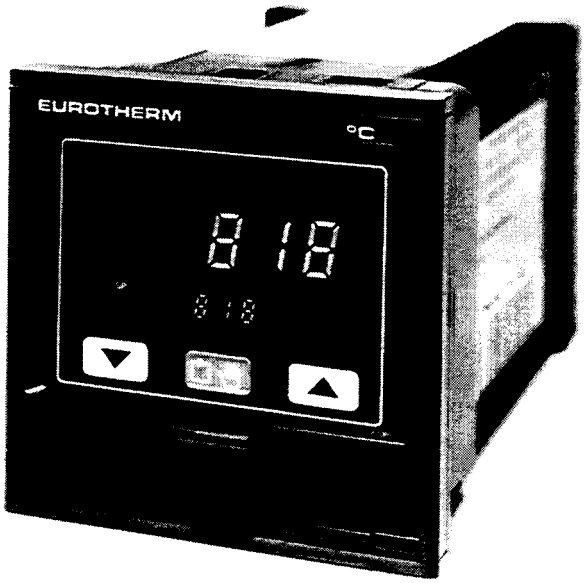
EUROTHERM
CONTROLS

Engineering Manual

MODEL 818 DIGITAL CONTROLLER



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RESTON, VIRGINIA, USA

CAUTION!

Before installing, operating or servicing equipment supplied by Eurotherm Controls Inc, please read the following:

INSTRUCTIONS FOR SAFE USE OF EUROTHERM EQUIPMENT

(Note: These instructions represent good engineering principles and are applicable to all control equipment of the same type, whether from Eurotherm or any other supplier.)

OVERCURRENT PROTECTION

It is recommended that AC power supplies to Eurotherm instruments be protected by fuses or automatic circuit breakers rated at not more than 2 Ampères.

VOLTAGE RATINGS

Care must be taken to ensure that maximum voltage ratings are not exceeded.
Unless otherwise stated in the specification of any particular unit, the maximum voltage which may be applied between any two isolated circuits, or between any isolated circuit and ground, is limited to the highest rated supply voltage for that unit.

ENCLOSURE OF LIVE PARTS

Some metal parts of certain types of Eurotherm equipment can become electrically "live" in some conditions of normal operation.
Unless clearly intended to be panel mounted and accessible during normal operation, all units should be installed inside a suitable grounded metal enclosure to prevent live parts being accessible to human hands and metal tools.
It is recommended that rear terminal covers (available as an option on most Eurotherm units) be fitted wherever possible.

WIRING

It is important to connect all equipment correctly in accordance with the installation data provided for each type of unit.
Unlabelled terminals must not be used as "tie points" for other wires (unless the installation instructions mention that this is permissible). Such unlabelled terminals may be internally connected. Any questions concerning the correct wiring of a Eurotherm unit should be directed to the nearest Eurotherm Sales and Service representative.
Most connections to Eurotherm equipment require correct polarity to be maintained, and due attention must be given to ensure this.
Wiring should conform to appropriate standards of good practice and local codes and regulations. Conductors should be commensurate with voltage and current ratings of the units.

OUT-OF-LIMITS ALARMS

In applications where excessive deviation of a controlled parameter due to equipment failure could cause damage to machinery or materials, or injury to personnel, it is recommended that an additional separate unit be used to give alarm indication or to shut down the process or both, as may be appropriate. (Note: "Alarm boards" fitted inside controllers may not give sufficient protection in these circumstances). When "alarm units" or "alarm boards" are used they should be checked for correct operation and calibration at regular intervals.

(CONTINUED INSIDE BACK COVER)

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Chapter 1.0
Standard Precautions

When designing any control system 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:

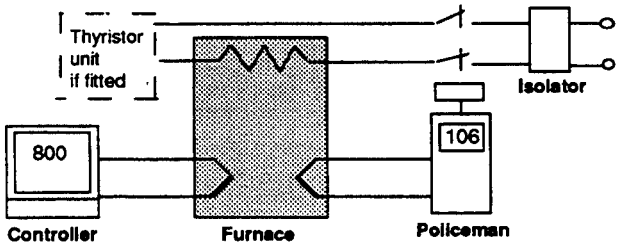
1. Thermocouple or sensor becomes "detatched" from the system i.e. it is no longer measuring the actual temperature achieved.
2. Thermocouple or thermocouple wiring becomes short-circuited.
3. Component failure within the controller in such a way as to leave the output switched on.
4. Microprocessor 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.
   e.g. (a) Controller left in Manual with high output power set.
   (b) Setpoint set too high
8. Any lack of maintenence in serviceable parts.

....and many other unforseen 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 seperate 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 main controller is **NOT** sufficient protection for all eventualities.

Before installing, operating or servicing industrial electronic equipment, please read the following which highlights some important parts of the proposed standards document IEC 801, currently in draft form.

1.1 Guidelines for safe use of Electronic equipment

Note: *All Eurotherm equipment is designed to operate in harsh industrial environments and is thoroughly tested. These guidelines represent good engineering principles for safe and trouble-free operation and are recommended for all control equipment, whether from Eurotherm or any other supplier. They should be used in conjunction with local regulations.*

1.2 Overcurrent Protection

It is recommended that AC power supplies to instruments be protected by fuses or automatic circuit breakers rated at not more than 2 Amperes, and must be separated from any load current circuits.

1.3 Voltage Ratings

Care must be taken to ensure that maximum voltage ratings are not exceeded.
Unless otherwise stated in the specification of any particular unit, the maximum voltage which may be applied between any two isolated circuits, or between any isolated circuit and earth, is limited to the highest rated supply voltage for that unit.
Take particular care not to connect AC supplies to low voltage control inputs such as sensor inputs, logic inputs and outputs.

1.4 Enclosure of Live Parts

Some metal parts of certain types of equipment can become electrically "live" in some conditions of normal operation.
Unless clearly intended to be panel mounted and accessible during normal operation, all units should be installed inside a suitable earthed metal enclosure to prevent live parts being accessible to human hands and metal tools.
It is recommended that rear terminal covers (available as an option on most Eurotherm units) be fitted wherever possible.

1.5 Wiring

It is important to connect all equipment correctly in accordance with the installation data provided for each type of unit.
Most connections to equipment require correct polarity to be maintained and due attention must be given to ensure this.
Unlabelled terminals must not be used as "tie points" for other wires.
Conductors should be commensurate with voltage and current ratings of the units, and should conform to appropriate standards of good practice and local codes and regulations.
Any questions concerning the correct wiring of Eurotherm units should be directed to the nearest Eurotherm Sales and

1.6 Routing of Wiring

Care should be taken to ensure maximum separation between low current control signal, wiring and power wiring.
Control wiring refers to those connections to the input of the controller, analogue or logic outputs, digital inputs, remote setpoint inputs and relays switching control signals.
Power wiring refers to those connections to relay or triac switched AC supplies, and wiring associated with external devices such as contactors, alarm relays or motor speed drives, etc.
It is essential that control and power wiring are routed separately through the cabinets and plant.
This requires that the mechanical design must take into account all the different items to be included and the type of wiring involved. The design layout should include the separation described above.

The ac supply to all the controllers should be taken from as close to the in-coming source as possible and should not under any circumstances be "daisy chained" from other equipment, especially if it is likely to generate, supply-bourne, electrical noise.

For controllers with digital communications it is strongly recommended that screened cable is used and that only one end of the screen is earthed at the "cleanest" end, usually at the computer. The screened cable should be routed with the control wiring. Do not use 'spare' wires in the cable for other signals.

1.7 Earthing

All earth terminals must be securely connected directly to a good local earth by conductors appropriate to the current ratings of the units.
Most Eurotherm instruments have internal circuits which are isolated or "floating". This is necessary to prevent the occurance of an "earth loop" in signal circuits. To avoid possible shock hazards in the event of an internal fault causing breakdown of insulation, it is recommended that all equipment connected to any Eurotherm unit be enclosed in an earthed metal enclosure. Sheaths of thermocouples (or other sensors) should be properly earthed by a separate conductor (instead of being dependent on earthing via the machine framework).

1.8 Supply Isolators

Every electrical system should be provided with a device for isolating the system from the AC supply to allow safe working during repair and maintenance. Thyristors and triacs are not adequate means of isolating the supply and should always be backed by a suitable mechanical isolator.

1.9 Supply Impedance

Control cabinets and equipment should be sited as close to the incoming supply as possible. This is essential on high power systems using thyristors driving large transformer loads. In all cases, both inside and outside the cabinet, long supply cables should be avoided. If they are unavoidable, conductors of an adequate rating must be used.
Avoid running instruments from a supply which has shared wiring with high current circuits, particularly if these are switched by contactors or thyristors.

1.10 Plant and Personnel Protection

On control applications it is essential to consider what will happen if any individual part of the system malfunctions. Where excessive deviation of a controlled parameter, due to equipment failure, could cause damage to machinery or materials, or injury to personnel, it is recommended that an additional separate unit, such as the Eurotherm 106, with its own separate sensor, be used to give alarm indication or to shut down the process or both, as may be appropriate.
Note: "Alarm relays" fitted inside the controller itself may not give sufficient protection in all possible circumstances.
When "alarm units" or "alarm boards" are used they should be checked for correct operation and calibration at regular intervals.

1.11 Hazardous Atmospheres

No product should be connected to a circuit which passes into or through a hazardous area, unless appropriate precautions are taken (even though the instrument itself may be located in a safe area). Such an installation should conform to the requirements of the relevant local regulations.
Unless categorically stated in the published specification of any particular unit, it should be assumed they are not suitable for direct use in areas subject to hazardous atmospheres.

1.12 Procedure in the Event of Trouble

Before beginning any investigation of a fault, the electrical supplies to all equipment concerned should be switched off and isolated. Units suspected of being faulty should be disconnected and removed to a properly equipped workshop for testing or returned to the manufacturer for repair. Any attempt to troubleshoot while installed could be hazardous to personnel and equipment.

IF IN DOUBT, ASK!

If you have any questions regarding any aspect of installing, operating or servicing your Eurotherm equipment, please contact your nearest Eurotherm Sales and Service engineer.

Chapter 2.0
Technical Specification

2.1 Inputs

General

Input range :-
-8.0mV to + 60mV

Min span :-
5.0mV

Max span: -
68mV

Max zero offset: :-
20% of span (in mV)

Common mode rejection:-
< 50µV display change for 264V rms at.50/60Hz
Series mode rejection:-
<50µV display change for 50mV rms at 50/60Hz

Input impedance:-
>1M ohm resistive (includes 0.6µA open circuit sensor current)

Resolution :-
12 bit for all ranges (14 bit max)

Sample period:-
125 milliseconds

Linearity error:-
Better than ± 0.1% of input span.

Thermocouple

Standards:-
British BS4937 (1973) German DIN 43710 US ASTM E230(1972)

Linearisation :-
Better than ± 0.2°C for standard thermocouple. Effect of thermocouple lead resistance, 0.5µV/ohm

CJC:-
Internal or 0°C, 45°C, 50°C external

Internal CJC Error:-
Typically 0.05°C/°C ambient change (20:1)

RTD

Standards:-
British BS1904 German DIN 43760 PT 100

Linearisation:-
Better than ± 0.2°C for standard resistance thermometers

Connection:-
3 Wire automatic lead resistance compensation

Bulb current:-
0.2mA

Lead compensation Error:-
With up to 22 ohms in all three leads no change in display indication

Volts

Range:-
Minimum span 5.00 mV. For spans above 60.0mV an external attenuator mounted in an extension block on the rear terminals is used

Input Impedance:-
>100K ohms

Current

0-20mA or 0-10mA. With all current ranges, burden resistors are mounted onto the rear terminals 2.5 ohms for 20mA inout and 5 ohms for 10mA input. Offsets are provided as software option i.e. 4-20mA.

2.2 Outputs (2 or Valve Positioner Drive)

Relay :-
Maximum of 264V 2A ac into resistive load, with spark suppression. On/Off or time proportional. Minimum voltage 30V rms or dc
Leakage current through spark suppression network= 2mA at 264 V ac 50Hz

Triac:-
Maximum of 264V 1A ac into resisitve load. On/off or time proportional. Minimum voltage 85V rms. Leakage current through snubber = 2mA at 264V ac 50Hz

Isolated logic:-
20mA at 15Vmin. On/off or time proportional

Cycle Time:-
0.3 to 100 seconds at 50% power (relay 10 to 100 seconds)

Power Feedback:-
Normally fitted to any of the above when using output 1 (heat)

Analogue:-
Isolated dc, 0-10v at 20mA max or 0-20mA at 12 volts. Offsets provided as software option, i.e. 4-20mA. Output impedance on voltage ranges is < 0.1 ohms (including connectors)

Retransmission:-
Output 2 (cool output) or output 3 (alarm 1) can be designated retransmission output of setpoint, linearised measured variable, error or output power (only one retransmission output available in the controller)

Retransmission Output:-
10 volts span (max), range lying between 0 to +10 volts at 20 mA max. 0-20mA(max) at 12 volts (min) offsets provided as software options, i.e. 4-20mA. Output impedance on voltage ranges is < 0.1 ohms (including connectors)

Retransmission resolution:-
12 bit Effective

Retransmission linearity accuracy:-
Better that 0.5% under all load conditions which are within specifications

Isolation:-
Both output 1 and 2 are isolated from each other and the remainder of the instrument to IEC348,UL1092, VDE411 and BS4743 standards

Reverse/Direct:-
Time proportioning and analogue in output 1 (heat) can be configured either reverse or direct. Output 2 (cool), time proportioning or analogue, is configured as acting the opposite to output 1

Non-Linear:-
Output 2 (cool) , when not on/off, can be configured as either linear or non-linear characteristic. The non-linear characteristic is ideal for controlling water which may flash off to steam.

Option:-
Output 2, (3 and 4) may be assigned to control by programmer segments in the 818P/4/15 instruments.

2.3 Alarms (2 or 1 only with V.P. output when Motor Position Potentiometer option is fitted)

Relays:-
264V 2A maximum into resistive load, with spark suppression. Minimum switched voltage- (30 volt rms or dc). Leakage current through spark suppression = 2mA at 264V ac 50Hz

Hysteresis:-
0.1-10.0% variable, in 0.1% resolution steps

Type:-
Full scale high and low ; deviation high and low; deviation band

Range:-
Alarms may be set over the complete instrument range

Option:-
One or both alarm outputs plus output 2 may be assigned to programme segments on 818P/4/15. Alarm 1 may be used for a retransmission of setpoint, linearised measured value, error or power output and alarm 2 may be used as a remote input either full scale, trim or power limit of either the heat or cool output. Only one retransmission and one remote input available in the controller.

2.4 General

Display

Upper display:-
5 x 7 segment 12mm high fluorescent indicator. Display range + 19999 to -9999

Resolution:-
± 1 least significant digit

Lower display:-
5 x 7 segment 5mm high fluorescent indicator

Resolution:-
± 1 least significant digit

Calibration

Error:-
Better than ± 0.25% of recommended min. and max. ranges (see section 3)

Control Parameters

Auto/Manual:-
Bumpless procedure auto to manual and manual to auto when SP track is set. Bumpless procedure auto to manual when SP hold is set.
Manual output variable from 0 to 100% for heat outputs and -100% to +100% for heat and cool instruments.

Local/remote:-
Local SP = SP1.
Remote SP = Either full scale remote or
Full scale remote + local trim (LSP) or
Remote Trim + Full scale local(LSP)
Not available with programme running, SP2 or ST

Derivative Action:-
On measured value or error signal

Dual P.I.D.:-
Selecting SP2 engages separate values of integral time, derivative time, manual reset, approach and relative cool gain.

A further option for instruments fitted with software version 4.11 and above is to switch SP1/SP2 independently of PID1/PID2.

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Commissioning Parameters

*Proportional Band (PB):-
0.1 to 999.9% based on the range ' display max' - ' display min ' or 1 to span in Engineering Unit

Integral Time (ti):-
off,1 to 9999 secs or 1-150 mins

Approach Limit (AP):-
0.1-3.0 x Pb

Travel Time (tt) :-
10-1000 secs

Deadband (db):-
0.1-Pb (in %)
1-Pb (in units)

Pot Min Limit (Pl):-
0-100%

Pot Max Limit (Ph):-
0-100%

Manual reset (RES):-
-100 or 0 to + 100% (automatically selected if integral time is 'off')

Derivative time:-
off, 0.1 to 999.9 secs or 1-15 mins

Cut Back (CBL/CBH):-
off,0.1 to display range for both low and high

Heat output limit (HL):-
0 to 100%

Cool output limit (CL):-
0 to - 100%

Heat cycle time (HC):-
0.3 to 100 seconds (10 to 100 secs for relay)

Cool cycle time (Cc):-
0.3 to 100 seconds (10 to 100 secs for relay)

*Relative cool gain (Cr):-
0.1 to 20.0% of proportional band (PB)

Heat-cool deadband (DB):-
-5 to +5% of proportional band

Setpoint rate limit (Pr):-
1 to 19999 units per min or hour with decimal position as display, eg: XX.XXX display gives 0.001 to 19.999

Emissivity (PE):-
0.01 to 1.00

Sensor break power (Sbr):-
0 to 100% (heat only) or -100% to 100% (heat/cool) activated by 10% over or under range.

**For on/off outputs proportional band and/or relative cool gain are replaced by dead band and relative dead band.*

2.5 Communications

Analogue Input

General:-
This input allows a remote signal to represent either full scale setpoint, setpoint trim, heat power limit, or cool power limit. (Only one remote input available in the controller). This facility can be selected either from the front push buttons, the digital inputs or via digital communications. Power limit can only be selected via a digtal input or digtal communications.

Voltage:-
Max. 10 volts range lying between -5.0 to + 10.0 volts

Input impedance :-
> 75K ohms

Current:-
0-10mA 0-20mA; offsets provided as software options, eg 4-20mA

Input impedance:-
50 ohms mounted on rear terminals

Potentiometer Supply:-
10 volt, 1mA max, potentiometer supply available, short circuit proof

Configuration:-
Isolated remote setpoint, remote trim, output power limit

Resolution:-
12 bit effective

Accuracy:-
Better than 0.5%

Sample period:-
750 milliseconds

Input wiring break:-
Drops to 12%, or below, on inputs configured with 20% offsets, will cause the output to switch to sensor break power and the 'REM' legend to flash.

Analogue Output

General:-
This output gives a retransmission signal representing either the setpoint, the linearised measured value, error or the power. (Only one retransmission output available in the controller.)

Voltage:-
Max 10 volts, range lying between - 5 volts to + 10 volts internal impedance<0.1 ohms (including connectors)

Impedance:-
Load must be >500ohms

Current:-
0-20mA (max) at 12 volts min, offsets provided as software options, ie 4-20mA

Configuration:-
Setpoint,measured value, error, or output power (excludes use of channel 2 or 3 as retransmission).

Resolution:-
12 bit

Linearity Accuracy:-
Better than 0.5% under all load conditions which are within specification.

Digital

Protocol:-
Variable speed link, ASCII format RS232 or RS422/485 protocol ANS1 X 3.28 (1976) 2.5 A4, or Modbus® RTU or J-bus® RTU at baud rates variable from 300, 600, 1200, 2400, 3600, 4800 and 9600.

Isolation:-
Between communications link and all other inputs and outputs meets IEC348, UL 1092 ,VDE 411 and BS4743 standards.

Format:-
Start bit - seven data bits - even parity bit - one stop bit. (ANSI x 3.28 (1976) 2.5A4 Protocol).
**Start bit - eight binary data bits, - one stop bit (J-Bus® RTU and Modbus® RTU). (The J-Bus and Modbus can have an optional even parity bit).*

Address:-
Two digits

Digital input:-
Overrides, the digital communications link and holds 'keylock' and 'parameter security' disabled.

2.6 Logic Inputs (2)

(Standard on all Instruments).

Drive :-
Pulled up to +5 volts in rest state : must be pulled down to 0 volts with an impedance of <100ohms to activate.

Isolation:-
Logic inputs not isolated from one another, or measured value input, but isolated from all other inputs and outputs to IEC348, UL1092, VDE411 and BS4743 standards.

Voltage Level Limits:-
For logic input active the input level must be less than 0.70 volts; for logic input in-active the input level must be greater than 4.00 volts.

Input current:-
0.5mA maximum

Configuration:-
(one only per logic input)

Auto/manual	*Ramp enable.*
Remote/local	*Run/Hold*
SP 2 / SP 1	*Run/Reset*
Adaptive/self tune	*Remote up/down key*
Keylock	*PID 2 / PID 1*
Skip Segment	*Prog No monitor/step*
	Parameter modification
	Security

Trigger:-
All are level triggered except self tune and skip current segment which are edge triggered.

2.7 Auto-Tune

Self tune (ST) and Fast Self Tune (FST)*:-
Operation:-
A single shot approach, which exercises the output in an on/off mode, measuring the response of the measured value and installing values of PID, cycle time, relative cool gain and,under certain conditions, cutback. During the routine the output is turned off and on to force the self tune routine into a single cycle of oscillation. The fast self tune only performs 1/2 of a cycle.

Enhancements:-
A) Operates in reverse or direct.
B) If integral turned "off",unit tunes as a PD controller.
C) If integral and derivative turned 'off', unit tunes as a P controller.

Suspension:-
If the instrument is switched to manual whilst in self tune the self tune will be suspended. On reverting to ' auto' the unit will recommence the self tune routine from the start.

Limitation:-
The instrument will not self tune when configured in the on/off mode or when SP2, ramp or programme is enabled.

Abort:-
'Stop' will be flashed into the top display alternating with the measured value if the instrument is unsuccessful in self tuning the loop. Under these circumtances the 'ST' or 'FST' feature should be terminated by manually switching 'off'.
** Only available on instruments fitted with version 2.07 software and above.*

Adaptive tune (AT)

Operation:-
A continuous appraisal and re-defining of three term parameters.

Enhancement:-
A) Operates in reverse or direct.
B) Will not introduce derivative if turned 'off'.
C) If integral is turned 'off', the adaptive tune algorithm may switch it 'on' in order to achieve zero error.
D) Will not operate on controller configured with an on/off output.
*E) Automatically set trigger level that can also be manually adjusted.**

Suspension:-
While switched into 'manual' the adaptive tune will be suspended. It will however be automatically reinstated when the instrument is switched back to 'auto'.

** Only available on instruments fitted with version 2.07 software and above.*

Limitation:-
Adaptive tune will operate on all setpoints but will automtically be inhibited from operation whilst the setpoint is moving such as a programmed ramp.

2.8 Ramp

Ramp rate is set in units/minute or hour, this being configured in the instrument software. The range of the ramp rate is dependent upon the decimal point position in the display as shown below.

	Decimal Point Position of Display.			
	XXXXX	XXXX.X	XXX.XX	XX.XXX
Ramp Rate Limit in Units/ Minute or hour	1 to 19999	0.1 to 1999.9	0.01 to 199.99	00.001 to19.999

Limitations:-
The ramp is not operative whilst remote, SP2., selftune or programme are enabled. When a high resolution Ramp is specified the decimal point is moved one place to the left on the above Ramp rates.

2.9 Programming
(818P, 818P4 and 818P15)

Number of programmes:-
One (818P), four (818P4) or fifteen (818P15)

Programme length:-
Maximum of 16 segments in fixed ramp/dwell sequence.

Ramp setting:-
Normal ramps set as rates : variable from 1 to max. Display increment/ min or hour.
High resolution ramp set as rates: variable from 0.1 to max. Display increment/min or hour.
Ramp set as time to target: variable from 0.1 - 999.9 mins or hours.
All ramp settings also have 'step', 'none', and 'end 'in scroll

.Dwell Setting:-
Dwell variable from 0.1 to 999.9 mins or hours, plus 0= no dwell and 'end'.

Programme cycles:-
Maximum of 999

Holdback:-
Can be configured for whole programme either as deviation high, low, or band. Variable from off, 0- display range.

Run/Hold:-
Operation by toggle action of front pushbutton or by a configured digital input or via the digital communications link. Run/Hold-digital-in switch open to Run, close to Hold Hold/Run- digital-in switch open to Hold, close to Run

Reset:-
Operative throughout the programme or at the 'end' state. Enabled by pressing the 'up' and 'down' buttons together or by a configured digital input or via the digital communications link.

Programme parameters:-
Can only be changed when the programme is reset or in 'hold'. Elapsed time for dwells can be varied by viewing the elapsed time with 'Hold' enabled and scrolling using the 'up' and 'down' buttons.

Suspension:-
Switching to 'manual ' whilst a programme is running will enable 'Hold' . 'Hold' will remain set when 'auto' is again enabled. The 'run/hold' button must be pressed to restart programme.

Limitations:-
'Run' cannot be selected when 'remote', 'manual 'or SP2 are enabled.

Power failure:-
A running programme will be placed into 'Hold' on power failure. Recovery, on re-instating the power, will be as follows:-
A) In ramp- servo start at the ramp rate.
B) In dwell - servo start, ramping at previous segment ramp rate. (Time remaining will decrement from re-instating power if holdback is off. With holdback set, time remaining does not start to decrement until measured value is within holdback value of dwell level).
C) With track set working setpoint will track measured value in manual and power failure.

Outputs:-
One or both alarms plus output 2 can be driven from segments of the programme, as event relays.

Linking:-
Multiprogrammers (818P4 and 818P15) may have their programmes linked together. On completion of the current programme the next programme is innitiated and run.

2.10 Valve Positioner

Outputs:-
The output stage to drive the valve open is installed in either the heat or cool channel. The other channel then carries the output stage to drive the valve closed.

Motorised Position Potentiometer:-
The valve positioner loop does not require a motor position potentiometer, but if one is fitted it provides limits to the valve travel in auto and gives indication of valve position. Circuitry to accept the motor position potentiometer input, when fitted, is installed in place of alarm 2 output, therefore alarm 2 cannot drive an output stage.

2.11 Priority

Most functions of the instrument can be switched from three sources, the front pushbuttons, configured digital inputs or by the digital communications link. Priority of these sources are as follows:-
A) Digital inputs have the highest priority unless these have been locked out by the digital communications link.
B) Front pushbuttons and the digital communications link have equal priority except where the front pushbuttons have been locked out by the digital communications link.
C) Operation from the digital inputs are level-triggered and will therefore override the front pushbuttons. The only exception to this is 'self tune' and skip segment which are edge-triggered.

2.12 Setpoints

Instruments can operate on one of the following setpoints:-

Setpoint	Source	Level	Enabling parameter
SP1	Internal	Fixed	(default)
SP2	Internal	Fixed	Digital input or digital comms
Programmer	Internal	Variable	Run button,digital input or digital comms
Ramp	Internal	Variable	Run button,digital input or digital comms
rSP	External	Fixed or Variable	Remote button,digital input or digital comms
LSP + rsP	Internal + External	Fixed or Variable	Remote button,digital input or digital comms.

The current value of the selected setpoint is displayed against the legend 'SP' in the short scroll.

2.13 Switching Modes

Current Mode	Next Mode (Valid Switching) via		Next Mode (Invalid Switching) via any means
	Digital input Digital Comms	Pushbuttons or	
Manual	Auto Run Remote 2 PID 2 SP2 ST AT	Auto (1) Run Remote (2) PID 2 SP2 ST AT SAT	
Remote (Auto)	Not remote Manual AT	Not remote (1) Manual AT	Run SP2 ST SAT
Programmer (Run,Auto)	Hold Reset Manual PID 2 AT	Hold (3) Reset Manual PID 2 AT	Remote SP2 ST SAT
Programmer (Hold) Assuming programme was in Run & Auto	Run Reset Manual PID 2 AT	Run (4) Reset Manual PID 2 AT	Remote SP2 ST SAT
Ramp (Auto)	Remote Manual PID 2 ST AT SAT	Remote Manual PID 2 ST AT SAT Reset	
SP2 (Auto)	Not SP2 Manual AT	Not SP2 (1) Manual AT	Run Remote ST SAT
ST (Auto)	Not ST Manual AT	Not ST (1) Manual AT	Run Remote SP2
AT (Auto)	Not AT Run Remote Manual ST SAT	Not AT(1) Run Remote Manual ST SAT	

1) Valid only if current mode was selected via front panel buttons or comms.

2) Will select 'remote' on exiting from the 'manual' mode.

3) Available only if digital input configured for HOLD ACTIVE.

4) Available only if digital input configured for RUN ACTIVE.

2.14 Environmental

Supply Voltage :-
85 -264V ac

Supply frequency:-
48 - 62Hz

Power consumption:-
8.5 watts

Supply fuse:-
500mA (anti surge).

Interference:-
VDE 0871 specification, curve A for conducted EMI in range 150K Hz to 30M Hz.

Creepage:-
Clearances conform to IEC 348, UL 1092 and VDE 411 and BS4743 standards.

Relative humidity:-
0-90% non-condensing.

Operating temperature:-
0 to 55°C.

Storage temperature:-
-10 to 70°C.

Panel sealing:-
The instrument fascia meets IP64 when mounted into a cut-out as specified.

Electrical safety:-
IEC 348 class 1 (250 Volt max), UL 1092 (3mm creepage and clearance) and VDE 411 and BS4743 standards.

Customer connections:-
Screw terminals with terminal cover (fastons an option).

Ambient temperature coefficient:-
Typically ± 50 ppm/°C of instrument input span. Excluding CJC on thermocouple instruments.

Warm up drift:-
<±0.5% of display range (from 1 to 30 mins).

Supply voltage coefficient:-
<±0.1% of display range over full supply voltage range.

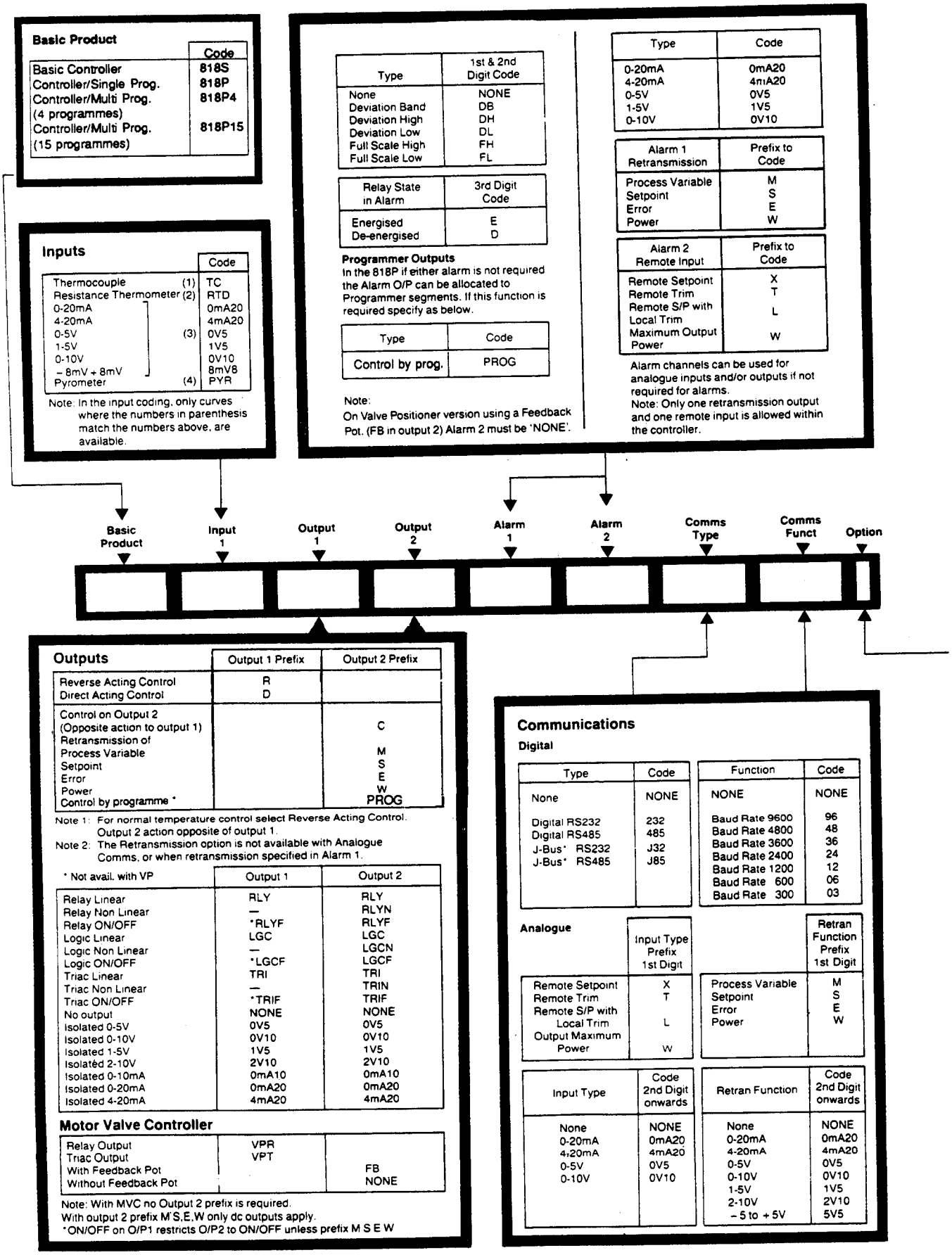
Mounting:-
Plug-in with panel mounting sleeve. Panel cut-out 92 x 92mm + 0.8-0.0mm to DIN 43710.

Weight:-
1.2 Kg (2.6lbs) including sleeve and clamp.

Rear Cover:-
Gives electrical safety to rear terminals.

Chapter 3.0
Coding with Relationship to Configuration

Instruments are configured to the customers order before leaving the factory. Confirmation of the installed configuration is by the ordering code printed on the side cover of the instrument.
To establish the features that are included in the instrument the ordering code on the side cover of the instrument may be interpreted using the coding chart on the next page.
Modifications required to the instrument that can be identified with a change to the model coding, can be accomplished by reference to the paragraph numbers highlighted in the following pages of chapter 3.0.


Basic Product
Code
Basic Controller 818S
Controller/Single Prog. 818P
Controller/Multi Prog. (4 programmes) 818P4
Controller/Multi Prog. (15 programmes) 818P15
Inputs
Code
Thermocouple (1) TC
Resistance Thermometer (2) RTD
0-20mA 0mA20
4-20mA 4mA20
0-5V (3) 0V5
1-5V 1V5
0-10V 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.
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
Programmer Outputs
In the 818P if either alarm is not required the Alarm O/P can be allocated to Programmer segments. If this function is required specify as below.
Type
Code
Control by prog.
PROG
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
1-5V 1V5
0-10V 0V10
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.
Basic Product
Input 1
Output 1
Output 2
Alarm 1
Alarm 2
Comms Type
Comms Funct
Option
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 avail. with VP
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
Communications
Digital
Type
Code
None NONE
Digital RS232 232
Digital RS485 485
J-Bus* RS232 J32
J-Bus* RS485 J85
Function
Code
NONE NONE
Baud Rate 9600 96
Baud Rate 4800 48
Baud Rate 3600 36
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
Remote Trim T
Remote S/P with Local Trim L
Output Maximum Power W
Process Variable M
Setpoint S
Error E
Power W
Input Type
Code 2nd Digit onwards
None NONE
0-20mA 0mA20
4-20mA 4mA20
0-5V 0V5
0-10V 0V10
Retran Function
Code 2nd Digit onwards
None NONE
0-20mA 0mA20
4-20mA 4mA20
0-5V 0V5
0-10V 0V10
1-5V 1V5
2-10V 2V10
– 5 to + 5V 5V5

Input Coding

Curve

Select from the range list shown below

	Notes	Recommended Min & Max ranges	Min Span	Code		Notes	Recommended Min & Max ranges	Min Span	Code
Iron/Constantan J	(1)	0C to 600C	100C	01	Pt100 ohm at 0°C	(2)	– 200C to 850C	50C	70
Fe/Konst(DIN) L	(1)	0C to 600C	100C	02	Pyrometer (Q004 Land)	*(4)	800C to 1550C	5mV	48
Ni Cr/Ni Al K	(1)	– 250C to 1200C	125C	03	Pyrometer (Q003 Land)	*(4)	700C to 1400C	5mV	51
Cu/Con T	(1)	– 250C to 400C	150C	04	Pyrometer RO 26	*(4)	100C to 500C	5mV	54
Pt13% Rh/Pt R	(1)	0C to 1600C	600C	05	Pyrometer IVD1	*(4)	1000C to 2500C	5mV	61
Pt10% Rh/Pt S	(1)	0C to 1600C	600C	06	Pyrometer DT1	*(4)	1200C to 2500C	5mV	62
Pt30% Rh/Pt6% Rh B	(1)	0C to 1800C	1000C	08	Pyrometer DT1/10	*(4)	1500C to 3000C	5mV	63
W/W 26% Re	(1)	0C to 2300C	450C	09	Pyrometer RO 23	*(4)	800C to 1700C	5mV	64
W5% Re/W 26%	(1)	0C to 2300C	500C	11	Pyrometer FP/GP 10	*(4)	500C to 900C	5mV	82
Ni Cr/Con E	(1)	0C to 780C	100C	12	Pyrometer FP/GP 11	*(4)	700C to 1300C	5mV	83
Pt10% Rh/Pt40% Rh	(1)	200C to 1800C	1000C	23	Pyrometer FP/GP 12	*(4)	1000C to 1850C	5mV	84
W5% Re/W 26% Re C	(1)	0C to 2300C	500C	24	Pyrometer FP/GP 20	*(4)	400C to 750C	5mV	85
Pt20% Rh/Pt40% Rh	(1)	0C to 2000C	1900C	25	Pyrometer FP/GP 21	*(4)	500C to 1100C	5mV	86
Platinel 11	(1)	0C to 1200C	150C	28	Linear	(3)	– 9000 to 19999	●	00
W/W 26% Re	(1)	0C to 2200C	500C	29	Sq. root	(3)		●	92
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					

● Note: For linear inputs sensitivity must not be less than 5μVs/digit

Display Min/ Display Max

These should be selected from the recommended minimum and maximum ranges shown in Curve.

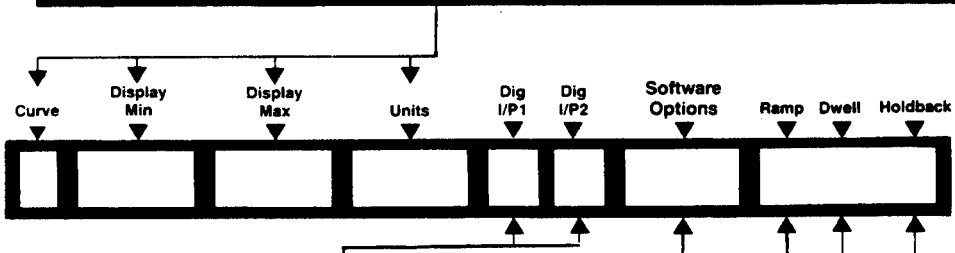
Include decimal point position — This is especially important on linear range.

*Decimal points not available on these ranges.

Units

NONE
°C
°F
K
mV
V
mA
%
(Or specify up to 5 characters)

Note (1), (2), (3) and (4) refer to inputs



Option

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

Digital Inputs

	Dig I/P1	Dig I/P2
NONE	NO	NO
Auto Manual	AM	AM
Local Remote	LR	LR
Adaptive Tune	AT	—
Keylock	KL	—
Run/reset Prog.	RS	—
DIG I/P 1 up key *	UK	—
DIG I/P 2 down key *	—	DK
Parameter Security	PS	—
Self tune	—	ST
Ramp	—	RP
Run/Hold Programme	—	RH
Hold/Run Programme	—	HR
SP 2 /SP 1**	S2	S2
Skip Segment Programme	SS	SS
Step Programme number	—	SP
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 0°C Ref	0
External 45°C Ref	45
External 50°C Ref	50

Function	Code
Integral and Derivative in Secs	S
Integral 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 818P

All other models end code with software options.

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 and or output 2 are not required as alarms, retransmission or control, their output stages can be driven from the segments of the programme. For this feature enter 'PROG' into the required field, (output 2, alarm 1 or alarm 2).

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

Chapter 4.0
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 accompanied by hardware (printed circuit board or switch link) changes. Changes to the configuration are under the security of a hardware switch. However, the 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 "CI" will appear on the lower display. To reveal the numerical value of "CI" 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)

MNEMONIC	FUNCTION
i8*	These paramenters are associated with calibration and no attempt should be made to alter them without first referring to chapter 7.0.
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.

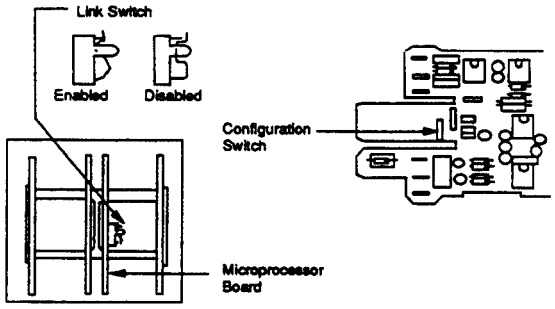
Functions which are only available with specific versions of software are indicated by the following key.

- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

4.1 Configuration Changes
(General Operating Procedure)

To change the configuration of an instrument it is essential that the following 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 are 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' appear 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 when the scroll button is pressed to move to the next parameter. The same parameter will remain on the lower display, press the 'up' or 'down' button to return to the code and re-enter a valid code.
   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 has an auto-repeat facility and enables other configuration paramaters to be selected; 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.

4.2 Hardware Changes
(General Operating Procedure)

1. Remove the instrument from its sleeve.

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

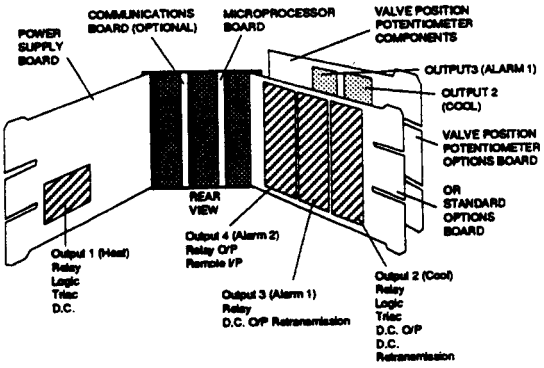
3. Release the catches of the board retainer by inserting a screwdriver into the slots of the square cut out on each side of the instrument.

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.

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 4.1 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 4.1 above and referring to this table.
Idn= "ABCD"

Digit	Function
A	Output 4 (alarm 2) or valve position potentiometer circuit.
B	Output 3 (alarm1)
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

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

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

4.3 To Change the Display range, Decimal point or Sensor type

Hardware

No changes are required within the instrument when changing the display range, decimal point or sensor type.
If the display units are to be changed, the label in the top right-hand corner of the bezel should be changed. (Strip of display unit labels. Part No. GA021836.)
Instruments with milli-amps, pyrometer or voltages greater that 50mV into the main input, terminals 25 and 26, are fitted with an extra block mounted onto the rear of the sleeve.
The part numbers of these blocks are given below:

Input into rear terminals	Part no. of Block
0-5 volts or 1-5 volts	LA021419U006
0-10 volts or 2-10 volts	LA021419U005
0-20 mA or 4-20 mA	LA021419U003
Optical Pyromeyer Q004 or Q003	LA021419U004
Optical Pyrometer IVDI, DTI, DTI/10, FP/GP10, FP/GP11 FP/GP12, FP/GP20, FP/GP21	LA021419U005

All other pyrometer, thermocouple, resistance thermometer or linear inputs have the input wired directly to the sleeve terminals.

Note: -
For the above changes it is NOT necessary to scroll through the configuration list to "idn" and enter this change

Software

Sensor Type.

1. Carry out the procedure in paragraph 4.1, changing mnemonic, "C1", character 'C' and 'D', as given in the table below.

C1 (C & D)

CD				
	=	00	J	(01)
	=	01	JDIN	(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)
	=	11	C	(24)
	=	12	R20/40RH	(25)
	=	13	Platinel 11	(28)
	=	14	W/W26%Re	(29)
	=	15	Ni/Ni·18% Moly	(33)
	=	16	W3/W25HER	(35)
	=	17	W5/W26BOC	(38)
	=	18	Nisil	(45)

C1 (C & D)(continued)

CD				
	=	19	Q009 (46) DTI	(62)
	=	20	Q002 (50) DTI/10	(63)
	=	21	Q003	(51)
	=	22	Q005 (57) R023	(64)
	=	23	Q007 (58) R026 or ORK35-2-3	(54)
	=	24	Q004	(48)
	=	25	RT100	(70)
	=	26	Linear to 8mV	
	=	27	Linear to 20mV	
	=	28	Linear to 50 mV	
	=	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/GP21	(86)

Numbers in brackets are Eurotherm input code.

Note if pyrometer inputs are configured, ensure that after leaving config, the emisivity (ES in long scroll list) is set to 1.00 or a suitable value.

2. For ranges using a thermocouple as a sensor the cold junction compensation must be selected by setting character "A" of mnemonic "C1" as follows.

C1(A)

A					
	=	0	Internal	CJC	Cal Trim (µV)
	=	1	External	O°C	Cal Trim (µV)
	=	2	External	45°C	Cal Trim (µV)
	=	3	External	50°C	Cal Trim (µV)
	=	4	Internal	CJC	PV Offset (Eng Units)
	=	5	External	O°C	PV Offset (Eng Units)
	=	6	External	45°C	PV Offset (Eng Units)
	=	7	External	50°C	PV Offset (Eng Units)

Note: -
For all non thermocouple inputs any value of "A" may be set. Only CAL TRIM is set by this character.

3. Ranges using either thermocouples, resistance thermometers or pyrometers, as sensors must have the display units set by mnemonic 'C1' character 'B' as follows:-

Cl (B)

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

Note:-
For all other inputs the setting of 'B' has no significance except for setting the integral and derivative times.

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Decimal Point
Using the procedure given in paragraph 4.1 change mnemonic 'C6', character 'A', as follows:-

C6 (A)
Decimal Point Position.

A	= 0	XXXXX	Pyrometer	T/C or R.T.	Linear or Square Root
	= 1	XXXX.X			
	= 2	XXX.XX			
	= 3	XX.XXX			

Display Range.

dSL
dSh
Again use the procedure given in paragraph 4.1 to change the mnemonic 'dSL', display lower limit, and dsh, display higher limit. The values of these mnemonics are in display units. The maximum and minimum span of the display range is shown in the table below:-

	Recommended Min & Max ranges	Min Span
Iron /Constantan J	0C to 600C	100C
Fe/Konst(DIN)L	0C to 600C	100C
Ni Cr/Ni Al K	-250 to 1200C	125C
Cu/Con T	-250C to 400C	150C
Pt 13% Rh/Pt R	0C to 1600C	600C
Pt 10%Rh/Pt S	0C to1600C	600C
Pt30% Rh/Pt6% Rh B	0C to 1800C	1000C
W/W 26% Re	0C to 2300C	450C
W5% Re/W 26%	0C to 2300C	500C
Ni Cr/Con E	0C to 780C	100C
Pt 10% Rh/Pt40% Rh	200C to 1800C	1000C
W5% Re/W 26% Re C	0C to 2300C	500C
Pt20% Rh/Pt40% Rh	0C to 2000C	1900C
Platinel 11	0C to 1200C	150C
W/W 26% Re	0C to 2200C	500C
Ni/Ni 18% Molybdenum	0C to 1100C	600C
W3% Re/W 25% Re D	0C to 2400C	1000C
W/Re 5% W/Re 26%	0C to 2000C	1000C
Nicrosil/Nisil	0C to 1300C	150C
Pt100 ohm at 0C	-200C to 850C	50C
Pyrometer (Q004) Land)	800 to 1550C	5mV
Pyrometer (Q003 Land)	700C to 1400C	5mV
Pyrometer RO 26	100C to 500C	5mV
Pyrometer IVD1	1000C to 2500C	5mV
Pyrometer DT1	1200C to 2500C	5mV
Pyrometer DT1/10	1500C to 3000C	5mV
Pyrometer RO 23	800C to 1700C	5mV
Pyrometer FR/GP 10	500C to 900C	5mV
Pyrometer FP/GP 11	700C to 1300C	5mV
Pyrometer FP/GP 12	1000C to 1850C	5mV
PyrometerFP/GP 20	400C to 750C	5mV
Pyrometer FP/GP 21	500C to 1100C	5mV
Linear	-9000 to 19999	*
Sq. root	-9000 to 19999	*

* Note:For Linear and square root inputs sensitivity must not be less than 5µV/digit.

Refer also to :-
Section 4.20 Calibration Trim
Section 4.12 Security
Section 4.17 Second Setpoint
Section 4.4 Setpoint Limit.

4.4 To Change the Setpoint Limits

Hardware
There are no hardware changes associated with the setpoint limits.

Software

SPL
SPh
Carry out the procedure in paragraph 4.1.
The limits of the working setpoint are set by 'SPL', lower limit, and 'SPh', higher limit. The working setpoint is the current setpoint which can be either SP1, SP2, remote setpoint or programmer setpoint. The limits apply to all these setpoints. The values of these limits are in display units. 'SP1' can be set to any value higher or equal to 'dsL' and 'SPh' can be set to any value lower or equal to 'dSh'.

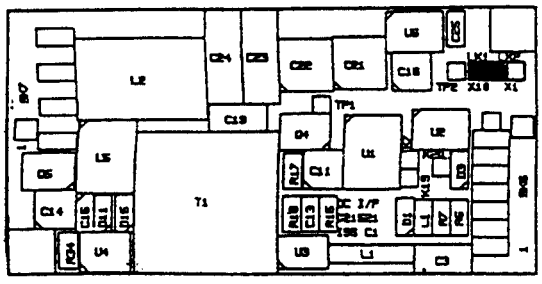
S2L
S2h
The limits of setpoint 2, (SP2) which on certain configurations becomes LSP are set by the mnemonics 'S2L' and 'S2h'. The values of the limits are in display units.
These limits can be set to any value within the complete range of the instrument i.e. - 9000 to 19999.

Refer also to:-
Section 4.5 Remote Inputs
Section 4.12 Security
Section 4.17 Second Setpoint.

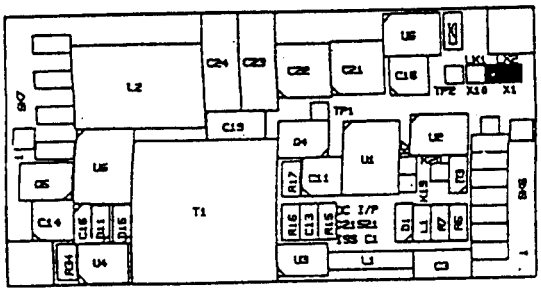
4.5 To Set or Change the Remote Setpoint

Hardware
A remote input is an analogue signal brought into the rear terminals via a d.c. input board.
This can either be part of an analogue communications board fitted into the communications slot on the instrument or via a remote input board fitted into output 4 (alarm 2) position. Install one of the above options and observe paragraph 8 of section 4.2.
Links must be set on these boards to the range of the input to either a 10 volt or a 1 volt span. The 1 volt span is used for current input, a 50 ohm resistor being fitted across the rear terminals. These links are shown below.

REMOTE INPUT BOARD

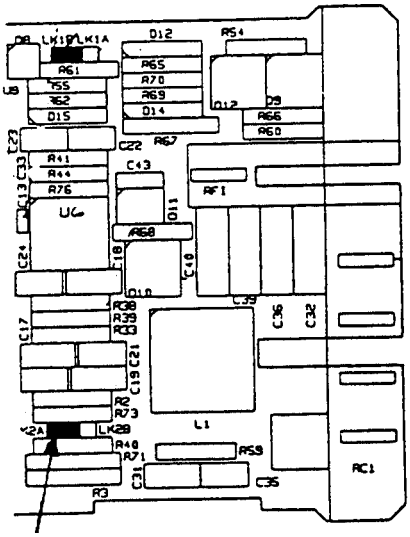


Select link 1 for a maximum span of 1 volt



Select link 2 for a maximum span of 10 volts

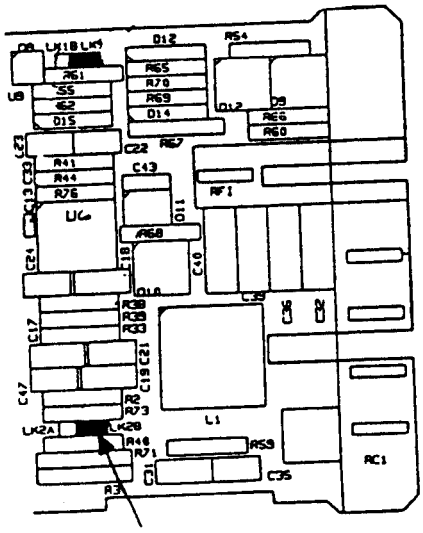
ANALOGUE COMMUNICATIONS BOARD
Max 10V input



Select LKB and LKA for High Voltage Input (maximum span of 10 volts lying between -5.0 and +10.0 volts).

Max range of 10 volts Input lying between -5.0 to 10.0 volts (Remote Setpoint)

Max 1V input



Select LKA and LKB for High Voltage Input (maximum span of 10 volts lying between -5.0 and +1.0 volts).

Max range of 1.0 volts Input lying between -0.5 to +1.0 volts (Remote Setpoint)

The other hardware change that may have to be made is the inclusion of the 50 ohm resistor across the rear terminals if the remote input is a 20mA current signal.
The part number of this resister assembly is given below:-

Instrument	Part Number of Resistor Assy.
With Screw Terminals	CA06650R
With fasten terminals	AH021618U002

Software

Using the procedure in paragraph 4.1

C3(C) Scroll to mnemonic 'C3' character 'C' and set to 'O' if a d.c. remote input board is plugged into alarm 2 position.

C7(D) Scroll to mnemonic 'C7' character 'D' and set to 'I' if an analogue communications board is plugged into the communications board position.

C5(B) Scroll to mnemonic 'C5' character 'B' and set to the type of remote setpoint required as shown in the table below:-

Remote Analogue Input and Second Setpoint
C5(B)

B.	= 0	No Remote	SP2 available
	= 1	Remote+Local SP (LSP)(Front/Rear)	SP2 Not available
	= 2	Remote+Local SP (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

Note: -
Setting a '1' or '2' gives a working setpoint of the remote signal plus the local setpoint LSP
Setting a '3' or '4' gives a working setpoint of the remote signal only.
A '5' or '6' set uses the remote signal to set the output power limit either in the heat or cool channel.

IcL
Ich

The mnemonics 'icL' and 'ich' calibrate the incoming analogue signal. This procedure is covered in the calibration section (see paragraph 7.5).
During this procedure the calibration points are displayed as a percentage of either 1 or 10 volts depending on the setting of the links in paragraph 4.5. The range of this display is 0-100% for a d.c. remote input board and -50 to +100% for the analogue communications board.

Note:-
If standard 20% offsets i.e. 1-5 volts, 2-10 volts, 4-20mA or 2-10mA are set using the procedure in (iv) above, no detection of an open circuit input (zero milliamps or volts) is provided.

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

C5(D)	If open circuit detection of the remote input circuit is required set mnemonic 'C5' character 'D' to a 'I' . The mnemonic 'icL' in (iv) above should then be calibrated with zero input. For all other values of input set C5(D) to zero.

Note :-
If C5(D) is set to 'I' and the input falls to below 12% of maximum , the output power will automatically be switched to the sensor break value (Sbr) until the input returns to a value > 12% of maximum.

riL rih	Set mnemonics 'riL' and 'rih' to the required limits in display units, corresponding to the range in external signal. 'riL' is the display value when the input is at its calibrated low. 'rih' is the display value when the input is at its calibrated high.

Note:-
Trim values are obtained by setting a 'riL' to a small negative number and 'rih' to a small positive number.

S2L S2h	If C5 (B) is set to a 'I' or '2' then 'S2L and 'S2H' have to be set to the limits of the range of the local setpoint (LSP). 'S2L' is the lower value and 'S2h' is the higher value.

Note:-
A local trim can be set by setting 'S2L' to a small negative number and 'S2h' to a small positive number.
Refer also to:-
Section 4.12 Security
Section 4.10 Digital Inputs
Section 4.13 Track/Hold

4.6 To Change the Heat or Cool Output

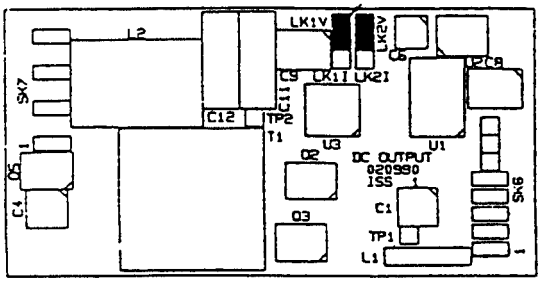
Hardware

The heat (channel 1) and cool (channel 2) output modules are situated on the power supply and options board respectively. The procedure given in paragraph 4.2 should be followed if either or both of these require changing. Addinga cool channel may also entail fitting an options board if it is not already installed.

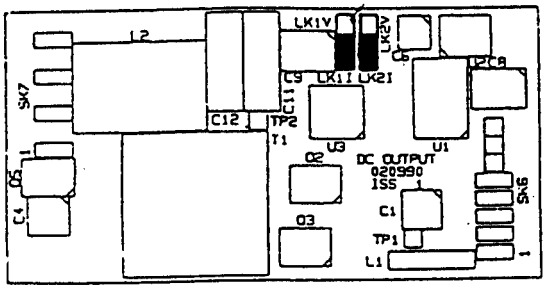
Note:-
Eurotherm part numbers for the output modules and options board can be found in chapter 8.

Links are fitted on two of the output modules, the dc and relay versions, and these must be correctly set before installing them into the instrument as shown below:-

D.C. (Output) Board

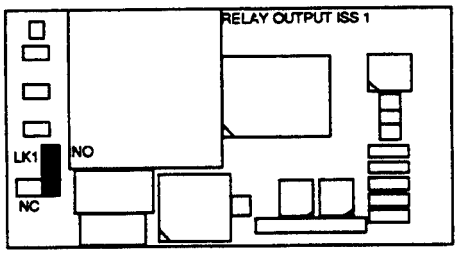


Position of links for Voltage Output

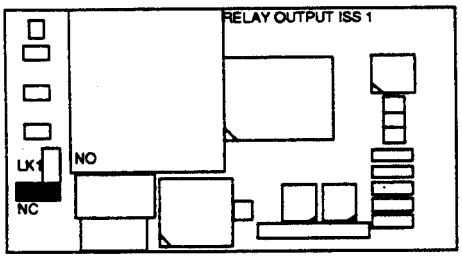


Position of links for Current Output

Relay Output Board



Snubber network (100 ohms resistor in series with 0.022µF capacitor) across normally open contacts of relay.



Snubber network (100 ohms resistor in series with 0.022µF capacitor) across normally closed contacts of relay.

Note:-
For the valve positioner version of the instrument one of the output modules, usually channel 1 is used to open the valve and channel 2 to close the valve (energise the other winding).

Software

Carry out the procedure in paragraph 4.1 and scroll to mnemonic 'C2' setting characters 'A' 'B' 'C' and 'D'.

C2(A) = 0 Output 1 and Output 2 Separate (derivative error driven).
= 1 Output 2 equals Output 1* (derivative error driven)
= 2 Output 1 and 2 separate (derivative PV driven)
= 3 Output 2 equals Output 1* (derivative PV driven)

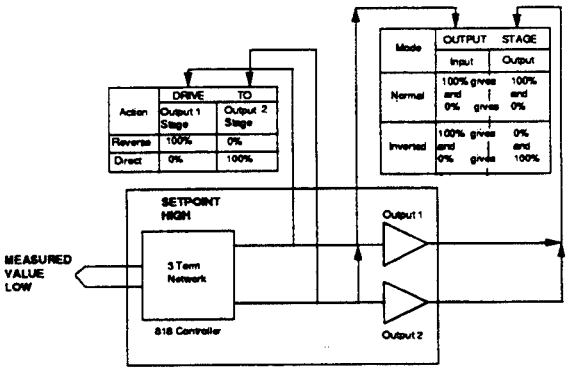
* Not available on valve positioner versions

Note: -
Setting '0' or '2' ensures that output 1 is driven by the heat signal and output 2 is driven by the cool signal. Selecting a '1' or a '3' ensures that both output 1 and output 2 are driven with the heat signal and the cool signal is not used.

C2(B) = 0 No power feedback, reverse acting
= 1 Power feedback, reverse acting
= 2 No power feedback, direct acting
= 3 Power feedback, direct acting.

Note: -
Setting a '0' or '1' gives reverse acting whilst a '2' or '3' gives direct acting as shown in the diagram.

Explanation of Normal/Inverted and Direct/Reverse



Note:-
Setting a '0' or a '2' will give Power feedback on output 1, the heat output. Power feedback is not operative for valve positioner instruments and dc outputs.

C2(C) = 0 Output 1- normal, output 2-normal (P.I.D.)
Output 1- raise, output 2- lower (V.P)
= 1 Output 1- normal, output 2-inverted (P.I.D)
Output 1- raise,, output 2 -lower (VP)
= 2 Output 1- inverted, output 2- normal (P.I.D.)
Output 1- lower, output 2 - raise (VP)
= 3 Output 1- inverted, output 2inverted (P.I.D.)
Output 1- lower, output 2 raise (VP)
= 4 Output 1- raise, output 2- lower, asymetric valve (VP)
= 5 Output 1- lower, output 2- raise asymetric valve (VP)

Note: -
This character sets the normal or inverted output as shown in the diagram above. On the valve position versions of software it sets the raise and lower outputs.

C2(D) = 0 PID heat no cool
= 1 PID heat PID cool (LINEAR)
= 2 PID heat PID cool (NONLINEAR)
= 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 pot.
= 8 PID heat O/P2 dig out. Control by programme

Note: -
Character 'D' sets each output channel to either give On/Off or PID control. The (NON-LINEAR) PID cool should be used on water cooling systems where the water is likely to be flashed 'off' to steam. For all other cooling systems the LINEAR version should be used.

Note: -
Setting a '6' or '7' on a non valve positioner version of the instrument will cause the error display 'C2E' to appear.

C1L, C1h, C2L, C2h | Scroll onto the mnemonics 'C1L', 'C1h', 'C2L' and 'C2h' which are used for the calibration of dc outputs.

Note:-
For output 2 (cool) use parameter in brackets.
Scroll to 'C1L' ('C2L') and set the value to represent the minimum output as follows:-
0% for 0mA or 0 Volts
20% for 4mA or 2 Volts etc.
Scroll to 'C1h' ('C2h') and set the value to represent the maximum output as follows:-
50% for 10mA or 5 Volts
100% for 20mA or 10 Volts etc.

The actual % output used can be adjusted about these nominal values to give a more accurate setting, by monitoring the output with a D.V.M. and adjusting the value required with the 'up' and 'down' buttons.

Note: -
With non-d.c. output stages fitted the value set in these mnemonics is ignored by the instrument.
Refer also to:-
Section 4.7 Valve positioner
Section 4.9 Retransmission

4.7 To Change the Valve Position Output

Hardware

Two versions of valve positioner controller exis. One uses a potentiometer driven by the valve motor to indicate valve position and stop the drive to the motor before the motor micro switches operate. The other does not use the feedback potentiometer at all.

The version without the position potentiometer uses the same hardware as the P.I.D. version of the controller. When using the position potentiometer a different version of the options board must be fitted. This plugs into the options position on the mother board and has sites for only two modules; one output and one alarm (alarm 1) . The correct output modules must then be plugged into the output sites. A change of option board even though the output and alarm modules are the same necessitates performing the routine outlined in paragraph 4.2; namely, scroll to 'Idn' and press the 'up' and 'down' buttons. Then scroll to "CLr' and again press the 'up' and 'down' buttons.

Note:-
Eurotherm part numbers for the options boards and output modules can be found in chapter 8.

Software Key
2.05 and below
2.07 and above
3.11 and above
4.11 and above

Software

Using the procedure in paragraph 4.1 scroll to mnemonic 'C2' and set charcter 'D' to either '6' or '7', depending upon the type of loop required, see table below:-

C2(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 pot
	= 8	PID heat	O/P2 dig out. Control by programme

Note: -
Values of '6' and '7' for C2 (D) are only possible on a basic valve positioner instrument, see third field of the ordering code Section 3.
Refer also to :-
Section 4.6.and 4.7 outputs.

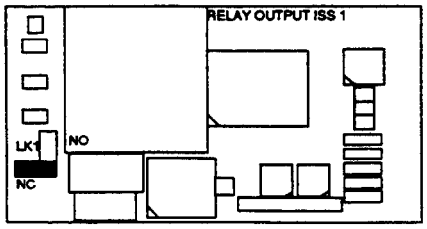
4.8 To Change the Alarms

Hardware

The alarm output modules are situated on the options board. The PID and valve positioner without feedback potentiometer versions have positions for two alarm modules whereas the valve positioner with the feedback potentiometer can only have one alarm output board.
It is possible to configure an alarm without an output module as a "soft" alarm which will only indicate the alarm on the front display or be interrogated via the digital communications link. A dc retransmission module may be installed into output 3 (alarm 1) position if retransmission is required. (see section 4.9). A dc remote input module may be installed into output 4 (alarm 2) position for a remote input signal. In all cases carry out the procedure outlined in section 4.2. before exiting after a change.

ALARM - RELAY OUTPUT:-

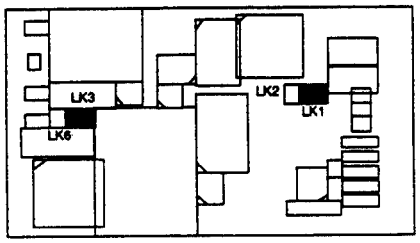
Fit the link in the required position on the relay module:



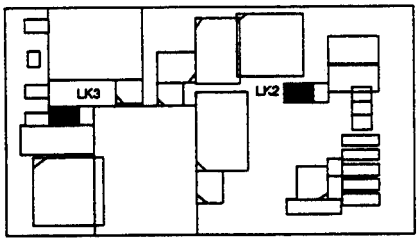
Snubber network (100 ohm resistor in series with 0.022µf capacitor) across normally closed contacts of relay.
Relay - De-energised in Alarm
Note: For relay energised in alarm fit the link in the NO position.

RETRANSMISSION (ALARM 1):-

Fit the links in the required position in the D.C. Output (Retransmission) Board



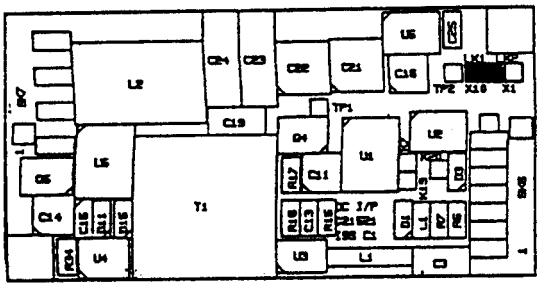
Position of links for current output.



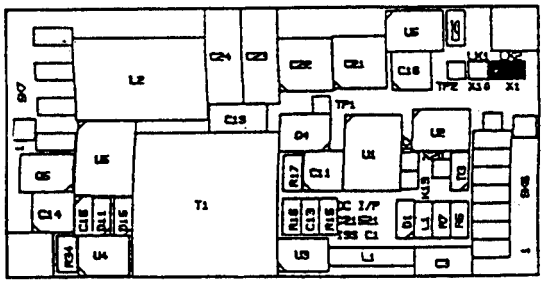
Position of links for voltage output.

REMOTE INPUT (ALARM 2):-

Fit the link in the required position in the D.C. (Remote Input) Board



Position of link for a maximum span of 1 volt (used for current input)



Position of link for a maximum span of 10 volts.

Software

Carry out the procedure outlined in paragraph 4.1 scrolling to mnemonic 'C3' and setting characters B and C to the value indicated in the table below. Character B defines alarm 1 and character C defines alarm 2.

C3 (B or C)	=	0	No alarm (retransmission possible on channel 3 or 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) 818P/4/15 only
	=	7	Digital output, control via comms

Note :-
Setting a 0 or 6 for these characters will disable the alarm.

Note :-
Setting a '6' gives drives to the alarm relays from segments of the programme.

Set also character 'D' of 'C3' as shown in the following table:-

Alarm Relay States
C3(D)

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.

Note:-
If '0' or '6' is set for C3 (B or C) then the value given in C3D is ignored by the controller.

Ah1 **Ah2**	Set mnemonics 'Ah1' and 'Ah2' to the hysteresis of alarm 1 and alarm 2 respectively. These mnemonics have a range of 0.1 to 10% of the display range.

Refer also to :-
Section 4.9 Retransmission
Section 4.5 Remote input
Section 4.12 Security

4.9. To Change a Retransmission Output

Hardware

One retransmission output only may be obtained from the instrument. This output is available from either:-

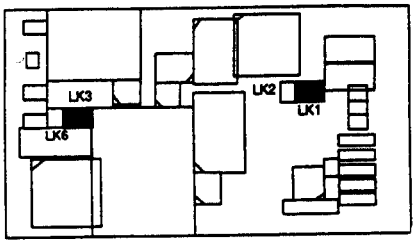
Output 2 (Cool)
or Output 3 (Alarm 1)
or The analogue communication board.

i) For retransmission signals from output 2 or 3, fit a d.c. retransmission output module into the relevant site.

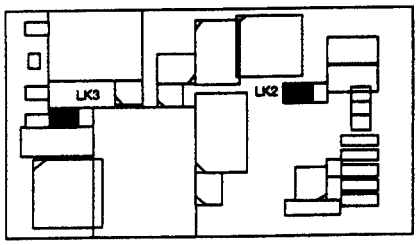
Note:-
Eurotherm part numbers of the output modules are given in chapter 8.0.

Set the links on this board to give the type of output required i.e. current or voltage, as diagram below.

D.C. OUTPUT (RETRANSMISSION) BOARD



Position of links for current output



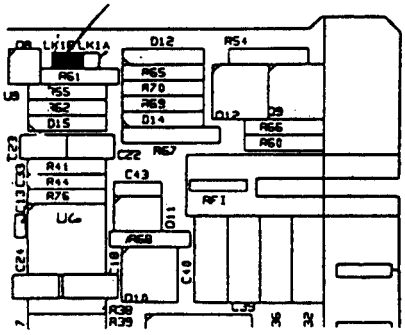
Position of links for voltage output

If the analogue communications board (Part No. SUB-SPARE-ANALG-COMM-BOARD) is to be used for retransmission this must be plugged into the communication board position.

Set the links on this board to give the output required either current or voltage as shown.

ANALOGUE COMMUNICATIONS BOARD

Voltage Output
(Retransmission)



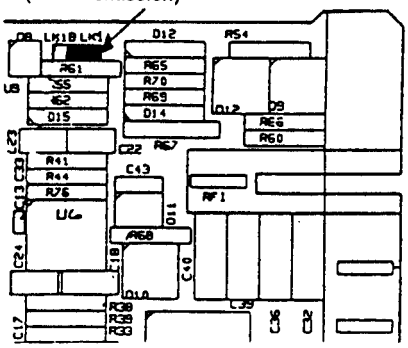
Link position for voltage output

Software Key

- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Link position for current output

Current Output
(Retransmission)



Carry out the procedure in chapter 4.2, to inform the instrument of the change.

Software

Carry out the procedure in chapter 4.1inserting the following mnemonics:-

C2(A)
C2(D)
If output 1 (cool) is to be used for retranmission the mnemonic 'C2 character 'A' must be set to either a '0' or a '2' and C2(D) must be set to either a '0' or a '5' as shown in the table below.

C2(A) = 0 output 1 and output 2 separate (derivative error driven)
= 1 output 2 equals output 1* (derivative error driven)
= 2 output 1 and output 2 seperate (derivative PV driven)
= 3 output 2 equals output 1* (derivative PV driven)

* Not available on VP versions

C2(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 pot.	
= 8	PID heat	O/P 2 dig out. Control by programme

C3(B)
If alarm 1 is to be used for retransmission then mnemonic 'C3' character 'B' must be set to '0'.

C7(D)
C7(C)
If an analogue communications board is to be used for a retransmission output then mnemonic 'C7' character 'D' must be set to '1' and character 'C' must be set to give the correct output as shown in the table below.

ANALOGUE COMMS RETRANSMISSION TYPE.
C7(C) = 0 Current
= 1 Voltage

COMMUNICATIONS HARDWARE.
C7(D) = 0 Digital
= 1 Analogue.

C2L
C2h
C3L
C3h
Calibration of retransmission outputs is achieved with 'C2L ' and C2h' for output 2 (cool) and 'C3L' and C3h for output 3 (alarm 1).
The range of these scalers is 0-100%.
100% for voltage outputs = 10 volts.
100% for current outputs = 20 mA.

roL
roh
For calibration of retransmission from the analogue communications board use 'rol' and 'roh'. The range of these scalers are 0-100% on current and -50% to +100% on voltage.
100% for voltage = 10 volts
100% for current = 20mA.

Note: -
In all cases the scalers suffixed with'L' set the lower end of the range whereas those suffixed with 'h' set the higher end.

On instruments fitted with software version below 3.11 the full range of the retransmission current or voltage will represent either
the full span range of the setpoint, or
the full span range of the linear measured value, or
± the full span range of measured value for error,or
0-100% power (on heat only instrument), or
-100% to +100% power (on heat/cool instruments)

rrL
rrh
On instruments fitted with software versions 3.11 and above the range of setpoint, measured value and error can be limited by the mnemonics 'rrL' and 'rrh'. Set 'rrL' to a value which represents the minimum retransmission signal and 'rrh' to a value which represents the maximum retransmission signal.

Set mnemonic'C5' character 'C' as in the table below:-
ANALOGUE RETRANSMISSION.

C5(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

Refer also to :-

Section 4.6 and 4.7	Outputs
Section 4.8	Alarms

4.10 To Change the Digital Inputs

Hardware
No hardware changes are required to change or implement this function.

Software
Carry out the procedure given in section 4.1 changing the mnemonics 'C4' characters 'A', 'C' and 'D' as shown in the table below:-

Supply Frequency and Digital Input 2

C4(A) = 0 50 ± 2Hz and 60 ± 0.3Hz
= 1 60 ± 2Hz
= 2 50 ± 2Hz and dig in 2 = PID 2 / PID 1
= 3 60 ± 2Hz and dig in 2 = PID 2 / PID 1
= 4 50 ± 2Hz and dig in 2 = Prog no. monitor/ step
= 5 60 ± 2Hz and dig in 2 = Prog no. monitor/ step

For C4(A) = 2, 3, 4 or 5 it is necessary to set C4(C) = 9.

Digital Input 2

C4(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. (programmer 818P/4/15 only)
= 9 Refer to digit (A)

Digital Input 1

C4(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 (C4(C) ignored)
= 7 parameter modification security
= 8 skip Current Segments(programmer 818P/4/15 only)
= 9 Second Setpoint.

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

Refer also to:-

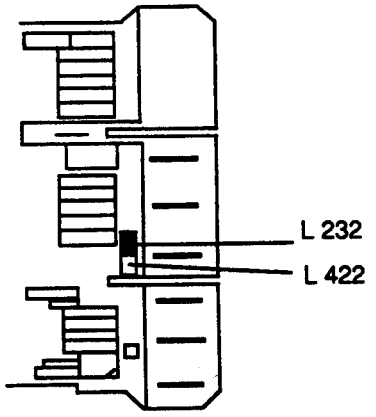
Section 4.17	Second Setpoint
Section 4.5	Remote Input
Section 4.12	Security
Section 4.14	Normal and Fast self tune
Section 4.15	Ramp
Section 4.16	Programming

4.11 To Change the Digital Communications

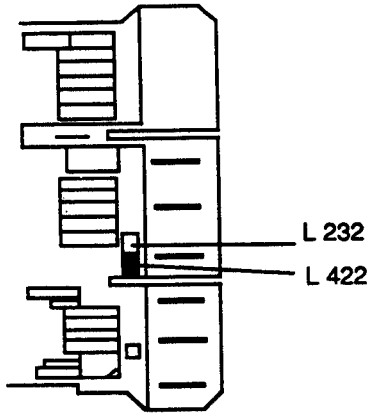
Hardware
Carry out the procedure as in section 4.2 to install the digital communications board Eurotherm part no. SUB-SPARE-DIGCOMM-BOARD. This is plugged into the communications board position on the mother board.

The link on the back of the digital communications board should be set to the communications standard, RS232 or RS422/485 as shown in the diagram below:-

DIGITAL COMMUNICATIONS BOARD



Link position for RS 232 communications



Link position for RS 422/485 communications

Software Key
2.05 and below
2.07 and above
3.11 and above
4.11 and above

Software

Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set mnemonic 'C7' character 'D' to zero as shown in the table below:-

COMMUNICATIONS HARDWARE
C7(D) = 0 digital
= 1 analogue

Set mnemonic 'C5' character 'A' to select the baud rate of the communications as shown in the table below:-

DIGITAL COMMS SPEED
C5(A) = 0 9600 Baud
= 1 4800 Baud
= 2 3600 Baud
= 3 2400 Baud
= 4 1200 Baud
= 5 600 Baud
= 6 300 Baud

Note: A setting of '6' (300 Baud) is not permissible for J- bus or Modbus.

Add | Set mnemonic 'Add' to the required address for the particular instrument. The value of the address can be varied for 0.0 to 9.9.

Set the mnemoic 'C6' character 'D' as shown in the list below:-

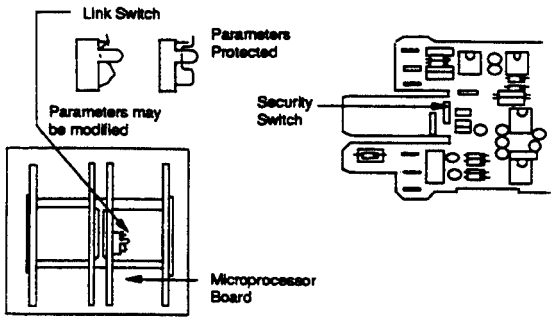
COMMUNICATION TYPE.
C6(D) = 0 Ascii Bi-Synch Communications

=	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.

4.12 To Change the Security

Hardware

One feature of the security, making certain values in the commissioning list read only, can be enabled by a switch on the rear of the microprocessor board, see diagram below. Alternativly enabled by a digital input or via digital communications.



Software

Carry out the procedure in section 4.1 to amend the following mnemonics:-
Select the commissioning values that are required to be read only by setting mnemonic 'C4' character 'B' in the table below:-

PARAMETER MODIFICATION SECURITY
C4(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 rate parameters
= 5 all parameters may be modified

Set mnemonic'C4' character "D" to the value given in the table below. This selects digital input 1 to switch either the 'keylock' or the 'parameter modification security' feature, desribed in (i) above.

DIGITAL INPUT1
C4(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 must be set to '0' if this option selected)
= 7 parameter modiification security
= 8 skip Current Segment
= 9 Second Setpoint.

* Software previous to 4.11 function is only reset.

The auto/manual switching facility can be disabled by setting the mnemonic 'C6 ' character 'B' shown below.

AUTO MANUAL SELECTION
C6(B) = 0 no manual
= 1 manual front/rear
= 2 manual rear only

The local/remote switching facility can be disabled by setting the mnemonic 'C5' character'B' as shown below:-

REMOTE ANALOGUE INPUT AND SECOND SETPOINT

C5(B) =	0	No remote	SP2 available
=	1	remote + local setpoint (LSP) (Front/Rear)	SP2 not avail.
=	2	remote + local setpoint (LSP) (rear only)	SP2 not avail.
=	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

The auto tune facilities can be disabled from the front push buttons by setting the mnemonic 'C7' character 'B' as shown below.

SELF AND ADAPTIVE TUNE
C7(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

The 'run/hold' button to operate the ramp facility can be disabled by setting mnemonic 'C8' character 'C' as shown below:-

RUN/HOLD, SELECTION
C8(C) = 0 run/hold front/rear
= 1 run/hold rear only.

The' run/hold' button and the 'reset' feature, i.e. depressing both the 'up' and 'down' buttons, can be disabled on the 818P by setting the mnemonic 'C8' character'C' as shown below:-

RUN/HOLD, RESET, SELECTION
C8(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)

Refer also to:-
Section 4.5 Remote input
Section 4.10 Digital inputs
Section 4.14 Normal and Fast self tune
Section 4.15 Ramps
Section 4.16 Programming

4.13 To Change the Track/Hold Facility

Hardware
No hardware changes are required to modify this feature.

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-

The value of the mnemonic 'C6' character 'C' sets the track or hold facility for both auto/manual and local/remote as shown below:-

SETPOINT TRACK MODE
C6(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 setpoint tracks PV
= 2 while in remote SP, SP1 tracks working SP
while in manual, hold working setpoint
= 3 while in remote SP, SP1 tracks working SP
while in manual, working setpoint tracks PV

4.14 To Change from Normal to Fast Self Tune

Hardware
No hardware changes are required to modify this feature.

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set the mnemonic 'C7' character 'B' to a value shown below:-

SELF AND ADAPTIVE TUNE
C7(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

4.15 To Change the Ramp Function

Hardware
No hardware changes are required to modify this feature.

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-
The value of mnemonic 'C8' character 'B' should be set as below to specify the ramp rate in display units per minute or per hour.

SEGMENT TIMES
C8(B) = 0 ramp in minutes
= 1 ramp in hours

The value of mnemonic 'C8' character 'D' should be set as below:-

CONTROLLER ACTION
C8(D) = 0 no ramp function
= 1 ramp function

The value of mnemonic'C8' character 'A' must be set to '0'.

Refer also to section 4.10 Digital Inputs.

Software Key
2.05 and below
2.07 and above
3.11 and above
4.11 and above

4.16 To Change the Programme Function on models 818P, 818P4 and 818P15

Hardware

No hardware changes are required to modify this feature

Software

Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set the mnemonic 'C8' character 'A' to select the required type of holdback and ramp resolution as shown below:-

C8(A)	=	0	No H/back	Norm Res Ramp Rate
	=	1	Band Dev H/back	Norm Res Ramp Rate
	=	2	High Dev H/back	Norm Res Ramp Rate
	=	3	Low Dev H/back	Norm Res Ramp Rate
	=	4	No H/back	High Res Ramp Rate
	=	5	Band Dev H/back	High Res Ramp Rate
	=	6	High Dev H/back	High Res Ramp Rate
	=	7	Low Dev H/back	High Res Ramp Rate

Set the mnemonic 'C8' character 'B' to select the ramp rates in display units/minute or/hour and the dwell times in hours or minutes as shown below:-

SEGMENT TIMES

C8(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)

Set the mnemonic 'C8' character D to select either a controller with none of these features or ramp feature only or the programme feature with the ramp set as a rate or as a time to achieve the target setpoint. This mnemonic should be set as below:-

CONTROLLER ACTION

C8(D)	=	0	no ramp function or programmer
	=	1	ramp function
	=	2	programmer (Ramp set as a rate)
	=	3	programmer (Ramp set as a time to target)
	=	4	Multi programmer (Ramp set as a rate)
	=	5	Multi programmer (Ramp set as a time to target)

Refer also to:-
Section 4.10 Digital Input

4.17 To Change Control of Second Setpoint

Hardware

No hardware changes are required to modify this feature.

Software

Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set the mnemonic 'C4' character 'C' if it is required to select the second setpoint with digital input 2 as below:-

DIGITAL INPUT 2

C4(C)	=	0	none
	=	1	auto/manual
	=	2	remote analogue input enable
	=	3	self tune
	=	4	ramp function
	=	5	run/hold (programmer 818P only)
	=	6	hold/run (programmer 818P only)
	=	7	second setpoint
	=	8	skip Current Segment
	=	9	Refer to digit (A)

Set the mnemonic 'C4' character 'D' if it is required to select the second setpoint with digital input 1 as below:-

DIGITAL INPUT 1

C4(D)	=	0	none
	=	1	auto/manual
	=	2	remote analogue input enable
	=	3	adaptive tune
	=	4	keylock
	=	5	reset (programmer 818P only)
	=	6	dig input 1 - up key (C must be set to 8) dig input 2 - down key (if this opt'n select')
	=	7	parameter modification security
	=	8	skip Current Segments
	=	9	Second Setpoint

4.18 To Change the Scaling of the Proportional Band

Hardware

No hardware changes are necessary to modify this feature.

Software

Carry out the procedure in section 4.1 to amend the following mnemonic:-
Set the mnemonic 'C3' character 'A' as below to set the proportional band either in percentage or display units.
Proportional Band

C3(A)	=	0	prop band in percentage	Single set of commissioning values
	=	1	prop band in display units	
	=	2	prop band in percentage	Dual set of commissioning values
	=	3	prop band in display units	

4.19 To Change the Integral and Derivative Terms

Hardware
No hardware changes are necessary to modify this feature.

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set the mnemonics 'C1' character 'B' as shown below:-

C1(B) = 0 °C'ti and td in secs
= 1 °F' ti and td in secs
= 2 'K' ti and td in secs
= 3 °C'ti and td in mins
= 4 °F' ti and td in mins
= 5 'K' ti and td in mins

Set the mnemonic 'C2' character 'A' as shown below:-

C2(A) = 0 output 1 and output 2 seperate — Derivative driven by error signal
= 1 output 2 takes same PID/manual o/p as output 1 — Derivative driven by error signal
= 2 output 1 and 2 seperate — Derivative driven by process variable
= 3 output 2 equals output 1 — Derivative driven by process variable

4.20 To Change Units of Calibration Trim

Hardware
No hardware changes are necessary to modify this feature

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set the mnemonic 'C1' character 'A' as shown below:-

C1(A) = 0 internal CJC — (Cal trim in µV)
= 1 external 0°C — (Cal trim in µV)
= 2 external 45°C — (Cal trim in µV)
= 3 external 50°C — (Cal trim in µV)
= 4 internal CJC — (Cal trim in eng. units)
= 5 external 0°C — (Cal trim in eng. units)
= 6 external 45°C — (Cal trim in eng. units)
= 7 external 50°C — (Cal trim in eng. units)

4.21 To Change Bandwidth of the Measured Value Input Filter

Hardware
No hardware changes are necessary to modify this feature.

Software
Carry out the procedure in section 4.1 to amend the following mnemonics:-
Set mnemonic 'C4' character 'A' as shown below:-

Supply Frequency and Digital Input 2
C4(A) = 0 50 ± 2Hz and 60 ± 0.3Hz
= 1 60 ± 2Hz
= 2 50 ± 2Hz and dig in 2 = PID 2 / PID 1
= 3 60 ± 2Hz and dig in 2 = PID 2 / PID 1
= 4 50 ± 2Hz and dig in 2 = Prog no. monitor/ step
= 5 60 ± 2Hz and dig in 2 = Prog no. monitor/ step

For C4(A) = 2, 3, 4 or 5 it is necessary to set C4(C) = 9.

4.22 To Change Dual PID Facility

This facility, when configured, gives a second set of commissioning parameters. (Pb2, ti2, rs2, td2, Cr2 and AP2 as applicable).

Hardware
No hardware changes are necessary to modify this feature.

Software
Note this facility is only available in instruments fitted with software 3.11 and above and is protected by a security code. Use the configuration procedure outlined in chapter 4.1 to change the following mnemonics and select dual commissioning parameters.

Set the mnemonic 'C3' character 'A' as shown below:-

Proportional Band
C3(A) = 0 prop band in percent — Single set of commisioning parameters
= 1 prop band in display units — Single set of commisioning parameters
= 2 prop band in percent — Dual set of commissioning parameters
= 3 prop band in display units — Dual set of commissioning parameters

Normally the second set of comissionimg parameters is selected simultaneously when selecting second setpoint. This is achieved either via digital communications, or by configuring digital inputs.

The active setpoint may be selected by digit A, bit 13 of the Status Word (SW). (see chapter 5.0)

The active setpoint may also be selected with a digital input by configuring C4;
C4 (D) = 9 to select second setpoint with Dig in 1 or
C4 (C) = 7 to select second setpoint with Dig in 2.
(see 4.10)

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

In addition to this above strategy instruments with software version 4.11 or later may be configured to switch setpoint and commissioning parameters independently. This will allow, for example, the second commissioning parameter set to be selected while a programme is running.
Again the facility may be activated either via digital communications, or by configuring digital inputs.

Via digital communications, setting digit C, bit 4, of the Extension Status Word (XS), enables setpoints and commissioning parameters to be independently selected.
The active setpoint may be selected by digit A, bit 13 of the Status Word (SW).
The active commissioning parameter set may be selected by digit C, bit 5 of the Extension Status Word (XS).
(see chapter 5.0)

As before the active setpoint may also be selected with a Digital input by configuring C4;
C4(D) = 9 to select second setpoint with Dig in 1 or
C4(C) = 7 to select second setpoint with Dig in 2
(see 4.10)

To select the active set of commissioning parameters with a Digital input, configure C4(C) = 9 (Refer to Digit A).
C4, Digit A is then configured to define the function of Digital input 2;

Supply Frequency and Digital Input 2

C4(A) = 0 50 ± 2Hz and 60 ± 0.3Hz
= 1 60 ± 2Hz
= 2 50 ± 2Hz and dig in 2 = PID 2 / PID 1
= 3 60 ± 2Hz and dig in 2 = PID 2 / PID 1
= 4 50 ± 2Hz and dig in 2 = Prog no. monitor/ step
= 5 60 ± 2Hz and dig in 2 = Prog no. monitor/ step

For C4(A) = 2, 3, 4 or 5 it is necessary to set C4(C) = 9.

Refer also to:-
Section 4.10

4.23 Mnemonics with Constant Values

The following mnemonics are always set to the same value as shown below.
C7(A) Mnemonic 'C7' character 'A' is always set to '0'
C8(A) [818S] Mnemonic 'C8' character 'A' in a 818S controller is always set to '0'.

Chapter 5.0
Configuration Parameters and their Ranges

5.0 CONFIGURATION PARAMETERS AND THEIR RANGES

C1

INPUTS AND UNITS (C1) = 'ABCD'

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

(B)	= 0	°C' ti and td in secs	UNITS
	= 1	°F' ti and td in secs	
	= 2	°K' ti and td in secs	
	= 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 TYPE	
	= 11	C	(24)		
	= 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	Q009	(46)	DT1	(62)
	= 20	Q002	(50)	DT1/Z1680	(63)
	= 21	Q003	(51)		
	= 22	Q005	(57)	RO23	(64)
	= 23	Q007	(58)	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)

C2

PID AND OUTPUTS (C2) = 'ABCD'

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

* 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.

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

C3

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

C4

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 rate parameters
	=	5	all parameters may be modified

C4(D) determines how many of the scroll parameters may be modified when the security access allows;

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.
3) The digital communications has engaged the feature.

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.

C5
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 configuration of the input to the analogue communications or 'outputs' 2 or 3.

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

C6
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

Software Key
2.05 and below
2.07 and above
3.11 and above
4.11 and above

C7

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	Normal tune on instruments with cool channel
	= 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	

Analogue Communication Retransmission type

(C)	= 0	current
	= 1	voltage

Communication Hardware

(D)	= 0	digital
	= 1	analogue

C8

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.

Idn

Output Hardware Idn = 'A,B,C,D,'

CH4

(Alarm 2)	= 0	none
	= 1	relay
	= 3	triac
	= 5	remote input signal
	= 6	V.P. Potentiometer

CH3

(Alarm 1)	= 0	none
	= 1	relay
	= 3	triac
	= 4	d.c. retransmission

CH2

(Cool)	= 0	none
	= 1	relay
	= 2	logic
	= 3	triac
	= 4	d.c.

CH1

(Heat)	= 0	none
	= 1	relay
	= 2	logic
	= 3	triac
	= 4	d.c.

RANGE LIMITS

Mnemonic	Function	Default values when shipped from factory	Comments
dSL dSh	= display low limit = display high limit		Used to define the maxinum operational span of the instrument. Maximum range - 9999 to 19999 Thermocouple, RT and Pyrometer inputs are limited to the working range of the selected input type (see Section 3.0).
SPL SPh	= setpoint 1 / working setpoint low limit = setpoint 1 / working setpoint high limit	SPL = dSL SPh = dSh	Used to define the maximum operational span of the effective instrument setpoint. Maximum range -9999 to 19999
S2L S2h	= setpoint 2 low limit = setpoint 2 high limit	Standard: S2L = dSL, S2h = dSh Local Trim: - 10% dSh, + 10% dSh	Used to define the maximum operational span of the second setpoint parameter. Maximum range - 9999 to 19999.
Ah1 Ah2	= alarm 1 hysteresis = alarm 2 hysteresis	= 0.1%	Used to define the level of hysterisis to be employed for each of the two possible alarms. Maximum range 0.1 to 10% of input range.
Add	= communications address	= 0.0	Instrument identifier used in conjunction with digital comms. Range 00 to 99.
c1L c1h c2L c2h c3L c3h	= output 1 low calibration = output 1 high calibration = output 2 low calibration = output 2 high calibration = output 3 (alarm 1) low calibration = output 3 (alarm 1) high calibration		The hardware defines the maximum range of these outputs as 0-10 volts or 0-20mA. These hardware limits therefore define the limits of the software scalers for each output which is expressed as 0-100%. Calibration of the span and zero of retransmission outputs can be accomplished by fine tuning these parameters whilst observing the true output with a suitable digital meter. Example :- For a 0-5 volt output requirement set the high range scaler to 50% and the low range scaler to 0%. For a 4-20mA output requirement set the high range scaler to 100% and the low range scaler to 20%.
roL roh	= retransmission low output calibration = retransmission high output calibration		Calibration of the output voltage/current as a percentage of 10 volts/20mA when retransmission is from the analogue comms board.
rrL rrh	= retransmission low display scaler = retransmission high display scaler		Defines the display unit changes of the retransmission output.
riL rih	= remote input low range scaler = remote input high range scaler	remote S/P+ local trim: ril = display min, rih = display max max power: 0, 100 remote trim: -10%, +10% (of display range)	Defines the change in the display units for the full change in the input voltage/current.
PcL Pch	= potentiometer low calibration = potentiometer high calibration	0% 100%	

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Chapter 6.0
Digital Communications

The 818 controller is designed to operate with either RS232 or RS422(485) digital communications.
Many of the modes of operation that can be set by the push buttons on the front of the instruments or the digital inputs at the rear of the instrument can alternatively be activated by the digital communications link.
Whilst the communications link is active a legend on the display will be illuminated.
Access to the facilities, keylock and parameter modification, via digital communications can be disabled by closing a link on the microprocessor board (see 4.12).
With the link open these facilities are availabe.

6.1 Communications Protocol

Three types of protocol are available on the 818 controller as shown below:-
a) ASCII BI-SYNCH
b) J-BUS® R.T.U.*
c) MODBUS ® RTU*

For the instruments that leave the factory configured for J-BUS® RTU and MODBUS® RTU a separate protocol booklet, part number HA02450, is included with the installation information.
For this reason only the ASCII BI-SYNCH communications system will be dealt with in this section.
* Only available on instruments fitted with version 3.11 software and above.

6.2 ASCII BI-SYNC Communications Protocol

Message Structure

REQUEST FOR DATA

Host transmission

EOT	UNIT ADDRESS (1)	MNEMONIC	ENQ

818 response

STX	MNEMONIC (2)	DATA (3)	ETX	BCC (4)

Host either repeats transmission message
or ACK (for polling mnemonics list)
or NAK (for repeat of mnemonic with latest value)

REQUEST TO CHANGE VALUES

Host transmission

EOT	UNIT ADDRESS (1)	STX	MNEMONIC	DATA (2)

ETX	BCC (3)

818 response either
ACK (Change has taken place)
or NAK (Change has been aborted)

Host either repeats transmission message
or for further changes in the same instrument:

STX	MNEMONIC	DATA (2)	ETX	BCC (3)

Note (1) Unit Address
Four characters long, consisting of the instrument address, appearing under the configuration mnemonic 'Add', with each digit repeated. For example an instrument address of '53' would give a unit address of '5533'.

Note (2) Data Format
Five or six character are assigned to data. Data can be either free or fixed format set by bit , '0' of character 'D' of the status word 'SW'.

Fixed Format:-
In this format all 5 character position must be filled, and for negative values, the decimal point is replaced by a minus sign.
Therefore + 5.3 can be entered as :
(5.300)
(05.30)
or (005.3)

and -5.3 can be entered as :
(5-300)
(05-30)
(005-3)
This system has the advantage that you have the same resolution for positive and negative numbers.

Free Format:-
In this system all six character positions need not be filled. A negative number is designated by a negative sign in front of the number, a value of 13.9 can be entered in any of the following forms:-
(0013.9)
(13.9)
(13.90)
(13.9)

and -2 can be entered as:

(-2.0)
(-2.0)
(-2)
(-2.)
(-2)
(-02.00)
(-2.000)

Status Word Data:-
Again 5 character are used but the first character is always a '>' sign to signify that the other 4 character in the data are hexadecimal.

Software Key
- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Note (3) B.C.C.:
Binary check sum, a verification code which is generated by taking the exclusive OR of the ASCII values of all the characters transmitted after but excluding (STX) up to and including (ETX).

For further information regarding the protocol and mnemonics used in the digital communications link, refer to the communications instruction book part number HA020161.

6.3 Communications Mnemonics

The order of this table is that which would be obtained if a fast poll was performed commencing from measured value (PV). Only parameters applicable to the particular instrument are displayed in the poll.

MNEMONIC	PARAMETER	AVAILABILITY
PV	Measured Value	Always available (R/O)
SP	Working Setpoint	Always available (R/O)
OP	Output	Always available
SW	Status Word	Always available
OS	Opt'l Status Word (See 6.4)	Always available
XS	Extend'd Status Word	Always available
1A	Alarm 1	Configuration dependent
2A	Alarm 2	Configuration dependent
ER	Error	Always available (R/O)
SL	Local Setpoint (SP1)	Configuration dependent
S2	Setpoint 2 (SP2)	Configuration dependent
RT	Local Setpoint Trim	Configuration dependent
MP	V.P. Pot Value	Configurable (R/O)
RI	Remote Input	Remote I/P Configured but not as Power Limit (R/O)
01	Status Word 1	Programmer configured
02	Status Word 2	
03	Status Word 3	
04	Status Word 4 (See 6.4)	
05	Status Word 5	
06	Status Word 6	
TM	Time remaining in current programme segment	Programmer configured and a programme is running or in Hold or Ramp function configured and ramp active
LR	Loops remaining for current programme	Programmer configured and a programme is running or in hold.
r1	Ramp rate 1 or Time to Target 1	Programmer configured
l1	Ramp level 1	Programmer configured
t1	Dwell time 1	Programmer configured
r2	Ramp rate 2 or Time to Target 2	Programmer configured
l2	Ramp level 2	Programmer configured
t2	Dwell time 2	Programmer configured
r3	Ramp rate 3 or Time to Target 3	Programmer configured
l3	Ramp level 3	Programmer configured
t3	Dwell time 3	Programmer configured
r4	Ramp rate 4 or Time to Target 4	Programmer configured
l4	Ramp level 4	Programmer configured
t4	Dwell time 4	Programmer configured
r5	Ramp rate 5 or Time to Target 5	Programmer configured
l5	Ramp level 5	Programmer configured
t5	Dwell time 5	Programmer configured
r6	Ramp rate 6 or Time to Target 6	Programmer configured
l6	Ramp level 6	Programmer configured
t6	Dwell time 6	Programmer configured
r7	Ramp rate 7 or Time to Target 7	Programmer configured
l7	Ramp level 7	Programmer configured
t7	Dwell time 7	Programmer configured
r8	Ramp rate 8 or Time to Target 8	Programmer configured
l8	Ramp level 8	Programmer configured
t8	Dwell time 8	Programmer configured
Hb	Holdback value	Programmer configured with holdback
Lc	Loop count	Programmer configured
RR	Ramp rate	Ramp function configured

MNEMONIC	PARAMETER	AVAILABILITY
HO	Max.Heat	Controller with PID heat
LO	Max cool	Controller with PID cool
RH	Remote Heat Limit	PID heat + remote as heat Limit (R/O)
RC	Remote cool limit	PID cool + remote as cool limit (R/O)
HS	Setpoint 1 maximum	Always available (R/O)
LS	Setpoint 1 minimum	Always available (R/O)
H2 (TH)*	Setpoint 2 maximum	Config. dependent (R/O)
L2 (TL)*	Setpoint 2 minimum	Config. dependent (R/O)
H3	Local setpoint Maximum	Configuration dependent
L3	Local setpoint Minimum	Configuration dependent
2H	Remote Max Scaler	Configuration dependent
2L	Remote Min Scaler	Configuration dependent
CH	Cycle time for channel 1	Channel 1 configured as time proportioning.
XP	Proportional band	PID heat configured
TI	Integral time	PID heat configured
MR	Manual Reset	On/Off,P or PD controller
TD	Derivative time	PID heat configured
HB	Cutback high	PID heat configured
LB	Cutback low	PID heat configured
RG	Reliative cool gain	PID heat/cool configured
P2**	Proportional band (2)	PID heat configured
I2	Integral time (2)	PID heat configured
R2	Manual reset (2)	On/off or P or PD controller
D2	Derivative tune (2)	PID heat configured
G2	Relative cool gain (2)	PID heat/cool configured
AU**	Approach (2)	VP configured
HC	Heat cool deadband	Heat/cool instrument
CC	Cool cycle time	Heat/cool instrument + time proportioning O/P 2
C2	Channel 2 cycle time	Heat with dual O/P + time proportioning O/P 2
AL**	Approach Limit	VP configured
TT	Travel Time	VP configured
Tt	Travel time down	VP configured
MT	Minimum on time	VP configured
TP	Valve update time	VP configured
HC**	Deadband	VP configured
LE	Motor Low Limit	VP configured
EH	Motor High Limit	VP configured
PE	Emissivity	Pyrometer configured
BP	Power level at sensor break	Always available
TR	Adaptive tune trigger point	Always available
Vø	Software version	Always available (R/O)
II	Instrument identity	Always available (R/O)
1H	Display maximum	Always available (R/O)
1L	Display minimum	Always available (R/O)

* Mnemonics used for local trim.
** Only available on software version 3.11

Note 1 :- The true limit of PV are 1H + 10% of (1H - 1L) to 1L - 10% of (1H -1L)
Note 2 :- R/O = Read Only

6.4 Status Words

Digits 'ABCD' are ASCII characters representing a hexadecimal digit (0-9, A-F).

Status Word (SW)

Format (> ABCD)

Digit	Bit	Function	Attribute	Clear / Set
D	0	Data format	R/W	Free / Fixed (see note 2)
D	1	Sensor break	R/O	No / Yes
D	2	Key lock	R/W	Keys enabled / disabled
D	3	N/A		
C	4	N/A		
C	5	Parameter changed via keys	R/W	No / Yes
C	6	N/A		
C	7	N/A		
B	8	Alarm 2 state	R/O	Off / On
B	9	N/A		
B	10	Alarm 1 state	R/O	Off / On
B	11	N/A		
A	12	Alarm active	R/O	No alarm/New alarm 1 or 2
A	13	SP 2 active	R/W	SP 1 / SP 2
A	14	Remote active	R/W	Local / Remote
A	15	Manual mode	R/W	Auto / Man

Optional Status Word (OS)

Format (>ABCD)

For programmers the numerical value of digit D (bits 0-3) has a value from 0-6 indicating the programme status.

Digit	Function	Attribute
D = 0	Reset programme / ramp	R/W
D = 1	N/A	
D = 2	Run programme / ramp	R/W
D = 3	Hold programme	R/W
D = 4	Programme end	R/O
D = 5	Ramp end (still active*)	R/O
D = 6	Programme in holdback	R/O

* After completing a ramp, should PV deviate from SP1, the working setpoint will ramp back to SP1 at the current ramp rate.

Digit	Bit	Function	Attribute	Clear / Set
C	4	Hold logged	R/O	Continue/hold
C	5	Skip current segm't	R/W	Remain/skip
C	6	Ramp/dwell	R/O	Ramp/dwell
C	7	Digital input lock	R/W	Enable/disable
B	8	Segment no.(LSB)	R/O	note 1
B	9	Segment no.		
B	10	Segment no.		
B	11	Segment no.(MSB)		
A	12	Digital O/P2 (Output 4)	note 2	Off / on
A	13	Digital O/P1 (Output 3)	note 2	Off / on
A	14	Digital Input 2	R/O	Off / on
A	15	Digital Input 1	R/O	Off / on

Notes :-

1) Segment number is a nibble having the value 1 to 8 read only.
2) Bits 12 and 13 are normally R/O. In versions 4.11 or higher they become Read/Write if digital output 1 or 2 are configured to be controlled via communications. C3(B) = 7 or C3(C) = 7

Extension Status Word (XS)

Format (>ABCD)

Digit	Bit	Function	Attribute	Clear / Set
D	0	Self tune	R/W	Off/on
D	1	Adaptive tune	R/W	Off/on
D	2	Spare		
D	3	Spare		
C	4	PID control	R/W	SP+PID/PID independ't
C	5	Active PID set	R/W	PID 1 / PID 2
C	6	Digital output 0	R/W	Off/on
C	7	Spare		

For programmers the numerical value of digit B, (bits 8 to 11) is used to select or monitor the active programme number.

Digit B	Function	Attribute
B = 0	818P Single Programme	R/O
B = 1 - 4	818P4 Programme no.	R/W
B = 1 - 15	818P15 Programme no.	R/W

For valve positioners the numerical value of digit A (bits 12 to 15) is used to control or monitor the raise and lower outputs.

Digit A	Function	Attribute	
		Auto	Manual
A = 0	Outputs off	R/O	R/W
A = 1	Lower output on	R/O	R/W
A = 2	Raise output on	R/O	R/W
A = 3	Lower nudge*	-	W/O
A = 4	Raise nudge*	-	W/O

* Nudge is a pulse of minimum on time.

Digital Output Status Word 1 (01)

Format (>ABCD)

Status of output 3 during each segment

Digit	Bit	Segment	Attribute	Clear / Set
D	0	ramp 1 to output 3	R/W	Non active/active
D	1	dwell 1 to output 3	R/W	Non active/active
D	2	ramp 2 to output 3	R/W	Non active/active
D	3	dwell 2 to output 3	R/W	Non active/active
C	4	ramp 3 to output 3	R/W	Non active/active
C	5	dwell 3 to output 3	R/W	Non active/active
C	6	ramp 4 to output 3	R/W	Non active/active
C	7	dwell 4 to output 3	R/W	Non active/active
B	8	ramp 5 to output 3	R/W	Non active/active
B	9	dwell 5 to output 3	R/W	Non active/active
B	10	ramp 6 to output 3	R/W	Non active/active
B	11	dwell 6 to output 3	R/W	Non active/active
A	12	ramp 7 to output 3	R/W	Non active/active
A	13	dwell 7 to output 3	R/W	Non active/active
A	14	ramp 8 to output 3	R/W	Non active/active
A	15	dwell 8 to output 3	R/W	Non active/active

Software Key

- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Digital Output Status Word 2 (02)

Format (>ABCD)

Status of output 3 at end

Digit	Bit	Segment	Attributes	Clear/Set
D	0	End to output 3	R/W	Non active/active
D	1	Spare		
D	2	Spare		
D	3	Spare		
C	4	Spare		
C	5	Spare		
C	6	Spare		
C	7	Spare		
B	8	Spare		
B	9	Spare		
B	10	Spare		
B	11	Spare		
A	12	Spare		
A	13	Spare		
A	14	Spare		
A	15	Spare		

Digital Output Status Word 3 (03)

Format (>ABCD)

Status of output 4 during each segment

Digit	Bit	Segment	Attributes	Clear/Set
D	0	ramp 1 to output 4	R/W	Non active/active
D	1	dwell 1 to output 4	R/W	Non active/active
D	2	ramp 2 to output 4	R/W	Non active/active
D	3	dwell 2 to output 4	R/W	Non active/active
C	4	ramp 3 to output 4	R/W	Non active/active
C	5	dwell 3 to output 4	R/W	Non active/active
C	6	ramp 4 to output 4	R/W	Non active/active
C	7	dwell 4 to output 4	R/W	Non active/active
B	8	ramp 5 to output 4	R/W	Non active/active
B	9	dwell 5 to output 4	R/W	Non active/active
B	10	ramp 6 to output 4	R/W	Non active/active
B	11	dwell 6 to output 4	R/W	Non active/active
A	12	ramp 7 to output 4	R/W	Non active/active
A	13	dwell 7 to output 4	R/W	Non active/active
A	14	ramp 8 to output 4	R/W	Non active/active
A	15	dwell 8 to output 4	R/W	Non active/active

Digital Output Status Word 4 (04)

Format (>ABCD)

Status of output 4 at end

Digit	Bit	Segment	Attributes	Clear/Set
D	0	End to output 4	R/W	Non active/active
D	1	Spare		
D	2	Spare		
D	3	Spare		
C	4	Spare		
C	5	Spare		
C	6	Spare		
C	7	Spare		
B	8	Spare		
B	9	Spare		
B	10	Spare		
B	11	Spare		
A	12	Spare		
A	13	Spare		
A	14	Spare		
A	15	Spare		

Digital Output Status Word 5 (05)

Format (>ABCD)

Status of output 2 during each segment

Digit	Bit	Segment	Attributes	Clear/Set
D	0	ramp 1 to output 2	R/W	Non active/active
D	1	dwell 1 to output 2	R/W	Non active/active
D	2	ramp 2 to output 2	R/W	Non active/active
D	3	dwell 2 to output 2	R/W	Non active/active
C	4	ramp 3 to output 2	R/W	Non active/active
C	5	dwell 3 to output 2	R/W	Non active/active
C	6	ramp 4 to output 2	R/W	Non active/active
C	7	dwell 4 to output 2	R/W	Non active/active
B	8	ramp 5 to output 2	R/W	Non active/active
B	9	dwell 5 to output 2	R/W	Non active/active
B	10	ramp 6 to output 2	R/W	Non active/active
B	11	dwell 6 to output 2	R/W	Non active/active
A	12	ramp 7 to output 2	R/W	Non active/active
A	13	dwell 7 to output 2	R/W	Non active/active
A	14	ramp 8 to output 2	R/W	Non active/active
A	15	dwell 8 to output 2	R/W	Non active/active

Digital Status Word 6 (06)

Format (>ABCD)

Status of output 2 at end

Digit	Bit	Segment	Attributes	Clear/Set
D	0	End to output 2	R/W	Non active/active
D	1	Spare		
D	2	Spare		
D	3	Spare		
C	4	Spare		
C	5	Spare		
C	6	Spare		
C	7	Spare		
B	8	Spare		
B	9	Spare		
B	10	Spare		
B	11	Spare		
A	12	Spare		
A	13	Spare		
A	14	Spare		
A	15	Spare		

Software Key

- 2.05 and below
- 2.07 and above
- 3.11 and above
- 4.11 and above

Chapter 7.0 Calibration

The 818 controller can be calibrated whilst installed in its sleeve if the relevant wiring can be re-routed to the calibration device and the instrument is not configured for a pyrometer, high level voltage (greater than 60mV), or current input. Alternatively the instrument can be removed from its sleeve and calibrated on a bench, in which case it can either be plugged into an additional sleeve, part number LA021348 (faston connections) or LA021347 (screw connections), or be fitted with a number of individual connector blocks which are used in the make up of the sleeve. A set of three of these blocks, LA018341 (standard) LA021248 (Input) and LA018831 (mains) is required to calibrate the instrument fully.

To carry out the complete calibration of the 818 controller a number of instruments is required. These are listed below:-

a) A suitable stable millivolt and voltage source with the ability to switch 'in' and 'out' some means to compensate for the cold junction of thermocouples. The Eurotherm calibrator model 239 is suitable for this purpose.

b) A length of compensating cable suitable for the thermocouple to be used with the controller or type K.

c) A decade resistance box capable of being set to 50.00 and 250.00 ohms with an accuracy better than +/-0.01 ohms. Alternatly two precision resistors of this accuracy may be used.

d) A digital voltmeter capable of indicating a maximum voltage of 10 volts DC with an accuracy of better than 0.05% and an input impedance higher than 5 Megohms.

e) A digital current meter capable of indicating a maximum of 20mA DC with an accuracy of better than 0.05% and an input impedance of less than 400 ohms.

When the 818 instrument is despatched from the factory it has been calibrated for all thermocouples, RTDs, pyrometers, voltage and current inputs and if a remote input or retransmission has been specified in the ordering code these will also have been calibrated.

When reconfiguring the instrument from one sensor type to another or one range to another it is not necessary to recalibrate the instrument, providing that the full calibration has not been corrupted.

The recalibration procedure can either be performed for the configured input and output ranges only, or for all ranges.

Note 1:-
The full list of mnemonics that will have to be scrolled through to get to (i8) is shown below.

C1, C2, C3, C4, C5, C6, C7, C8, idn, dSL dSh, SPL, SPh, S2L, S2h, Ah1, Ah2, Add, C1L, C1h, C2L, C2h, C3L, C3h, roL, roh, rrL, rrh, riL and rih.

Note 2:-
After calibration follow the clear configuration operation in paragraph 7.8.

The table below shows which mnemonics have to be selected to calibrate a particular range and input.

The configured range of the instrument being calibrated	Selected Mnemonic
Pyrometer or voltage inputs where input span is < 8mV	i8
Pyrometer or voltage inputs where input span is > 8mV and is < 20mV	i20
Pyrometer or voltage inputs where input span is > 20mV and is < 50mV	i50
Zero Trim (may be used with all inputs)	tr
Thermocouple inputs where input span is < 8mV	i8 & CJC
Thermocouple inputs where input span is > 8mV and is < 20mV	i20 & CJC
Thermocouple inputs where input span is > 20mV and is < 50mV	i50 & CJC
RTD Inputs	rtL & rth
Analogue remote inputs	icL & ich
Analogue retransmission outputs	roL & roh
Motor valve position potentiometer	Pcl & Pch

To calibrate a single range use only those parts of the procedure containing the mnemonics in the above table.

7.1 Calibration Procedure

To alter the calibration of the instrument the configuration mode has to be entered.

1) Remove the instrument from the sleeve and make the lower of the two switches on the rear of the microboard (see paragraph 4.1).

2) Replace the instrument in its sleeve, or connect the terminal blocks.

3) Now connect the instrument as in diagrams 1, 2,3, 4 or 5 as appropriate. Power up the instrument and the calibrator.

4) The upper display will now read 'CONF' and the lower display will read 'C1'. (C1 is the first mnemonic in the configuration list and is not required for calibration).

5) Press the scroll button repeatedly until the first mnemonic of the calibration procedure is indicated (i8)

6) Leave powered for at least 20 minutes before proceeding.

7.2 Calibration Voltage, Thermocouple and Pyrometer Inputs

I8 Calibration Procedure
1) Press the scroll button until 'i8' is displayed. Set the 239 calibrator, output to 8.000mV and the compensator switch set to mV.

2) Press the 'up' and 'down' buttons together.

3) The 'i8' will disappear and the top dot of the least significant digit (LSD) will flash for approximately 15 seconds.

4) The display will now indicate a mV reading of 8.000. A drift of more than a few µV's in this reading in 30 seconds indicates that the calibration procedure was unsuccessful.

5) If unsuccessful check the calibrator, instrument and interconnections.

6) Press the 'up' and 'down' buttons together to repeat the calibration.

7) If the reading is to be accepted press the 'scroll' button.

I20 Calibration Procedure
8) Press the scroll button until 'i20' is displayed. Repeat the procedure in paragraphs 1 to 7 above for a 20.000mV input.

I50 Calibration Procedure
9) Press the scroll button until 'i50' is displayed. Repeat the procedure in paragraphs 1 to 7 above for a 50.000mV input.

10) If no futher calibrations are required leave configuration as described in 7.8.

Calibration Trim
11) The mnemonic Tr is provided to allow a zero trim of the input calibration. This may be useful to allow calibration of the sensor (thermocouple or RT).
Default setting of calibration trim is zero.

12) The trim may be configured to be either in micro volts (config word C1(A) = 0 to 3) or in display units (config word C1(A) = 4 to 7) see 4.3.2.

13) Press the 'scroll' button until 'tr' (zero trim) is displayed.

14) Use the up/down button to set this value to the desired number of µV or display units of zero offset.
e.g. if the thermocouple calibration shows that its output is 20µV above the table value scroll this trim value to -20µV.

15) If this feature is not going to be used it must be set to zero.

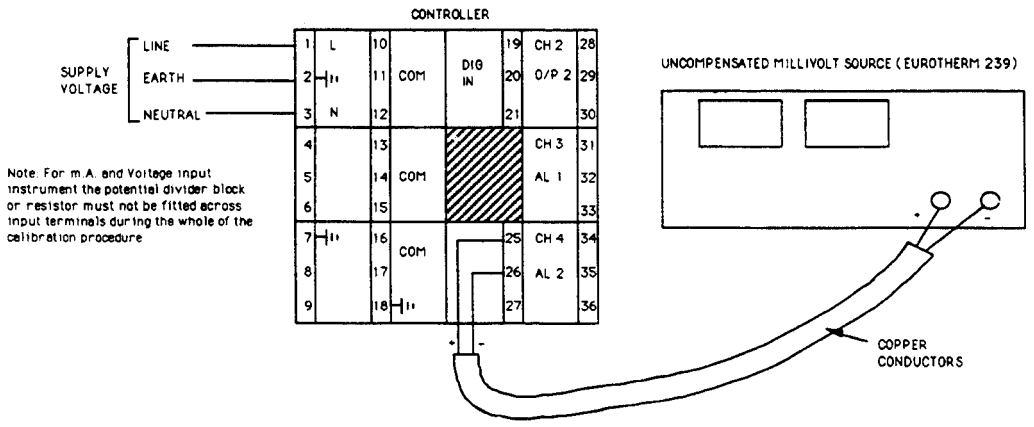


Diagram 1. Instrument connections for i8, i20 and i50 Calibration procedure.

7.3 Calibration Cold Junction Compensation (cJc)

1) The leads between the calibrator and the instrument should now be changed for compensating cable, see diagram 2.

2) If the instrument has been configured for a thermocouple input the compensating cable should be for this thermocouple type.

3) If the instrument has been configured for a non-thermocouple input; eg. RTD, pyrometer, millivolts or current, then the compensating cable should be type K.

4) The compensation of the calibrator should be set to the same type as the compensating cable from the calibrator to the instrument.

5) Set the output of the calibrator to a value that represents 25°C for the thermocouple type to which the instrument has been calibrated - ie. if type K, then set value at 1.000mV.

6) Press the 'scroll' button until 'cJc' is displayed.

7) The 'up' and 'down' buttons should now be pressed together and the 'cJc' will disappear.

8) The top dot of the LSD will flash for approximately 15 seconds.

9) The display will now read the temperature in °C as 25.0.

10) If the reading drifts by more than a few tenths of a degree in 30 seconds the calibration of 'cJc' has been unsucessful. Check the calibrator, instrument and compensating cable wiring.

11) Press the 'up' and 'down' buttons simultaneously together to repeat the calibration of 'cJc'.

12) If the reading is to be accepted press the scroll button.

13) If no futher calibrations are required leave configuration as described in 7.8.

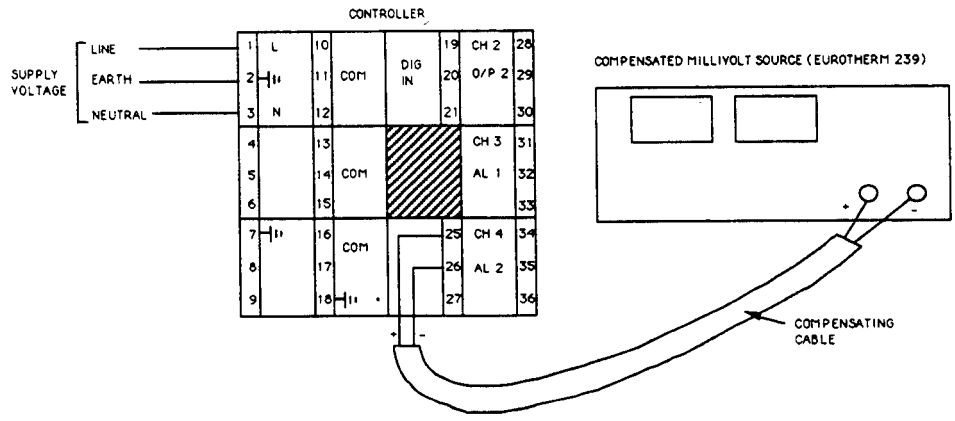


Diagram 2. Connections for C.J.C. Calibration Procedure

7.4 Calibration Resistance Thermometer

1) Connect the input of the instrument to a decade resistance box as shown in diagram 3.

2) Press the scroll button until 'rtL' is displayed.

3) Set the resistance box to 50.00 ohms (or use a precision resistor).

4) Simultaneously press the 'up' and 'down' buttons. The lower display will now blank, leaving the top dot of the LSD of the display flashing for 15 seconds.

5) 'rtL' will now be displayed.

6) Press the scroll button and 'rth' will be displayed.

7) Set the resistance box to 250.00 ohms (or use a precision resistor).

8) Press the 'up' and 'down' buttons simultaneously.

9) The 'rth' will disappear and the top dot of theLSD will flash for approximately 15 seconds.

10) The display will now read 250.0

11) If the reading drifts by more than a few tenths of a degree in thirty seconds, the RT calibration is unsucessful. Check the calibration resistors, instrument and wiring. Repeat procedure 1 to 10.

12) When calibration is satisfactory press the scroll button.

13) If no futher calibrations are required leave configuration as described in 7.8.

Calibration Trim

14) The mnemonic Tr is provided to allow a zero trim of the input calibration. This may be useful to allow calibration of the sensor (thermocouple or RT).
Default setting of calibration trim is zero.

15) The trim may be configured to be either in micro volts (config word C1(A) = 0 to 3) or in display units (config word C1(A) = 4 to 7) see 4.3.2.

16) Press the 'scroll' button until 'tr' (zero trim) is displayed.

17) Use the up/down button to set this value to the desired number of µV or display units of zero offset.
e.g. if the thermocouple calibration shows that its output is 20µV above the table value scroll this trim value to -20µV.

18) If this feature is not going to be used it must be set to zero.

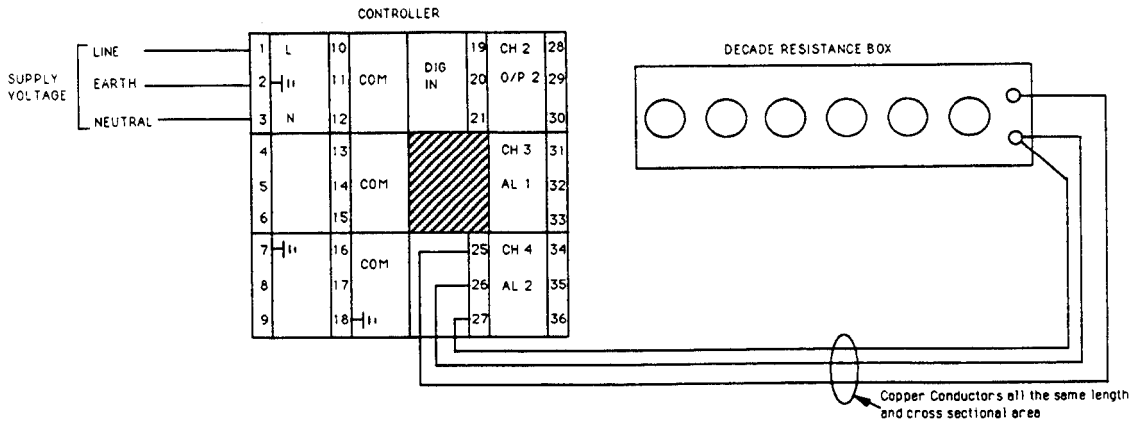


Diagram 3. Connections for 'rtl' and 'rth' calibration procedure

7.5 Calibration of Remote Input

If the controller is fitted with an analogue comms board or a D.C. remote input board and the input of this board requires calibration, use the next mnemonics in the configuration list 'icL' and 'ich' for this purpose. Note: If this input is current rather than voltage the burden resistor normaliy connected on the back of the sleeve must not be fitted during calibration. The voltages used for calibrating these inputs are the relevant currents, in milliamps, multiplied by 50.

1) Connect a voltage source such as the Eurotherm 239 to terminals 15 and 17 (analogue comms board) or 35 and 36 (remote input board) using copper wire as shown in diagram 4.

2) Press the scroll button and the display will now read 'icL'. Set the voltage source to the minimum input span.

Note;-
If the instrument has been configured with a 20% offset i.e. configuration 'C5' character 'D' set to 1 then the setting must be zero.

3) Press the 'up' and 'down' buttons together.

4) The top dot of the L.S.D. will flash for approximately 15 seconds.

5) IcL will then be displayed as a percentage of the max span.

6) If this value in 6) above drifts significantly reset the voltage source and repeat paragraphs 4, 5 and 6.

7) Press the scroll button and the display will now read 'Ich'.

8) Set the voltage source to the maximum input span volts.

9) Press the 'up' and 'down' buttons together.

10) The dot of the L.S.D. will flash for approximately 15 seconds.

11) Ich will then be displayed as a percentage of the max. span.

12) If this value is incorrect reset the voltage source and again repeat paragraphs 10, 11 and 12.

13) If the value is correct press the scroll button.

14) If no futher calibrations are required leave configuration as described in 7.8.

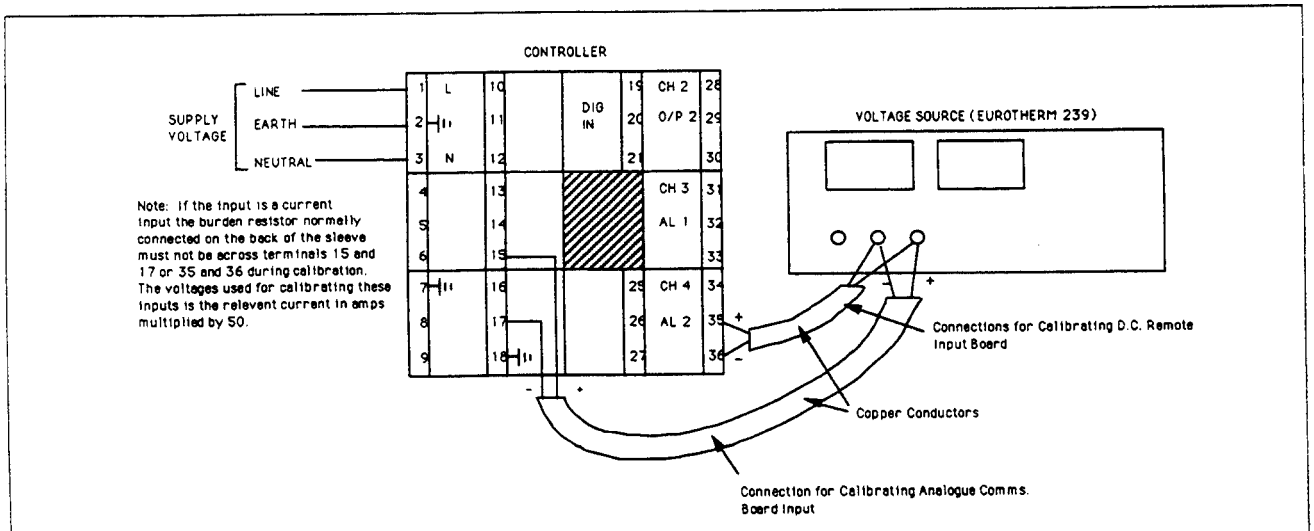


Diagram 4. Connections for 'icL' and 'ich' calibration procedure

7.6 Calibration of the Retransmission Output

Wire the instrument as shown in diagram 5 with either a digital voltmeter for instruments configured for voltage output retransmission signal or a digital current meter for instruments configured for current output retransmission signal.

1) Press the 'RUN/HOLD' button to scroll back to 'roL'.

2) Note the digital meter reading.

3) Press either the 'up' or the'down' button to adjust the reading on the digital meter until it gives the required minimum retransmission output signal.

4) Press the 'scroll' button and 'roh' will be displayed on the lower display.

5) Press either the 'up' or the 'down', button to adjust the reading on the digital meter to the maximum retransmission output signal.

6) If no futher calibrations are required leave configuration as described in 7.8.

A similar procedure to the above can be used to calibrate a retransmission signal from output 2 (cool) or output 3 (alarm 1). In this case join the digital volt/current meter to terminals 29 and 30 (29 is positive) for output 2 or 32 and 33 (32 is positive) for output 3. Adjust mnemonics C2L(low) and C2h(high) for output 2 or C3L(low) and C3h(high) for output 3.

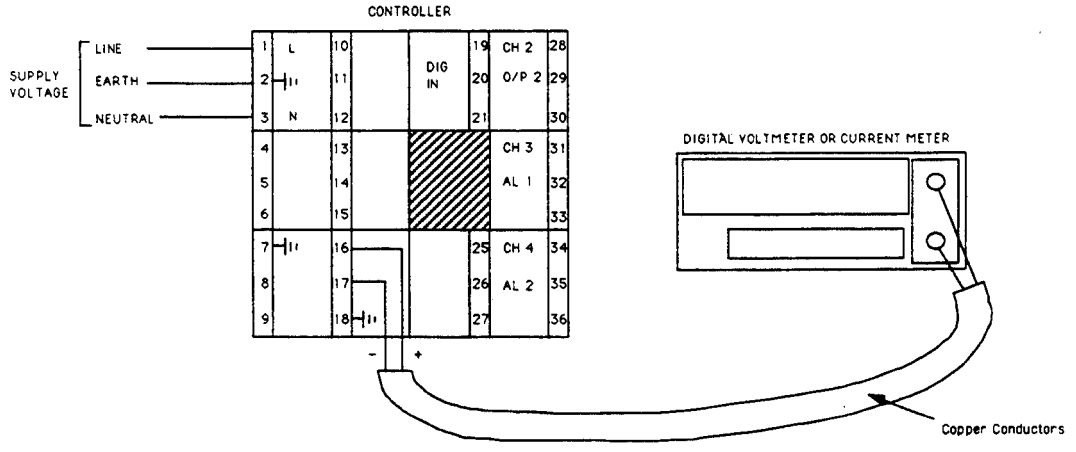


Diagram 5. Connections for 'roL' and 'roh' calibration procedure

7.7 Calibration of Valve Positioner Potentiometer

(Only applicable to the Valve Positioner version of the model 818 configured to use the valve position potentiometer)

The calibration of the valve position potentiometer should be carried out with the instrument wired to the valve motor it is going to control, as shown below.

1) Remove the instrument from its sleeve and make the lower of the two switches on the rear of the microprocessor board. (see paragraph 2 of chapter 4.1).

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 'up' and 'down' 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 to the mnemonic 'Pch'.

8) Use the 'up' and 'down' buttons to drive the motor to the position representing the maximum valve opening required.

9) Push the manual button to enter this value.

This calibration procedure rescales the potentiometer, under the mnemonic 'op' making the maximum and minimum selected positions 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.

7.8 Clear Configuration

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

2) Press the 'up' and 'down' buttons together.

3) Remove the instrument from its sleeve and open circuit the lower of the two switches on the rear of the micro board (See paragraph 2 of chapter 4.1)

4) Replace the instrument into its sleeve.

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

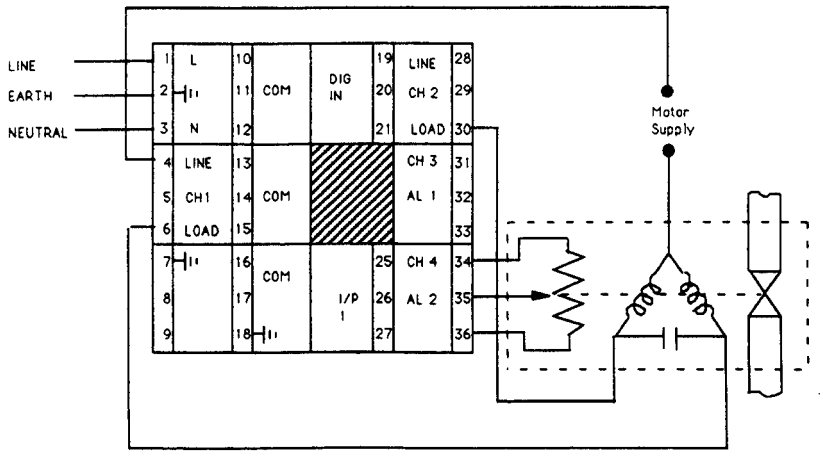


Diagram 6. Connections tor 'PcL' and 'Pch' calibration procedure.

Chapter 8.0
Spares List

ITEM	PART NUMBER
Complete power supply board without output module (85-264V~ Input)	SUB 818-SPARE-POWERSUP-BOARD
Complete power supply board without output module (18-40V~ or 20-40V dc Input)	SUB 818-SPARE-24VOLT-BOARD
Complete power supply board with CNOMO output stages~(85-264V~input)	SUB 818-SPARE-CNOMO-BOARD
Complete microprocessor board with micro-processor Xicor non volatile memory and software. Include model number and software version number in order code;	e.g. SUB 818-SPARE-MICRO-BOARD-818S-210
Complete microprocessor board with micro-processor, Dallas non volatile memory and software. Include model number and software version number in order code;	e.g. SUB 818-SPARE-DALLAS-BOARD-818P4-411
Complete options board without output or alarm boards	SUB 818-SPARE-OPTION-BOARD
Complete options board with valve position potentiometer circuit	SUB 818-SPARE-VP-BOARD
Complete digital communications board	SUB 818-SPARE-DIGCOMM-BOARD
Complete analogue communications board	SUB 818-SPARE-ALALG-COMM-BOARD
Complete display PC board with display	SUB 818-SPARE-DISPLAY 818-BOARD
Complete relay output module board	SUB 818-SPARE-RELAY-BOARD
Complete triac output module board	SUB 818-SPARE-TRIAC-BOARD
Complete logic output module board	SUB 818SPARE-LOGIC-BOARD
Complete dc retransmission output module board	SUB 818-SPARE-RETRAN-BOARD
Complete dc output module board	SUB 818-SPARE-DCOUTPUT-BOARD
Complete dc input module board	SUB 818-SPARE-DCINPUT-BOARD
Microprocessor Intel 8032	CR200069
Non volatile memory (2004) Xicor	CR100040
Non volatile memory (DS1220) Dallas	CR200088
EPROM 27512 programmed with software for specific model number and version number	e.g. EPROM-818S-2.10
Fuse 500mA 250V anti-surge	CS021199
Fuse 1.25A anti-surge	CS022078
Links small	CI069127
Links large	CI020907
Bezel assembly complete with push buttons	LA021346
PC board retainer	LA021251
Covers (2 off)	LA021343
Instrument sleeve (faston)	LA021348
Instrument sleeve (screw)	LA021347
Behind panel fixing clips (kit of 2)	LA020067
Extender cable (set of 3)	LA021585
Rear terminal connector blocks (Screw)	
Standard	LA018341
Input (T/C and RTD)	LA021248
Mains (Red)	LA018831

(CONTINUED FROM INSIDE FRONT COVER)

GROUNDING

All "ground" terminals must be securely connected to ground by conductors appropriate to the current ratings of the units.

Most Eurotherm instruments have internal circuits which are isolated or "floating." This is necessary to prevent the occurrence of a "ground loop" in signal circuits. To avoid possible shock hazards in the event of an internal fault causing breakdown of insulation, it is recommended that all equipment connected to any Eurotherm unit be enclosed in a grounded metal enclosure. Sheaths of thermocouples (or other sensors) should be properly grounded by a separate conductor (instead of being dependent on grounding via the machine framework).

SUPPLY ISOLATORS

Every electrical system should be provided with means for isolating the system from the AC supply to allow safe working during repair and maintenance. SCRs and triacs are not adequate means of isolating the supply, and should always be backed by a suitable mechanical disconnect switch.

TEMPERATURE SENSOR FAILURE

In the event of sensor failure (i.e., thermocouple break or open input circuit) the instrument might display erroneous readings before indicating the input fault condition. For example, upon thermocouple break, the display reading rises rapidly before an indication occurs.

HAZARDOUS ATMOSPHERES

Unless otherwise stated in the published specification of any particular unit, Eurotherm products are not suitable for use in areas subject to hazardous atmospheres. No Eurotherm product should be connected to a circuit which passes into or through a hazardous area unless appropriate precautions are taken (even though the instrument itself may be located in a safe area). Such an installation should conform to the requirements of the relevant Authority. (In the USA: Factory Mutual Research Corporation and Underwriters' Laboratories, Inc.).

PROCEDURE IN THE EVENT OF TROUBLE

Before beginning any investigation of a fault, the electrical supplies to all equipment concerned should be switched off and isolated. Units suspected of being faulty should be disconnected and removed to a properly equipped workshop for testing. Any attempt to troubleshoot while installed could be hazardous to personnel and equipment.

IF IN DOUBT, ASK !

If you have any questions regarding any aspect of installing, operating or servicing your Eurotherm equipment, please contact your nearest Eurotherm Sales and Service Representative.