User Manual

Series 256 Programmer
And 6 channel Controller

Series 256 User Manual
Contents

1   Installation.

1.1   Panel Mounting.

The instrument will fit into a DIN standard 92mm x 92mm +0.8mm -0 square cut-out and will accommodate a panel thickness up to 7mm.
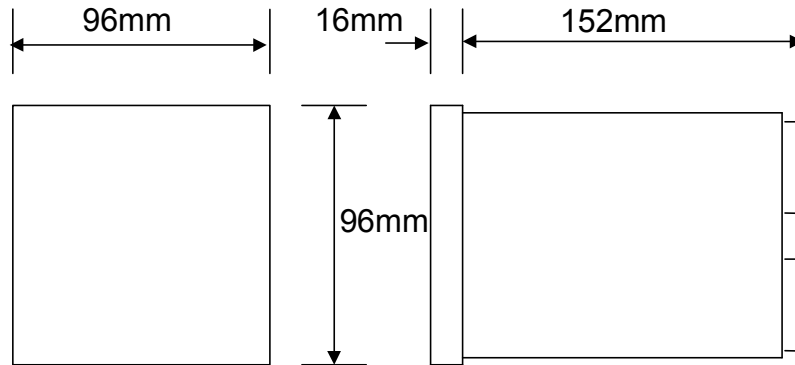
The instrument projects behind the panel by less than 152mm including terminal connections If IP65 sealing is required then ensure that the panel sealing gasket is fitted into position behind the bezel. The gasket may be omitted If IP65 sealing is not required.

Unscrew the two instrument mounting screws on the bezel until the two retaining ears are near their rearmost positions. Whilst holding the retaining ears retracted within the recesses, fit the instrument into the panel cut-out. Hold the instrument in place and gently tighten the two mounting screws on the front of the instrument until the gasket is compressed and the instrument is firmly retained in the panel. DO NOT OVER TIGHTEN THE SCREWS.
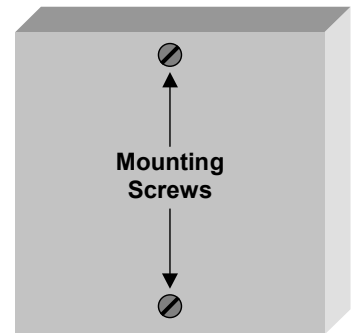
Additional measures will be required to seal multiple instruments if they are mounted in a common slot. These measures may consist of sealing compound or other devices at the discretion of the installer.
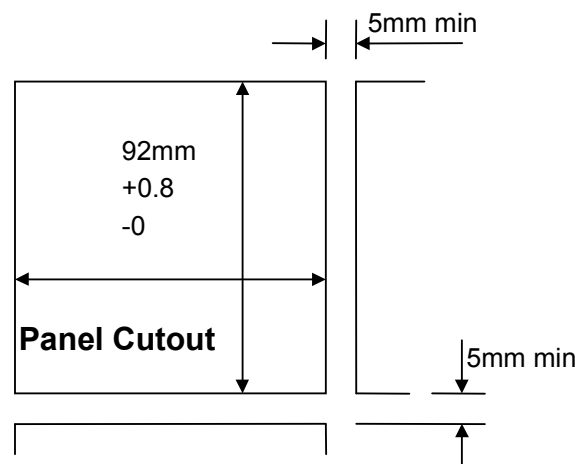
1.2   Electrical Connections

All electrical connections are made to the rear of the instrument via screw terminal blocks. Each terminal block plugs into a receptacle in the rear of the instrument and may be unplugged to allow easy wiring and to withdraw the instrument from the panel.
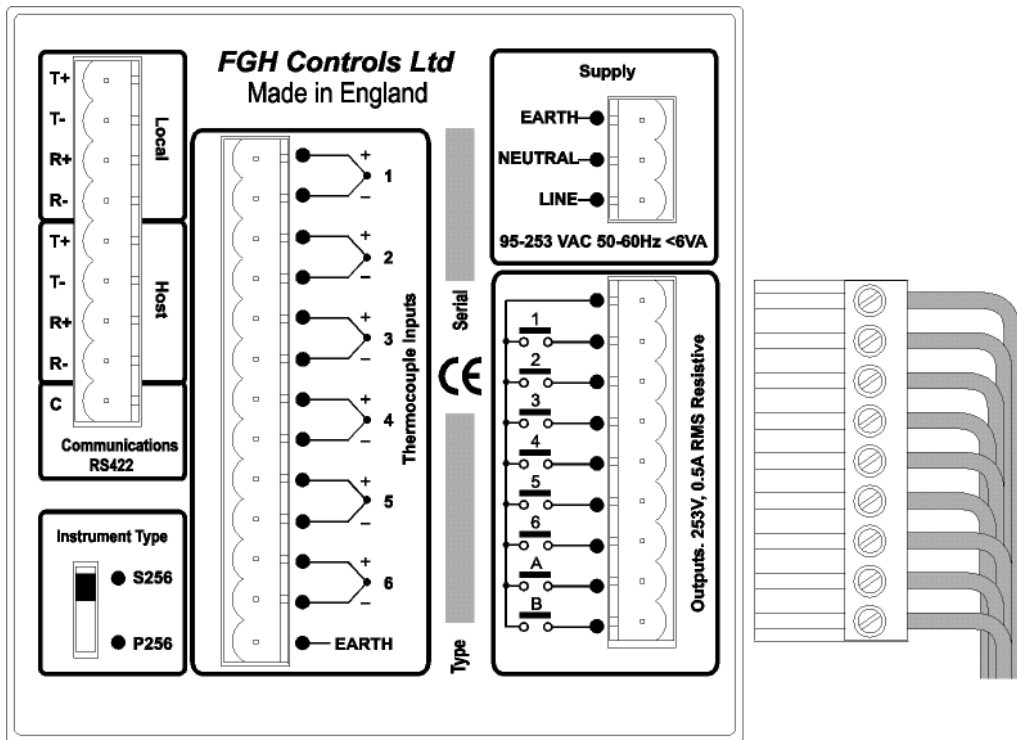
1.2.1   Supply

Mains power should be connected to the three way mains terminal block. The instrument will accept 95 to 253 V RMS at 50 to 60Hz and consumes approx. 6VA. A good earth connection is essential for safety and screening purposes and this is internally connected to the metal case of the instrument.
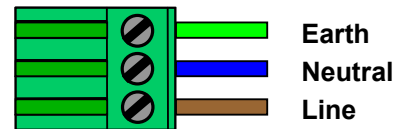
1.2.2   Sensors

Connect the thermocouple sensors to the 13 way terminal block. These should be wired in either compensating or extension cable appropriate to the type of thermocouple used. As standard the 256 series instruments use Type K thermocouples. The colour codes for type K are given in the table below. The Earth terminal should be connected to a solid chassis earth point to provide the best immunity to electrical noise.

Type K Thermocouple International Colour Codes		
International IEC 584-3	Sheath	Green
	Positive	Green
	Negative	White
American ANSI MC96-1	Sheath	Yellow
	Positive	Yellow
	Negative	Red
British BS 1843-1981	Sheath	Red
	Positive	Brown
	Negative	Blue
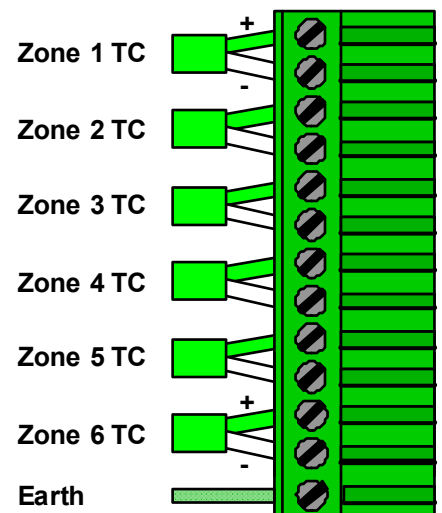
1.2.3   Outputs

The 6 zone controller outputs and the reverse thermocouple alarm output should be wired to the 9 way connector. Each output consists of a normally open relay contact rated at 0.5A RMS at 253V maximum into a resistive load.

Warning.

Each relay is internally fitted with a CR arc suppression device which will result in a small residual current flow (approx. 4mA at 250V) when the contact is open. This small current may result in very light loads failing to switch off.

Common
Zone 1 O/P
Zone 2 O/P
Zone 3 O/P
Zone 4 O/P
Zone 5 O/P
Zone 6 O/P
Rev. TC AI
Not Used

If this is the case **DO NOT** remove the internal arc suppression devices. A 10K, 10W resistor should be connected across the load, this will usually solve any problem. The resistor will get hot so take care to mount it so that this does not cause a hazard.
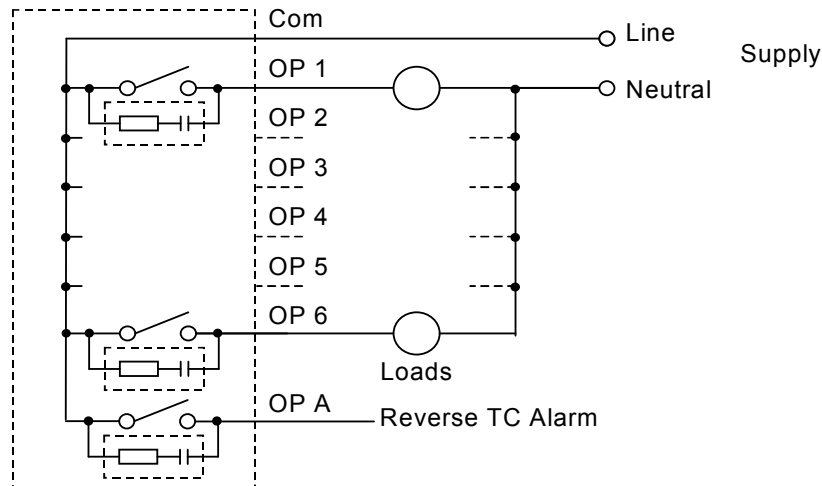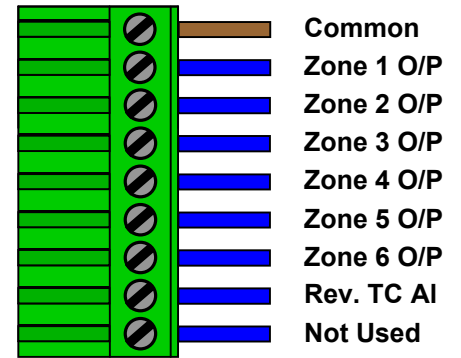
1.2.4   Serial Communications

All series 256 instruments are equipped with two RS422 standard serial communications ports. This allows the units to communicate with each other and any other suitable equipment over distances up to 1200m. The HOST port is used for communications with a host computer system for monitoring or recording purposes. The LOCAL port is intended purely for communications between series 256 instruments only and is used for the transfer of setpoints and control information.

Local Controller Comms Network

Host Computer Comms Network

TX+
TX-
RX+
RX-
TX+
TX-
RX+
RX-
Common
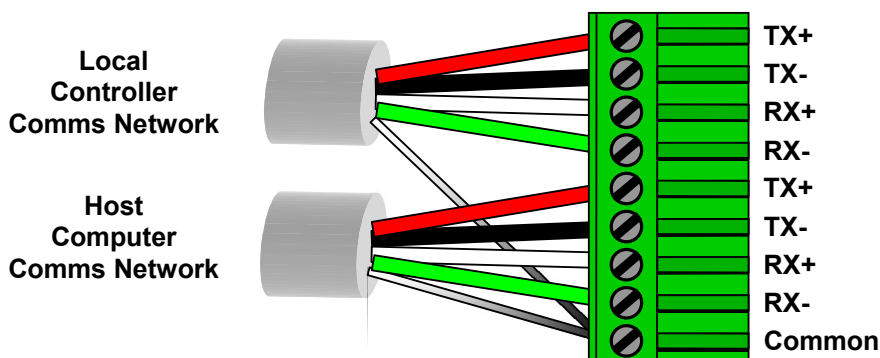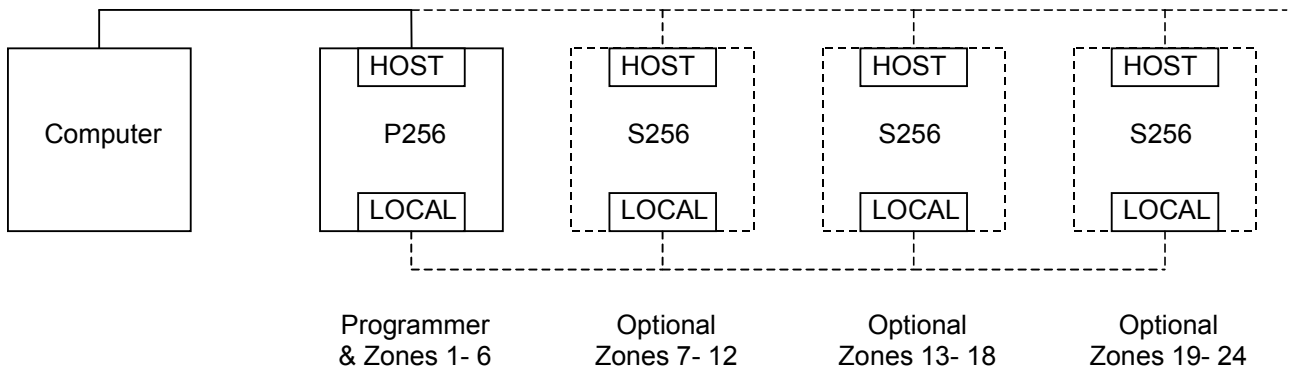
The serial communications may be connected using either the two or four wire system. The instrument uses a balanced voltage communications system which will perform well under most situations provided some simple guidelines are observed.

1. The communications wiring should be implemented using a suitable, screened twisted pair cable. The cable screen should be earthed at one point only.

2. The cable should be routed well away from sources of electrical noise such as motors, contactors and any other high voltage wiring.

3. The network should be wired as a daisy chain, taking the wires into one instrument and hence on to the next. Wiring spurs should be avoided. Take care to continue the cable screen on to the next instrument.

4. For long cable runs or noisy environments it may be necessary to fit a terminating resistor to the network. The terminator (a 200Ω resistor) should be fitted between RX+ and RX- on both the computer and the furthest instrument. For two wire networks this resistor should be fitted at the computer end only. Only one such terminator should be fitted on each wire pair.

4 Wire Connection to host computer.
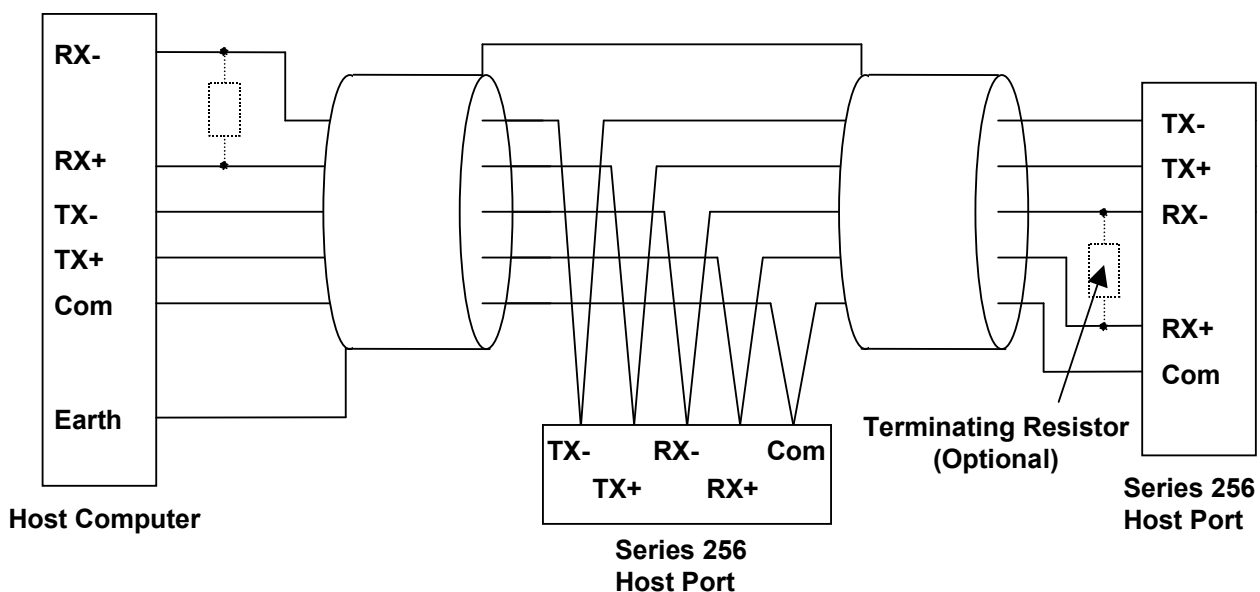
The above diagram shows the connections for 4 wire RS422 operation. This method of connection uses a separate pair of wires for transmission and reception and is the preferred connection method. Although called the '4 wire' connection, a fifth common wire is shown on the diagram. This wire should be fitted if at all possible

2 Wire connection to host computer.
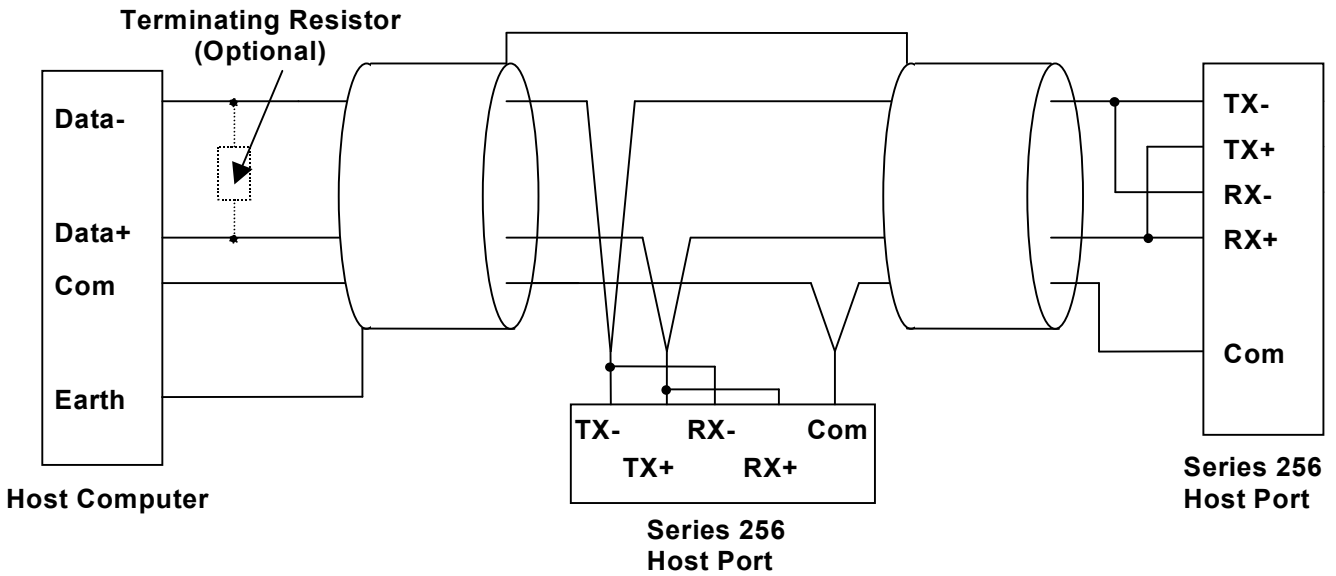
The above diagram shows the connections for 2 wire RS485 operation. This method of connection uses a single pair of wires for both transmission and reception with the data direction being controlled by the currently active device. As in the 4 wire connection, a common wire is shown on the diagram. This wire should be fitted if at all possible.

Controller network connection.
When more than 6 control zones are needed, additional S256 controller instruments are required. These instruments are connected to the P256 programmer via the local communications port.
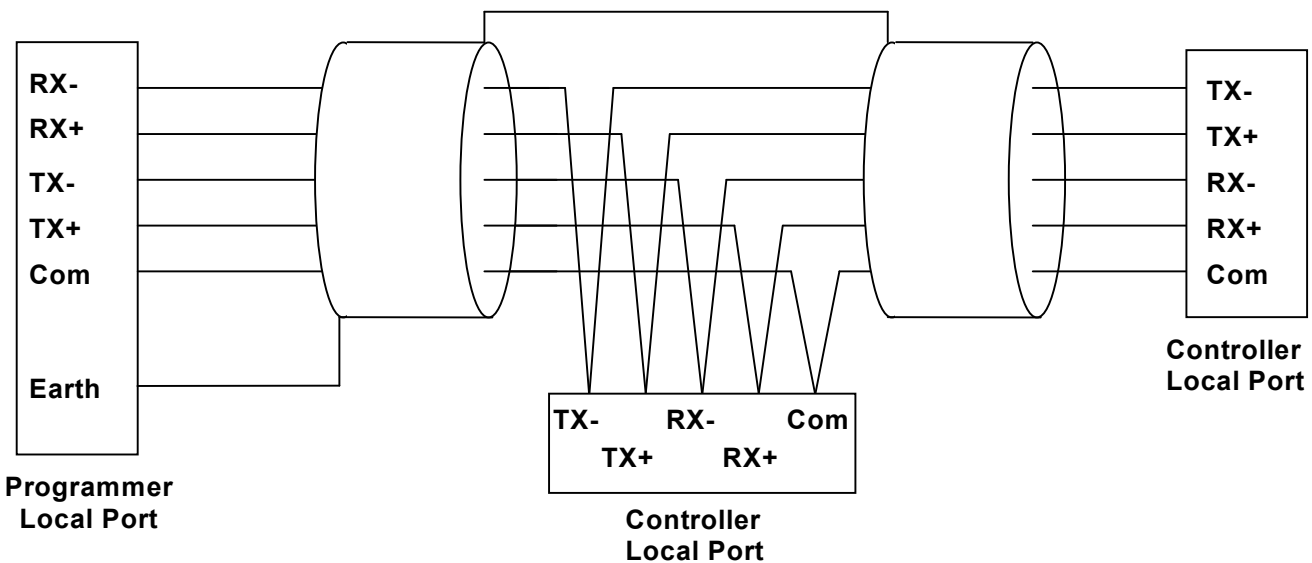
1.3 User Switch Settings

The instrument type is set by means of the switch on the back panel of the instrument. While aspects of the instruments operation are set by the user on the options DIL switch. This switch is accessible through a cut-out in the case at the bottom of the instrument. Use a narrow pointed device such as a ball point pen to set the switches to the required positions. The meanings of the DIL switch settings are different between the Programmer version (P256) and controller version (S256).

1.3.1 Programmer/Controller switch

The Programmer/Controller selector switch is situated on the back panel of the instrument. This switch should only be operated when the instrument is powered off.
Move the switch to the **S256** position to specify that the instrument is to be used as a slave controller.
Move the switch to the **P256** position to specify that the instrument is a profiler and controller.

1.3.2 P256 Programmer DIL Switch meanings
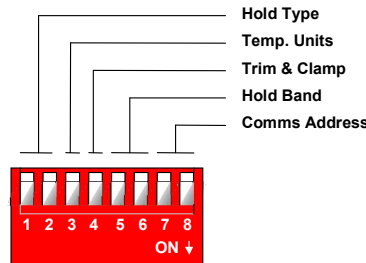
Switches 1 and 2 are used to select the type of hold operation.

SW 1	SW 2	Hold Type
OFF	OFF	Rates, Below setpoint only
OFF	ON	Rates, Above and below setpoint
ON	OFF	Rates and Soaks, Below setpoint only
ON	ON	Rates and Soaks, Above and below setpoint

Switch 3 is used to select the temperature units required.

SW 3	Temperature Units
OFF	Degrees Celsius
ON	Degrees Fahrenheit

Switch 4 is used to select whether or not the operator is allowed to apply trims and clamps to the setpoint value.

SW 4	Trim and Clamp
OFF	Trim and clamp Disabled
ON	Trim and clamp Enabled

Switches 5 and 6 set the unit's hold band in multiples of the unit's prop band (Xp) as follows:

Note that the Hold band is defined as the maximum temperature difference between the controller's set-point and temperature that is allowed before the profiler goes into a 'hold' condition. Thus if the set-point is 300, prop band is 10, Hold band is twice and both above and below hold is set then:

Hold occurs whenever the temperature is less than 280 or greater than 320. If the temperature is between 280 and 320 then no hold will occur.

SW 5	SW 6	Hold Band
OFF	OFF	Holds Disabled
ON	OFF	Xp x 1
OFF	ON	Xp x 2
ON	ON	Xp x 3

Switches 7 and 8 set the unit's communications base address.

SW 7	SW 8	Comms Base Address
OFF	OFF	Address = 00
OFF	ON	Address = 10
ON	OFF	Address = 20
ON	ON	Address = 30

1.3.3   S256 Controller DIL switch meanings
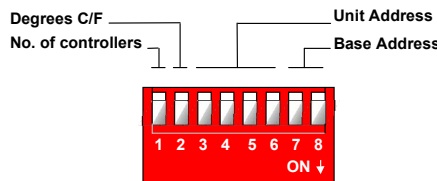
Switch 1 is used to select the number of controllers required.

SW 1	No. of controllers
OFF	All 6 controllers are used
ON	First 3 controller only are used

Switch 2 _must_ be set to the same temperature units as the P256 (OFF for C, ON for F). Switches 3, 4, 5 and 6 set the unit's communications address and controller number.

SW 3	SW 4	SW5	SW6	Unit Address
OFF	OFF	OFF	ON	Base address+1, Controllers 7 to 12
OFF	OFF	ON	OFF	Base address +2, Controllers 13 to 18
OFF	OFF	ON	ON	Base address +3, Controllers 19 to 24
OFF	ON	OFF	OFF	Base address +4, Controllers 25 to 30
OFF	ON	OFF	ON	Base address +5, Controllers 31 to 36
OFF	ON	ON	OFF	Base address +6, Controllers 37 to 42
OFF	ON	ON	ON	Base address +7, Controllers 43 to 48
ON	OFF	OFF	OFF	Base address +8, Controllers 49 to 54
ON	OFF	OFF	ON	Base address +9, Controllers 55 to 60

Switches 7 and 8 _must_ be set to same comms base address as the P256.

1.4 PCB Jumper Links

In addition to the DIL switch there are two jumper links which may be set by the user.

To gain access to these links, the instrument printed circuit boards must be removed from the case.

Unplug all wiring connectors and remove the rear plate retaining screws (two screws top and bottom). Lift off the rear plate and pull out the required PCB

Adjust the link settings as required and then reassemble the instrument by plugging in the PCBs. Note that there are no PCB card guides until the PCB is almost fully inserted.

Refit the rear plate and reconnect all wiring connectors.

Power Supply   Input Board   CPU Board
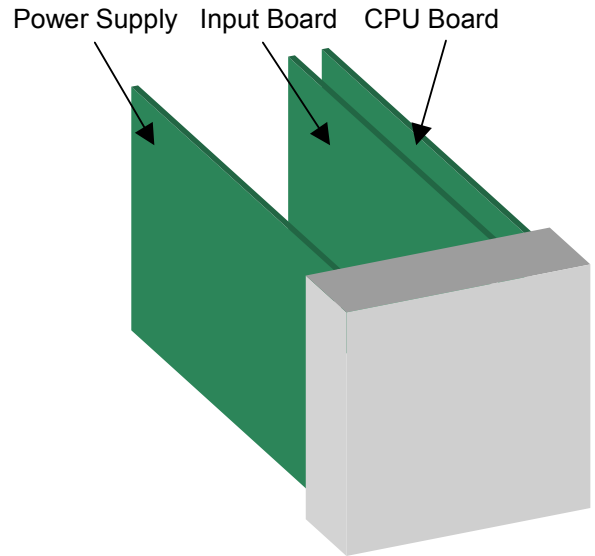
1.4.1 Thermocouple break detection

The instrument can detect broken zone thermocouples. If break detection is switched on, a broken thermocouple will be measured as over range. This will cause the zone controller to turn off the output for that zone. If break detection is switched off, a broken thermocouple will not be detected and its reading will float. Use the jumper link on the Input board to enable or disable thermocouple break detection as required.

Thermocouple Break Detection

OFF

ON

Input Board
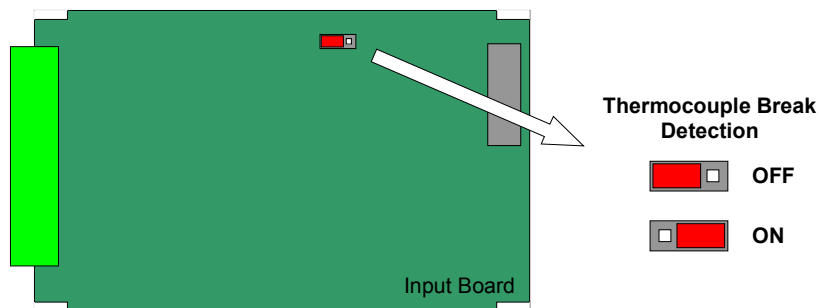
2   Operation

2.0   General

The P256 operates as a self contained, 3 segment profile generator and 6 identical zone controllers. The S256 has only the 6 zone controllers. Both have a reverse TC alarm feature that turns off a zone and closes relay A if heat is applied to an accidentally reversed TC.
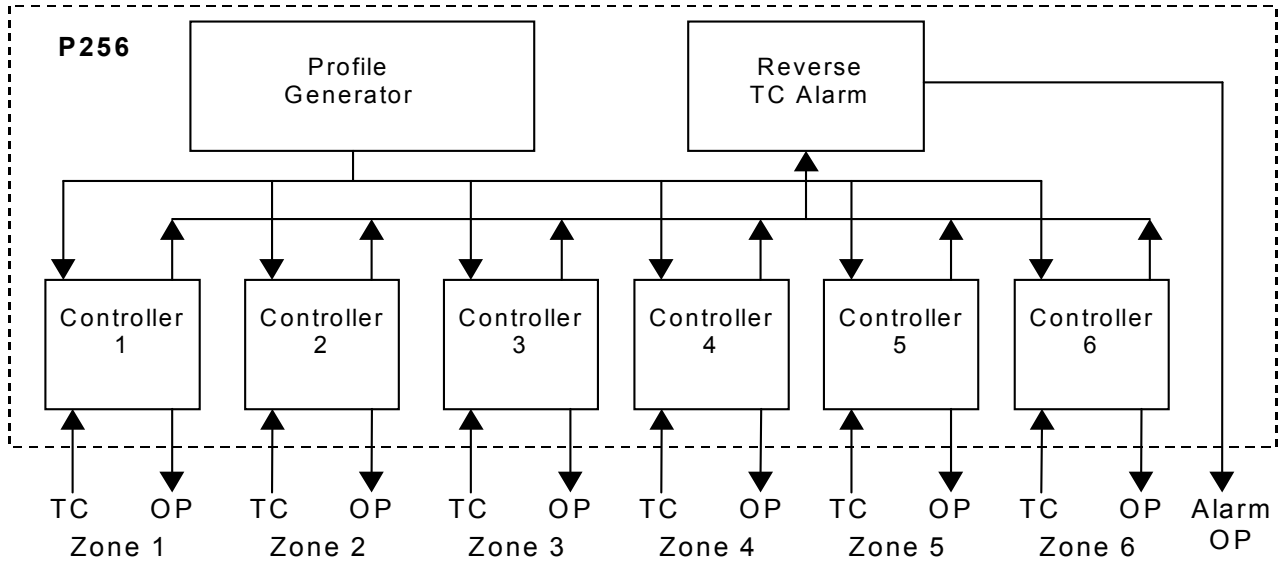
2.1   Operation of controller

There are 6 controllers available in every Series 256 instrument. Each controller can operate in Automatic or Manual modes.
Automatic Mode.
The controller uses the setpoint from the profile generator. The operator may apply a local trim to this setpoint and specify a high setpoint limit (clamp). The trim and clamp facilities can be disabled if required using DIL switch 4.
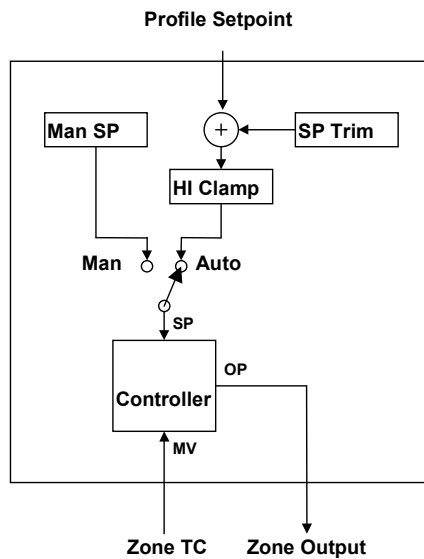
Manual Mode.
The controller uses a fixed manual setpoint entered by the operator.

All controllers operate in proportional only mode using a fixed proportional band setting of 10°C (18°F) and generate a time proportioning output with a cycle time of 20 seconds.

2.2   Operation of profile generator

The profile generator is used to generate the setpoint time-temperature profile. Each profile consists of four distinct stages.

2.2.1   Normal profile operation.
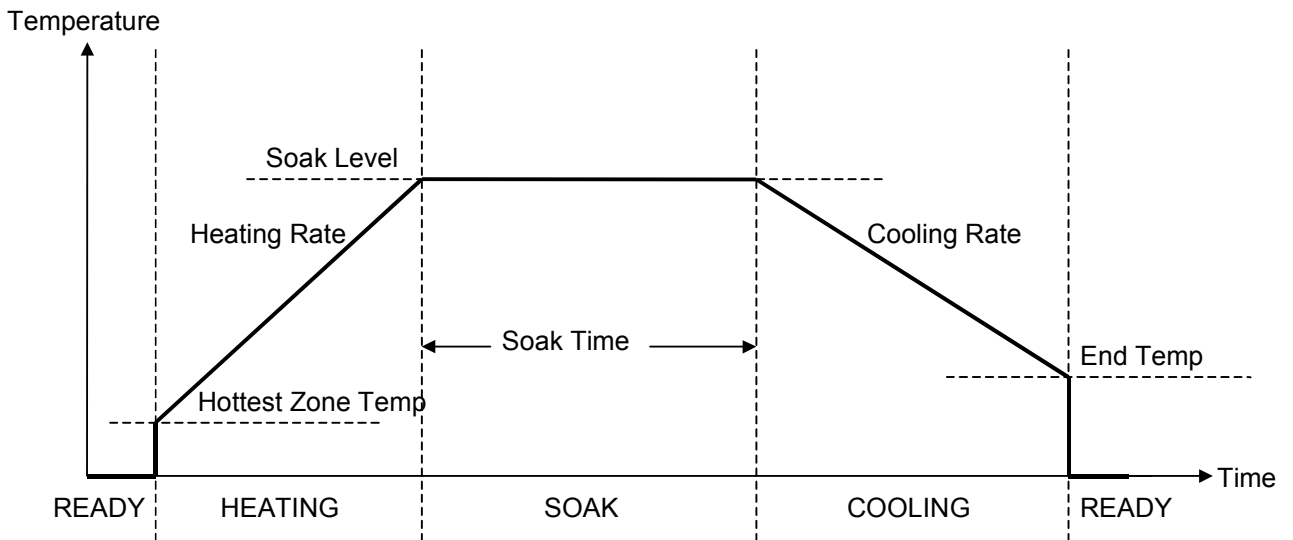
Ready Stage.
The profile generator is not running and the temperature setpoint is maintained at zero.

Heating Stage.
When the profile is started, the temperature setpoint is ramped from the current zone hottest temperature up to the soak temperature at the specified rate.

Soak Stage.
The temperature setpoint is maintained at the soak temperature for the specified soak time.

Cooling Stage.
The temperature setpoint is ramped downwards from the soak temperature at the specified cooling rate until it reaches the End temperature. At this point the profile ends and the profile generator returns to the Ready stage.

2.2.2   The affect of Holds.

The operation of the profile generator may be modified by the use of **Holds**.
A **Hold** comes into affect if any zone temperature deviates from setpoint by more than the current **Hold Band** setting.

When the profile generator is in **Hold** both the profile setpoint and profile time-base are frozen for the duration of the **Hold**. This effectively pauses the profile until the offending zone temperature has come back within limits.

If a Hold occurs during a ramp stage, the ramp is suspended for the duration of the hold. This has the affect of extending the expected ramp time.

HOLD during a ramp
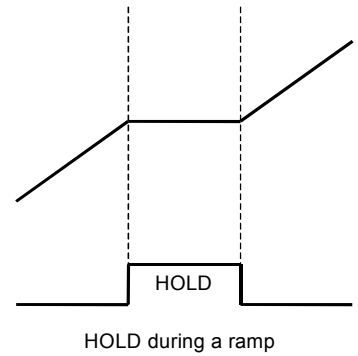
If a hold occurs during a soak stage, the soak time is stopped for the duration of the hold. This guarantees that all zones have been soaked to the required tolerance for the required time. Obviously the apparent soak time may be extended if a hold does occur.

1 Hour   1 Hour

HOLD

HOLD during a 2 hour soak
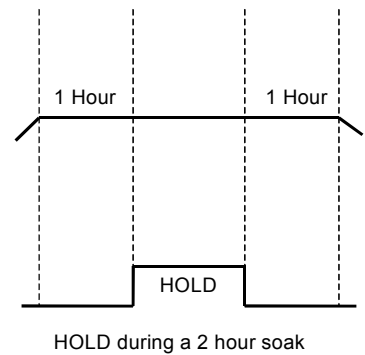
2.2.3   Supply failures during a profile.

Supply interruption during a ramp.
If the profiler is executing a ramp and a supply interruption occurs. It is very likely that during the power outage the zone temperatures will drop. Upon supply restoration the instrument forces its profile setpoint to be equal to the hottest of the zone temperatures and continues the ramp form there.

Zone temps fall
while power off

Ramp continues
from hottest zone

Power OFF   Power ON
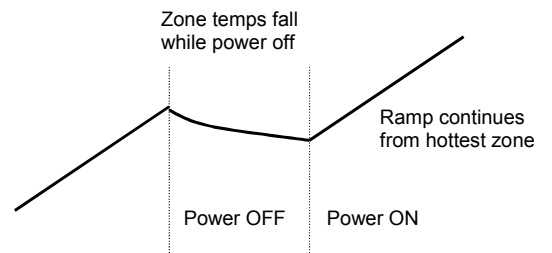
Supply interruption during a soak.
If the profiler is executing a soak and a supply interruption occurs. It is very likely that during the power outage the zone temperatures will drop. Upon supply restoration the instrument forces its profile setpoint to be equal to the hottest of the zone temperatures and ramps the setpoint back to the soak level at the heating ramp rate. When the setpoint reaches the soak level the soak timer is restarted from zero.

Zone temps fall
while power off

Soak Level   Soak continues

SP ramps back to
Soak level.

Power OFF   Power ON
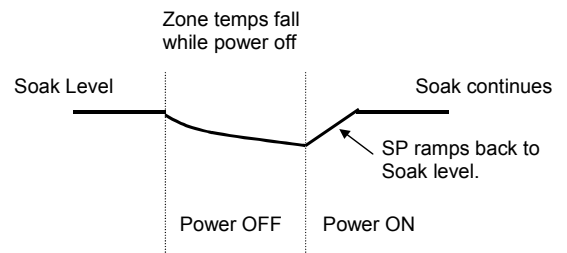
3   Controller displays

The controller displays consist of a controller overview and a scroll of up to four parameter displays for each control zone. The diagram below shows the relationship between each of the displays.
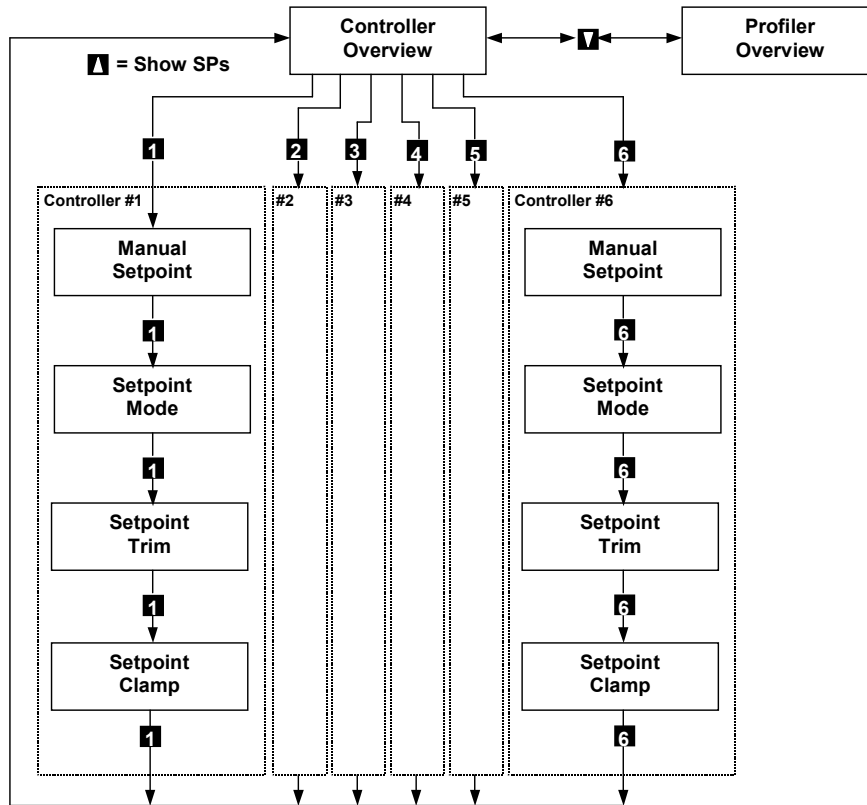
The user moves between each display by pressing one of the buttons. The instrument will emit a short beep every time a button is pressed.

3.1   Controller overview

The controller overview display is used to supervise the operation of the six internal zone controllers.
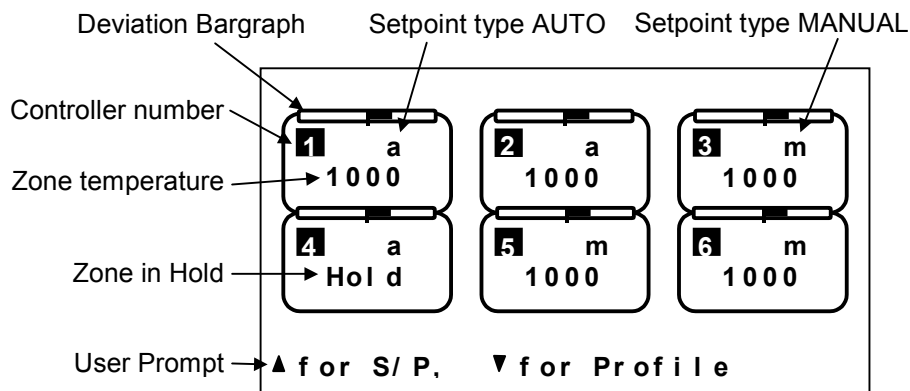
Each zone controller is represented by a rectangle on the display. Within this rectangle the current zone temperature is shown along with the setpoint mode.

At the top of each rectangle is a zone deviation bargraph this represents the error between the current zone temperature and the setpoint. The bargraph is scaled – 15 to +15 degrees from left to right with zero error in the centre. The graph is shaded from the centre outwards. Shading on the right hand side means that the zone is
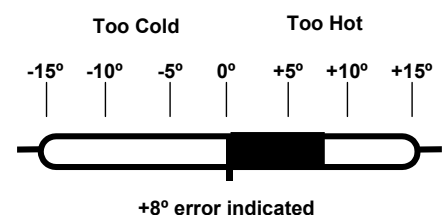
too hot. Shading on the left means that the zone is too cold.
If the profiler is running and a zone has caused the profiler to go into hold then that zone
temperature will be displayed flashing alternatively with the word **Hold**.

To display the current zone setpoints, press and hold the up button. While the button is
depressed the displayed zone temperatures will be replaced with the current zone setpoints.
Release the button and the display will return to normal.

Press the down button to monitor the profiler via the **Profiler Overview** display.

The setup parameters for each zone controller may be accessed by pressing the button
corresponding to the controller number. For example press the button 3 to access controller
3 and so on

3.2   Manual setpoint

A zone controller may be in either automatic or manual
modes. In automatic, the zone controller uses the
setpoint generated by the profiler. In manual mode the
controller uses a static setpoint entered by the operator.
Use the up and down buttons to enter the required
manual setpoint in degrees.
Alternatively press the button corresponding to the
controller number to advance to the **Setpoint Mode**
display.
If no buttons are pressed for 20 seconds then the display will revert back to the **Controller
Overview**.

```
   CONTROLLER # 1


 Manual S/P =      15


Use  ⬆ to change value
Use  🔳 for more...
```
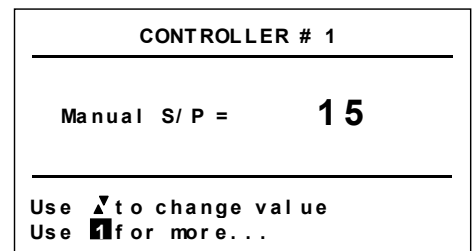
3.3   Setpoint mode

Use this display to toggle the zone controller between
automatic and manual setpoint modes. Use the up
button to select AUTO mode and the down button to
select MANUAL mode. If the controller mode is modified
then this change is implemented immediately so please
ensure that the manual setpoint value is correct before
selecting manual mode.
Alternatively press the button corresponding to the
controller number to advance to the **Setpoint Trim** display.
If no buttons are pressed for 20 seconds then the display will revert back to the **Controller
Overview**.

```
   CONTROLLER # 1


 S/P mode is    AUTO


Use  ⬆ to change mode
Use  🔳 for more...
```
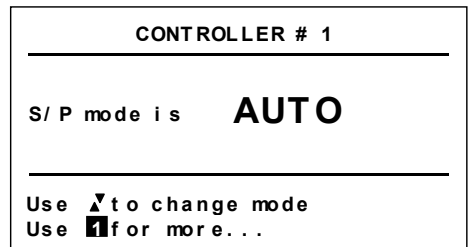
3.4   Setpoint trim

Use this display to apply a setpoint offset to the zone
controller in automatic mode. Positive values will cause
this zone controller to control slightly hotter than the
current profile setpoint. Negative values will cause this
zone controller to control slightly colder than the profile
setpoint. Any value between –50 and +50 degrees may
be entered.
The trim facility is only affective if the zone controller is
in automatic mode and the setpoint trim facility is enabled on the DIL switch.
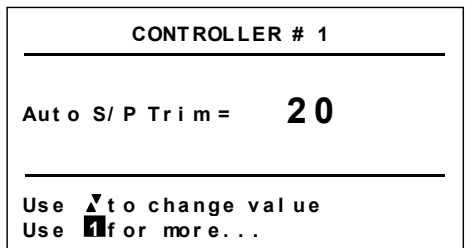
```
   CONTROLLER # 1


 Auto S/P Trim =    20


Use  ⬆ to change value
Use  🔳 for more...
```

Alternatively press the button corresponding to the controller number to advance to the **Setpoint Clamp** display.
If no buttons are pressed for 20 seconds then the display will revert back to the **Controller Overview**.

3.5 Setpoint clamp

Use this display to apply a high limit to the setpoint used by this zone controller in automatic mode. This clamp will limit the maximum control temperature for this zone.
The clamp facility is only affective if the zone controller is in automatic mode and the setpoint clamp facility is enabled on the DIL switch.
Alternatively press the button corresponding to the controller number to advance to the **Controller Overview** display.
If no buttons are pressed for 20 seconds then the display will automatically revert back to the **Controller Overview**.
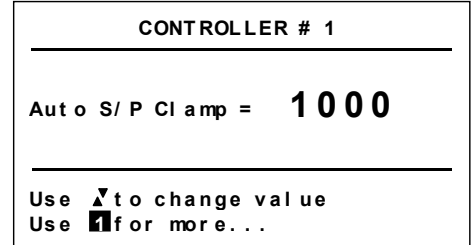
```
        CONTROLLER # 1
  _____

  Auto S/P Clamp =   1000


  _____
  Use ▲ to change value
  Use 🔳 for more...
```

4   Profiler displays

The diagram below shows the relationship between each of the displays in the profiler.
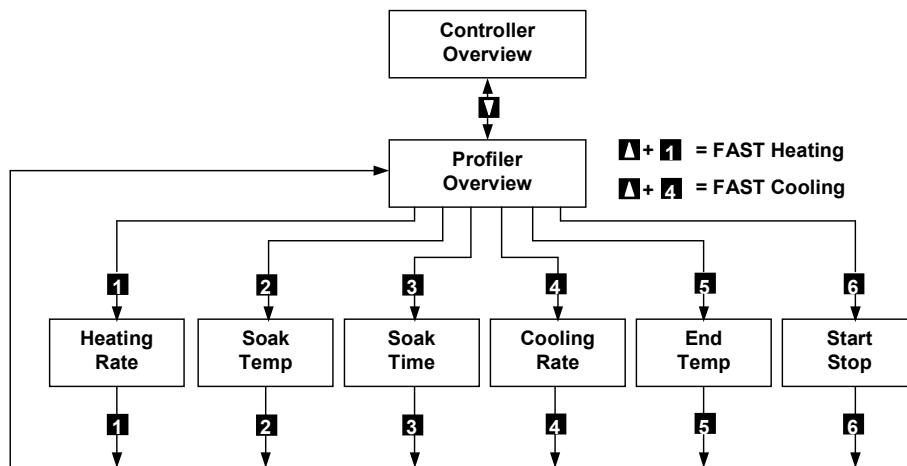
The user moves between each display by pressing one of the buttons. The instrument will emit a short beep every time a button is pressed.

4.1 Profiler overview

The profiler overview display is used to monitor and set up the operation of the profile generator by means of a mimic diagram.
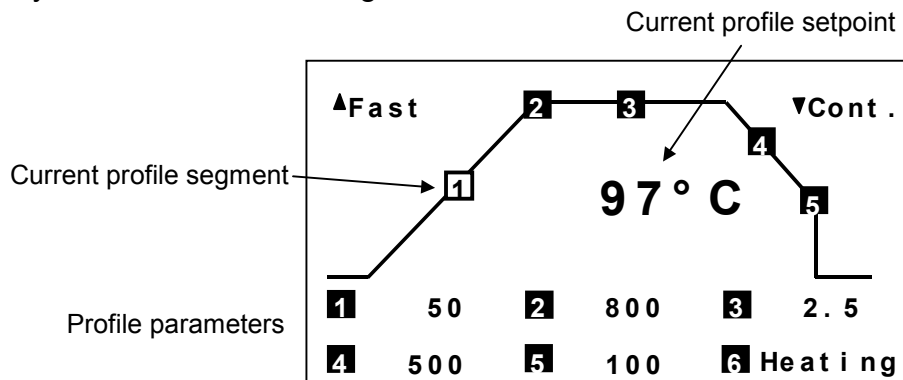
The diagram shows a typical heat-soak-cool profile with each stage numbered. The large number in the centre of the display shows the current profile setpoint with the current segment indicated by a flashing number.

While the profile is ramping up or down the user may speed up the ramp using the **Fast** facility.
To Fast through a heating ramp, press and hold down the up button and press button 1.
To Fast through a cooling ramp, press and hold down the up button and press button 4.

Press the down button to monitor the profiler via the **Controller Overview** display.

At the bottom of the display each profile parameter is listed adjacent to a number. To modify a parameter press the corresponding numbered button.

4.2   Heating rate

Use this display to set the profile heating rate in degrees per hour. This is the rate at which the profile setpoint increases from the starting temperature to the desired soak temperature. If the profiler is currently running the heating ramp, this change will take affect immediately. Enter a rate of zero if you require to step change the setpoint to the soak temperature.

```
┌─────────────────────────────────┐
│          HEATING RATE           │
│  ───────────────────────────    │
│                                 │
│   Heat at      600 Deg/Hr       │
│                                 │
│  ───────────────────────────    │
│  Use ↕ to change value          │
│  Use ■1 for more...             │
└─────────────────────────────────┘
```
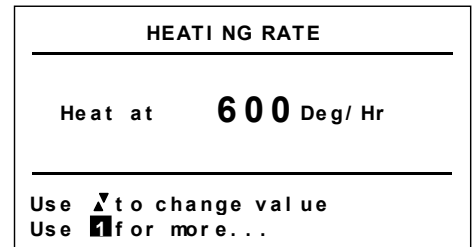
Press button 1 to return to **Profiler Overview** display.
If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**.

### 4.3   Soak temperature

Use this display to set the soak temperature in degrees. This is the temperature at which the profile setpoint remains static for the soak period. If the profiler is currently performing the soak and this value is changed, then the setpoint will be ramped to the new soak temperature at the specified heating rate and the soak will be restarted.

```
┌─────────────────────────────────┐
│        SOAK TEMPERATURE         │
│  ───────────────────────────    │
│                                 │
│   Soak at      800 Degrees      │
│                                 │
│  ───────────────────────────    │
│  Use ↕ to change value          │
│  Use ■2 for more...             │
└─────────────────────────────────┘
```

Press button 2 to return to **Profiler Overview** display.
If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**

4.4   Soak time

Use this display to set the profile soak time in hours. This is the time for which the profile setpoint remains at the desired soak temperature. If the profiler is currently performing the soak and this time is reduced below the currently elapsed soak time, the soak will terminate immediately and the cooling ramp will commence.
Enter a time of zero if you do not require a soak.

```
┌─────────────────────────────────┐
│           SOAK TIME             │
│  ───────────────────────────    │
│                                 │
│   Soak for      2.5 Hours       │
│                ( 1.8 to go )    │
│  ───────────────────────────    │
│  Use ↕ to change value          │
│  Use ■3 for more...             │
└─────────────────────────────────┘
```

If the profiler is running then the remaining soak time will be shown in brackets below the target time.

Press button 3 to return to **Profiler Overview** display.

If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**.

4.5   Cooling rate

Use this display to set the profile cooling rate in degrees per hour. This is the rate at which the profile setpoint reduces from the soak temperature to the desired end temperature. If the profiler is currently running the cooling ramp, this change will take affect immediately. Enter a rate of zero if you require to step change the setpoint to the end temperature.

```
┌─────────────────────────────────┐
│          COOLING RATE           │
│  ─────────────────────────────  │
│                                 │
│   Cool at      5 0 Deg/Hr       │
│                                 │
│  ─────────────────────────────  │
│  Use ⬍to change value           │
│  Use 4 for more...              │
└─────────────────────────────────┘
```
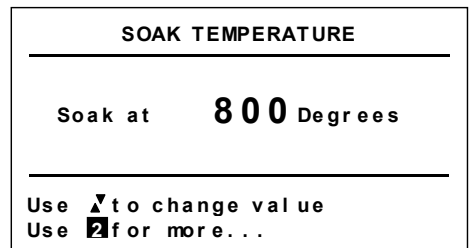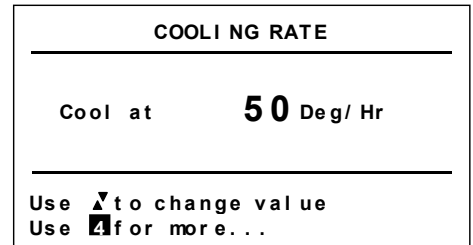
Press button 4 to return to **Profiler Overview** display.

If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**.
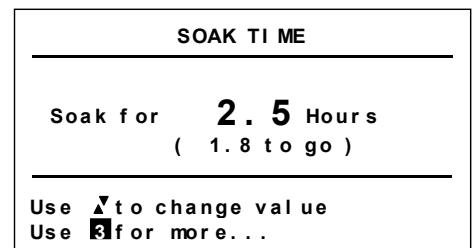
4.6   End temperature

Use this display to set the profile ending temperature in degrees. This is the temperature at which the cooling ramp terminates and the profiler returns to its ready state. If the profiler is currently running the cooling ramp, and this value is increased above the current profile setpoint, the profile will end immediately.

```
┌─────────────────────────────────┐
│        END TEMPERATURE          │
│  ─────────────────────────────  │
│                                 │
│   End at     1 0 0 Degrees      │
│                                 │
│  ─────────────────────────────  │
│  Use ⬍to change value           │
│  Use 5 for more...              │
└─────────────────────────────────┘
```

Press button 5 to return to **Profiler Overview** display.

If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**.

4.7   Profile start/stop control

Use this display to start or stop the profiler.

If the profiler is currently running then press the down button to stop the profiler and return it to the ready state

```
┌─────────────────────────────────┐
│       START/STOP CONTROL        │
│  ─────────────────────────────  │
│                                 │
│   Profiler is   RUNNING         │
│                                 │
│  ─────────────────────────────  │
│  Use ▼ to STOP                  │
│  Use 6 for more...              │
└─────────────────────────────────┘
```

If the profiler is ready (not running) then press the up button to start the profile.

```
┌─────────────────────────────────┐
│       START/STOP CONTROL        │
│  ─────────────────────────────  │
│                                 │
│   Profiler is   READY           │
│                                 │
│  ─────────────────────────────  │
│  Use ▲ to START                 │
│  Use 6 for more...              │
└─────────────────────────────────┘
```

Press button 6 to return to **Profiler Overview** display.
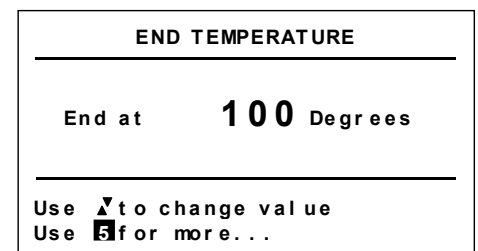If no buttons are pressed for 20 seconds then the display will revert back to the **Profiler Overview**.

5   Serial communications

The unit has 2 serial communications channels. The local communications port is used solely for communications between series 256 devices and is not available for use by the user. The host port however is available to the user and this section provides the details required to implement successful data communications between instrument and PC.

5.1   Data format

Communications may be performed in either 2 wire RS485 or 4 wire RS422 standards. Both modes are half duplex only.

The data format and Baud rate are fixed as follows.

Baud Rate	9600
Start bits	1
Word length	7 bits
Parity	Odd
Stop bits	1

5.2   Message structure

All series 256 instruments act as slave devices. This means that an instrument will not itself initiate a transaction, it merely responds to transaction requests initiated by a host computer or other similar device. Messages consist entirely of printable ASCII characters so transaction data may be conveniently tested or monitored using any terminal device.

There are two types of transaction which are supported by the 256 instrument. Read transactions (requests for data from the 256) or write transactions (data sent to the 256).

5.2.1   Read transactions

Read transactions are used to acquire data from the 256 and consist of messages of the following general form.

RAAPSS<CR>

Where **R**   = Read message header ASCII code 52h
       AA   = Instrument address
       P   = Parameter code
       SS   = Secondary parameter code
       <CR> = Message terminator ASCII code 0Dh

Messages to the instrument may include spaces or linefeeds if required. These will be ignored. Messages from the instrument will not contain either linefeeds or spaces.

5.2.2 Write transactions

Write transactions are used to write data into the 256 and consist of messages of the following general form.

WAAPSSD…D<CR>

Where **W** = Read message header ASCII code 57h
AA = Instrument address
P = Parameter code
SS = Secondary parameter code
D…D = Data to write
<CR> = Message terminator ASCII code 0Dh

Messages to the instrument may include spaces or linefeeds if required. These will be ignored. Messages from the instrument will not contain either linefeeds or spaces.

5.2.3 Instrument address

Each instrument must be given a unique address between 00 and 39. This address is set on the configuration DIL switch (see section 1.3). The address field of the message consists of two ASCII numerals and determines to which instrument the message is directed. An instrument will ignore a message that does not contain its own address. The user may choose to use the broadcast address facility. This is a means of writing data to a group of instruments at the same time. Either address character may be replaced by the character X (ASCII code 58h).
For example if a write message is sent to address 2X, then all instrument addresses 20 to 29 will action the message.
Please note instruments written to using the broadcast address facility will not reply to the message.

5.2.4 Parameter code and SS field

The parameter code field of the message is a single ASCII character, this identifies the parameter group within the instrument which is the target of the read or write message. Used in conjunction with the two digit SS field the instrument is able to identify the specific parameter required.

Code	SS	R/W	Parameter	Data Range	Units
A	01 to 06	R	Zone temperature 1 to 6	0 to 2000	Degs
A	07	R	Cold junction temperature	0 to 100	Degs
B	01 to 06	R	Zone outputs 1 to 6	0 to 1000	0.1 %
C	01 to 06	R/W	Zone manual setpoints 1 to 6	0 to 2000	Degs
K	01 to 06	R/W	Zone setpoint trims 1 to 6	-50 to +50	Degs
L	01 to 06	R/W	Zone setpoint clamps 1 to 6	0 to 2000	Degs
M	01	R	Zone hold status	(1)	
N	01 to 06	R	Zone actual setpoints 1 to 6	0 to 2000	Degs
O	01 to 06	R/W	Zone setpoint types 1 to 6	(1)	
Q[(p)]	01	R	Status of profiler	(1)	
Q[(p)]	11	R	Hold status of profiler	0 to 1	
R[(p)]	01	R	Current profiler setpoint	0 to 2000	Degs
S[(p)]	11	R/W	Profiler heating rate	0 to 1000	Degs/Hr

S$^{(p)}$	21	R/W	Profiler cooling rate	0 to 1000	Degs/Hr
T$^{(p)}$	11	R/W	Profiler soak time	0 to 1000	0.1 Hrs
U$^{(p)}$	11	R/W	Profiler soak temperature	0 to 2000	Degs
U$^{(p)}$	21	R/W	Profiler end temperature	0 to 2000	Degs
V$^{(p)}$	01	R	Profiler soak elapsed	0 to 1000	0.1 Hrs
Z$^{(p)}$	01	W	Profiler start/stop	0 to 1	

$^{(p)}$ Only available on P256
$^{(1)}$ Coded data field see section 5.3

5.2.5   Data field

The data field part of the message consists of 4 ASCII numeric characters preceded by an optional minus sign. The data field should be left padded with zeros such that there are always 4 numeric characters.

For example
    0000   represents zero
    0100   represents the number 100d
    -0100   represents the number -100d

5.3   Normal message responses

A successful message received by the instrument will usually initiate a message response. This will consist of a message of the following general form.

*AAPSSD…D<CR>

Where *   = Response message header ASCII code 2Ah
       AA   = Instrument address
       P   = Parameter code
       SS   = Secondary parameter code
       D…D   = Data
       <CR> = Message terminator ASCII code 0Dh

The returned data field contains either the data requested (read transaction) or confirmation of the data just written (write transaction). All data returned is numeric and is of the type defined in section 5.2.5

Certain parameters however use coded data fields as follows

Parameter **M** (controller hold status)
This parameter returns a bit weighted number with the following bit meanings

        Bit   Meaning
        0   zone 1 in Hold
        1   zone 2 in Hold
        2   zone 3 in Hold
        3   zone 4 in Hold
        4   zone 5 in Hold

5   zone 6 in Hold

for example the number 6 indicates that zones 2 and 3 are in hold.

Parameter **O** (controller setpoint type)
This parameter returns   0 for controller in manual setpoint
                              1 for controller in automatic setpoint

Parameter **Q01** (profiler status)
This parameter returns a number with the following bit meanings

Number	Meaning
0	Ready
1	Servo starting
2	Heating
4	Soaking
8	Cooling

Parameter **Q11** (profiler hold status)
This parameter returns   0 for profiler NOT in hold
                              1 for profiler in Hold

5.4   Error message responses

Commands to the P256, other than broadcast commands, that contain an error or cannot be understood result in an error reply of the general form:

?AAEF<CR>

Where **?**   = Message header ASCII code 3Fh
       AA   = Address of the replying instrument.

       E   = Character fault error code.
       F   = Message fault error code.
       <CR>   = Message terminator ASCII code 0Dh

Character error codes.
Field **E** is a single ASCII hexadecimal number who's binary weighting indicates the type of character corruption that may have given rise to the error:

BIT	MEANING
3	break in transmission
2	parity error
1	framing error
0	receiver over-run error

Message error codes.
Field F is a single ASCII hexadecimal number who's binary weighting indicates the type of message fault that may have given rise to the error:

BIT	MEANING
3	Illegal header
2	Illegal parameter code or number
1	Illegal data

      0   Illegal number of characters in command.

In general only one possible error will be identified thus either fields **E** or **F** will be zero. Where a command character is found to be corrupted then the receiving instrument(s) will treat the corrupted character as the final character of the message and will attempt to interpret it. Where the corruption has occurred in the header or address fields of the message then no reply is given and message is ignored. If, as is likely, the message continues after the corrupted character then the instruments will treat that part of the message after the corruption as a new message. This will generate a reply if the supposed address in the remainder of the message is recognised by an instrument: this is bound to result in an error message but fields E and F will refer, not to the original corruption, but to the meaningless nature of the remainder of the message. For this reason no great reliance should be placed on the validity of either E or F.

When the instrument detects a communications error it will emit a short beep from its internal sounder.

6   Specifications

6.1 General

Front bezel	Dark grey Noryl SE1
Bezel size	96 x 96 to DIN 43700
Panel cut out	92 +0.8/-0 square
Case	Zinc plated sheet steel
Case depth	152 including terminals
Connectors	2 part 5.08 pitch for up to 14 AWG
Display window	Polycarbonate
Display	Graphic LCD panel 128 x 64 pixels
Display backlight	Continuous yellow-green LED
Buttons	8 off blue-green silicone rubber
Panel fixing	2 off M3 screws allowing withdrawal of entire unit from front of panel
Weight	Approx. 800g
Protection	Front: IP65, Rear IP00
Safety	BS EN 61010-1
Installation Cat.	II
Pollution degree	2.
EMC	BS EN 50081-2, BS EN 50082-2
Serial interface	2 off RS422/RS485
Supply	95-253 V rms, 48 - 62 Hz, < 10VA
Environment	Operating 0 - 60 C, 5 - 95% rh non-condensing
	Storage -10 - 65 C, 5 - 95% rh non-condensing

6.2 **Controllers**

All controllers share the following common parameters:

Sensor	K to BS EN 60584-1 (others by special order)
Units	Degrees C or F

Resolution	Measurement:	0.1 degrees
	Display:	1.0 degree
Sampling	Every 0.735 seconds	
Isolation	100 V sensor – sensor	
	100 V sensor - earth	
Break detection	Up scale, sensor current 100 nA	
Prop band	10 degrees C (18 degrees F)	
TP cycle time	20 seconds	
Hold band	1, 2 or 3 times prop band	
Hold type	Below only or above and below	
TP output	1 form A relay contact per controller	
Relay rating	264 V rms max, 10 V dc min, 0.5 A resistive	
Leakage	Less than 4mA rms at 265 Vrms	

Each controller has the following independent parameters:

Set point type	Manual or Automatic
Manual set point	0 to 1200ºC (2000ºF) in 1 degree increments
Auto s/p trim	+/- 50ºC (+/- 90ºF) in 1 degree increments
Auto s/p clamp	0 to 1200ºC (2000ºF) in 1 degree increments

6.3 **Profiler**

The profiler has the following parameters:

Heating rate	0 (step) to 1000 degrees per hour in 1 increments
Soak temperature	0 to 1200ºC (2000ºF) in 1 degree increments
Soak time	0 to 100.0 Hrs in 0.1 Hr increments
Cooling rate	0 (step) to 1000 degrees per hour in 1 increments
End temperature	0 to 1200ºC (2000ºF) in 1 degree increments
Hold mode	Ramps only or ramps and dwell