts a programme running or restarts it from a hold condition.

SCROLL - A method of presenting a large number of mnemonics or numerals, on the display, in sequence, so allowing the operator to make a choice.

SELF TUNE - A facility which, when enabled, performs a number of 'on' and 'off' sequences of the controller output, measuring the influence this has on the measured value. From these results the value of proportional band, integral time and derivative time plus, under certain circumstances, cut back low, cut back high, heat cycle, cool cycle time and relative cool gain, for optimum control, are calculated and written into the commissioning mnemonics.

SERVO START - A condition at the start of a programme where the first ramp starts from the current measured value instead of a fixed level.

SINGLE STEP - A form of scrolling where the rate at which the parameter or numeral changes is controlled to one at a time.

TOGGLE - The selection of two states (i.e. AUTO & MANUAL) using a single push button. The first press gives one state (AUTO) and the second press the other (MANUAL). A further press will return to the first state (AUTO).

4.3 Error Codes

Entering invalid parameters will cause an error flag to be set within the instrument. Below is a table of error codes and corrective action. For all corrective actions enter configuration mode. (These apply to software version 3.11 and later).

Error Code	Meaning	Corrective action
C En	Invalid end to Config	Scroll to clear press '△' and '▽' keys.
C Er	Invalid Config parameter value	Re-enter correct value(s)
C ch	Config parameter checksum error	Re-enter corrupted value(s)
H Er	Invalid hardware ident	Check that output modules fitted are valid then scroll to 'idn' press '△' and '▽' keys.
P ch	Parameter checksum error	Re-enter corrupted value(s).

Note: All corrective actions must be completed by scrolling to 'CLr' and press '△' and '▽' keys together.

If any other error messages appears on the screen contact your nearest Eurotherm engineer.