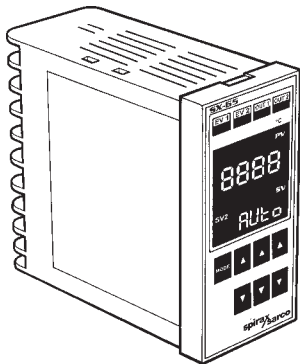


## SX65 Series Temperature Controller Installation and Maintenance Instructions



- 1. Technical data*
- 2. Safety information*
- 3. Installation*
- 4. Parameters*
- 5. Commissioning examples*
- 6. Error messages*

# 1. Technical data

## Front panel

### Event 1 (EV1) and 2 (EV2), LED indicators.

These light up when the alarm outputs are active.

### SV2, LED indicator.

This will light up when the second set value is activated by closing terminals 4 and 5.

### Mode key,

used to cycle through the parameters, and to enter the configuration mode.

### OUT 1 and OUT 2, LED indicators.

These light up when the control outputs are active.

### PV display,

shows the process variable in °C or °F of your system.

### SV display,

shows the set value in °C or °F, entered for the controller to maintain.

### Up and down arrow keys,

used to modify the parameters values.



## Description

The SX65 controller is a panel mounted temperature controller suitable for constant set point applications for use with the Spirax Sarco range of electric and pneumatic series actuators, valves and sensors.

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## General data

Mounting arrangement	Panel mounting 1/8 DIN
Power supply	100 V to 240 Vac 50/60 Hz
Power consumption	11 VA
Electrical connections	20 screw terminals at rear terminal block
Front protection	IP54
Operating temperature	From 0 to 50 °C
Storage temperature	-20 to +65°C
Humidity	From 35 % to 85 % (RH), non-condensing
Electromagnetic compatibility	89 / 336 / EEC, meeting the standards: EN 50081-1 (Emissions), EN 50082-2 (Immunity)
Safety requirements	73 / 23 / EEC and 93 / 68 / EEC reference harmonised standard EN 61010-1
Installation category	II
Input: RTD	Pt100 3 wire connection, °C or °F set via keypad entry
Display update time	500 ms
Set values	2 set values available, selected by the logic input
Logic input	One logic input to select the second set value
Event 1 output	Relay with SPST N.O. contact, 2 A at 250 Vac for Alarm 1
Event 2 output	Relay with SPST N.O. contact, 2 A at 250 Vac for Alarm 2
Accuracy	± 0.3 % of full scale
Memory protection	10 years
Weight	230 g
Materials: Enclosure	ABS black colour

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## General data

### SX65 mA version technical data\*

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mA control output	4-20 mA, maximum load 600 $\Omega$
mA control sensitivity	Only used for ON / OFF control action. The setting range is between the SLL (Set Low Limit) and the SLH (Set High Limit) of the input span.

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On the display the percentage of the output range can be viewed by pressing the Mode key.  
See Section 4.1

\* The SX65 mA retransmission output must be specified when ordering.

### SX65 VMD version technical data

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VMD control output	2 SPST (normally open) relays interlocked, 500 mA, 250 Vac on resistive load for VMD (Valve Motor Drive) control.
VMD dead band	The setting range is between 1 and 50

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On the controller's display, the LED's 'Out 1' and 'Out 2' indicate which output is active.

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## Control action

<b>The control action</b>	PID + OSP (Overshoot protection).
<b>Proportional band</b>	From 0.1 to 200.0 % of the input span (SLL to SLH). For mA output, when P = 0.0, the control action becomes ON/OFF.
<b>Integral time</b>	From 1 to 3 600 seconds, if zero value is selected, the integral action is excluded.
<b>Derivative time</b>	From 1 to 3 600 seconds, if zero value is selected, the derivative action is excluded.
<b>Auto tune</b>	Can be enabled from the keypad, to automatically calculate suitable PID values.
<b>Auto / manual</b>	Can be selected from the keypad.

## Event outputs

**Event 1 and Event 2:** are 2 SPST normally open relay outputs rated at 500 mA 250 Vac resistive load. These are used as outputs for the 2 alarms (A1F, A2F) which can be configured as a process alarm, or a deviation alarm. Both of these alarms can be set for high, low, high and low, or band settings. There are several other options that can be selected for the alarms, which are latch, sequence, and audio. When the threshold for Alarm 1 or Alarm 2 is reached, it will close the contacts to Event 1 or Event 2 output respectively. The alarm hysteresis (ALC) can be set from 0 to 999, units in °C to suit the users requirements.

See Section 4.4 for explanations on the alarms (A1F / A2F).

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## 2. Safety information

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**All personnel using this product must carefully read this manual prior to operation.  
Your attention is drawn to Safety Information Leaflet IM-GCM-10.**

If these controllers are handled improperly or not used as specified, the result may:

- Cause danger to the life and limb of the user or a third party.
- Damage to the controller and other items belonging to the owner.
- Hinder the performance of the controller.

### 2.1 Wiring notes

Every effort has been made during the design of the controller to ensure the safety of the user, but the following precautions must be followed:

- Maintenance personnel must be suitably qualified in working with equipment containing hazardous live voltages.
- Ensure correct installation. This controller is designed for installation in an enclosure which provides adequate protection against electric shock. Local regulations regarding electrical installation should be rigidly observed. Consideration should be given to prevention of access to the power termination's by unauthorised personnel. Safety may be compromised if the installation of the product is not carried out as specified in this manual.
- Isolate the controller from the mains supply before opening the unit.
- The controller is designed as an installation category II product, and is reliant on the building installation for over-current protection and primary isolation.
- Wiring should be carried out in accordance with IEC 364 or equivalent.
- Fuse rated at 2A / 250 V should be fitted in all phases of the controller's supply. Fuses should not be fitted in the protective earth conductor. The integrity of the installation protective earth system must not be compromised by the disconnection or removal of other equipment.

- 
- The mains cable connections at the rear of the controller, must be retained in position (by tiewrapping etc.). This will prevent the high voltage cables at the rear of the controller from touching the SELV (Safe Extra Low Voltage) connections, in the unlikely event of the terminals coming loose.
  - A disconnecting device (switch or circuit breaker) must be included in the building installation. This must be in close proximity to the equipment and within easy reach of the operator.  
There must be a 3 mm contact separation in all poles.
    - It must be marked as the disconnecting device for the controller.
    - It must not interrupt the protective earth conductor.
    - It must not be incorporated into a mains supply cord.
    - The requirements for the disconnecting device are specified in IEC 947-1 and IEC 947-3 or equivalent.
  - The controller must not be located in such a way that the disconnecting device is made difficult to operate.
  - When a neutral line is present, connect it to terminal 2.

## 2.2 Safety requirements and electromagnetic compatibility notes

This product is CE marked. It complies with the requirements of the low voltage directive 73 / 23 / EEC, by meeting the standard EN 61010-1. This product complies with the requirement of Electromagnetic Compatibility Directive 89 / 336 / EEC, by meeting the standards of EN 50081-1 (Emissions) and EN 50082-2 (Industrial Immunity).

### **This product may be exposed to interference above the limits of EN 50082-2 if:**

- The product or its wiring is located near a radio transmitter.
- Excessive electrical noise occurs on the mains supply.
- Cellular telephones and mobile radios may cause interference if used within approximately one metre of the product or its wiring.  
The actual separation necessary will vary according to the power of the transmitter.
- 'ac' power line protectors should be installed if mains supply noise is likely, Protectors can combine filtering , suppression, surge and spike arrestors.

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## 3. Installation

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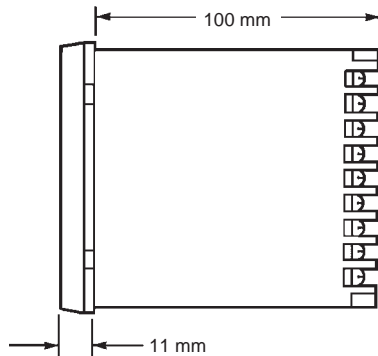
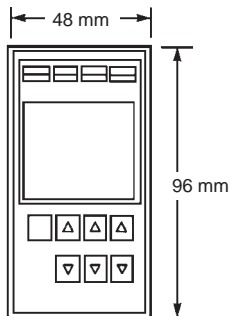
Select a mounting location where there is minimum vibration and the ambient temperature range is between 0 and 50°C. The controller can be mounted in a panel with a square cut-out of 45 mm x 92 mm, see Section 3.2.

The controller is shipped with a gasket and two retaining clips.

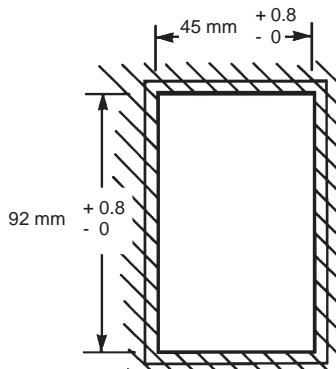
To ensure that the IP54 rating is achieved, insert the panel gasket between the controller and the panel, as shown in Section 3.3.

Whilst holding the controller against the panel, insert the two retaining clips, and with an appropriate screw driver, turn the screws with a torque between 0.3 and 0.4 N m.

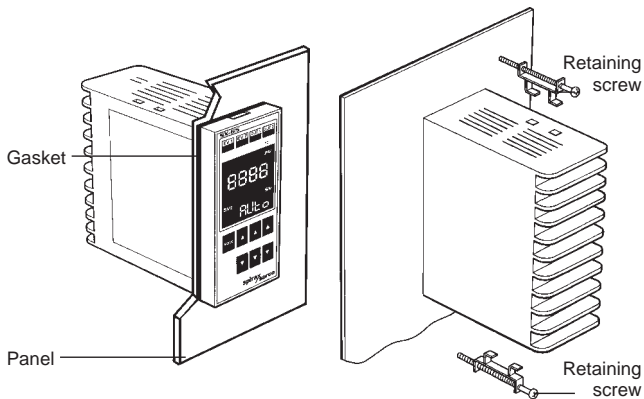
### 3.1 Dimensions



### 3.2 Panel cut-out



### 3.3 Mounting the controller



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### 3.4 Wiring details

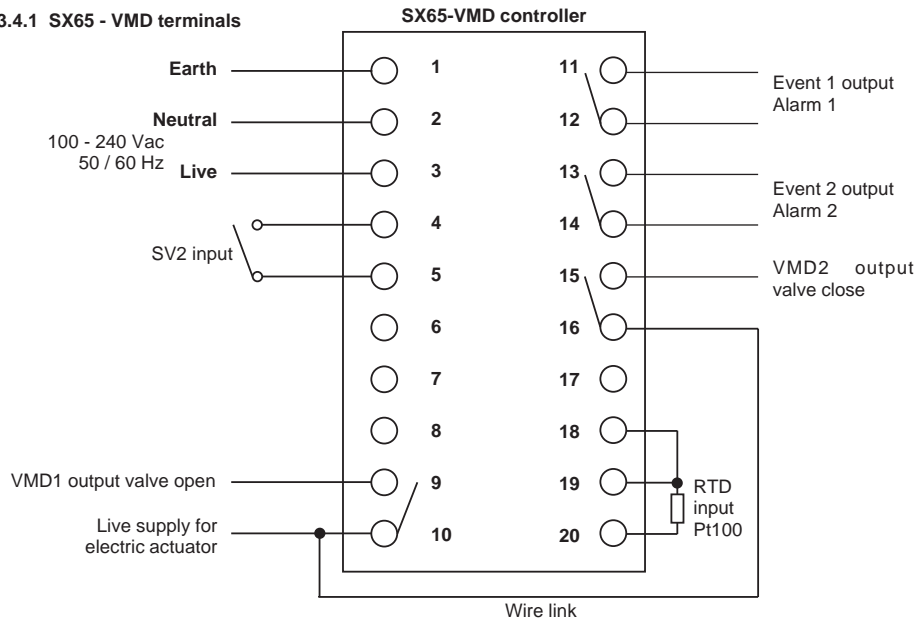
#### Important

**Read safety information wiring notes, before attempting to wire the supply to the controller.**

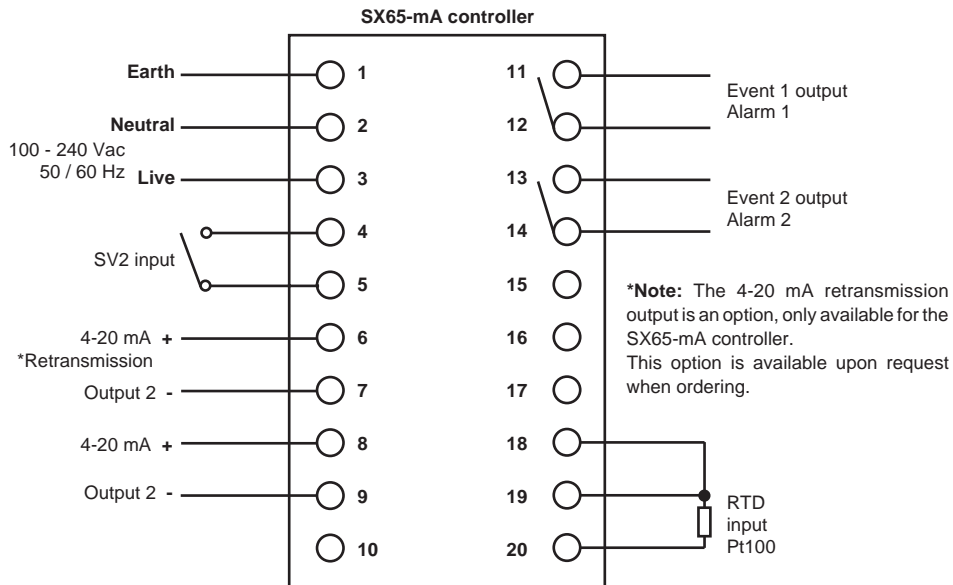
- Fuses should be fitted in all phases, but not in the protective earth conductor.
- The integrity of the installation protective earth system must not be compromised by the disconnection or removal of other equipment.
- For supply connections, use 0.75 mm<sup>2</sup> wire, double insulated as stated in IEC 364 if wires are exposed to touch.
- SX65-mA, the maximum load for the 4-20 mA output is 600 Ω

**RTD Pt100 input:** attention must be given to the line resistance. A high line resistance may cause measurement errors. The resistance of the 3 wires must have equal resistance. Do not run input wires together with power cables. To avoid ground loop currents in the shielded cable, only one end of the shielding should be earthed.

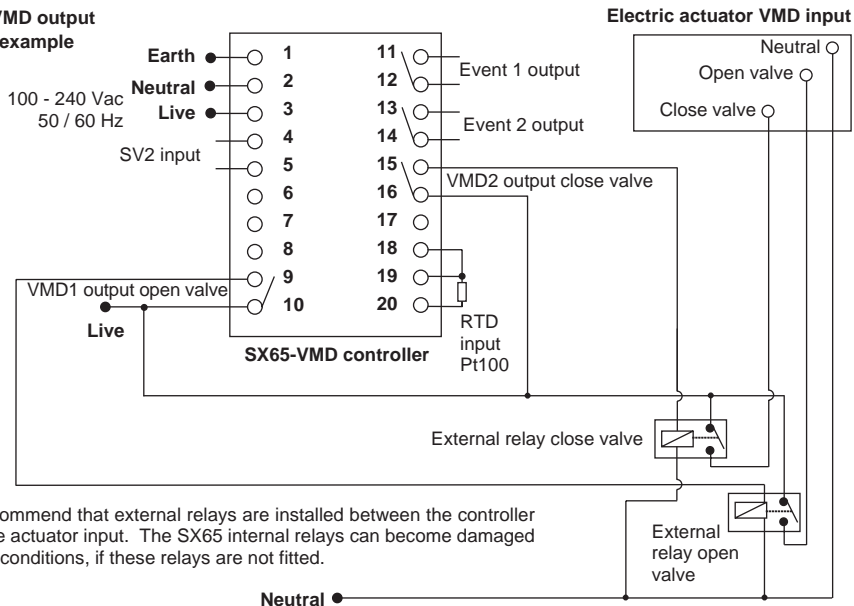
### 3.4.1 SX65 - VMD terminals



### 3.4.2 SX65 - mA terminals

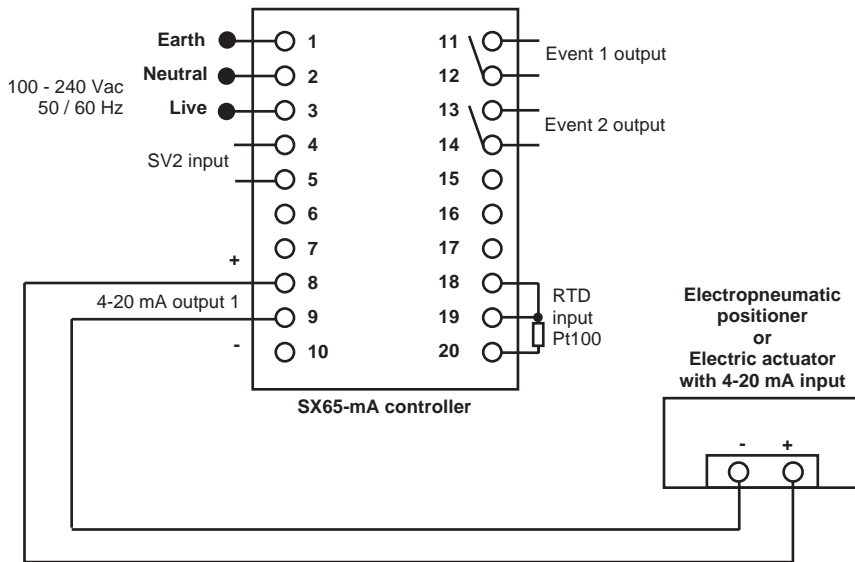


### 3.4.3 SX65-VMD output wiring example



**Note:** We recommend that external relays are installed between the controller output and the actuator input. The SX65 internal relays can become damaged under certain conditions, if these relays are not fitted.

### 3.4.4 SX65-mA output wiring example



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## 4. Parameters

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### 4.1 Level 1: Operator mode

#### Introduction

The operator mode is the normal day to day mode of the SX65 whilst it is controlling. Figure 1 below shows an example of the controller normal operating display.



#### Top display

Shows the process value of 20°C, from the input signal.

#### Bottom display

Shows the set value entered via the key pad, of 25°C.

#### Key pad

Use ▲ and ▼ keys to change values, and the mode key to select the next parameter

Fig. 1

To alter the parameters that are shown below, press the mode key to cycle through the list, and select the appropriate parameter. Then use the ▲ and ▼ keys to obtain the required value. For descriptions on these parameters see Section 4.2.

Parameter	Display	Adjustment range	Original settings
<b>Set value in °C or °F</b>	20.0 25.0	Between SLL (Set Limit Low) and SLH (Set Limit High)* (Together they make the input Span).	0.0
<b>Auto / manual control</b>	20.0 AUto	Auto or manual control	Auto
<b>Output % (mA version)</b>	20.0 50.0	Between -10 % to +110 %, check NLL (mA Limit Low) & NLH (mA Limit High) *.	None
<b>VMD position (VMD version)</b>	20.0 displays open / close	Opening, closing, or blank (no drive).	None
<b>Auto-tune</b>	At oFF	On or off	Off
<b>Alarm 1 low threshold</b>	AL 1L 0.0	-1 999 to 9 999 digits in °C or °F.	0.0
<b>Alarm 1 high threshold</b>	AL 1H 0.0	-1 999 to 9 999 digits in °C or °F.	0.0
<b>Alarm 2 low threshold</b>	AL 2L 0.0	-1 999 to 9 999 digits in °C or °F.	0.0
<b>Alarm 1 high threshold</b>	AL 2H 0.0	-1 999 to 9 999 digits in °C or °F.	0.0

**Note:**The alarm thresholds will not be displayed if they have not been activated. See configuration mode.

\* To view SLL, SLH, NLL, NLH, please go to Section 4.3 configuration mode.

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## 4.2 Operator mode descriptions

**Set value:** This is the temperature that the controller is aiming to achieve.

**Auto/manual control:** This is used to select automatic or manual control. Press the right hand ▲ or ▼ key, to toggle between the two.

**Output %:** This displays the percentage of the control output. In auto control this is 'read only'. In manual control, this value can be adjusted (mA version only).

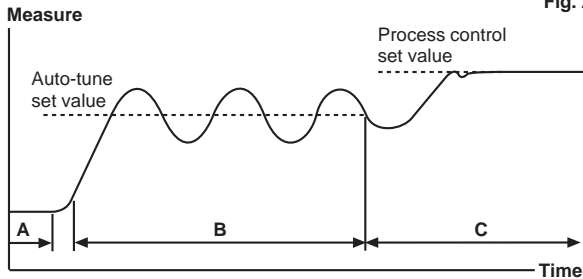
**VMD position:** This displays the condition of the control output. Shows opening, closing, or blank (not being driven). In auto control this is 'read only'. In manual control, the VMD position can be selected with the ▲ and ▼ keys to open or close the valve. (**Note:** this cannot be used to view the valve position)

**Auto-tune:** This function is used to tune the PID parameters to the optimum values. When the Auto-tune has been activated, the SX65 will stop control of your system, to run through the tune cycle. An appropriate value must be entered in the set value before you begin the tune. The set value must be of a temperature that will prevent the process value from exceeding your maximum operating temperatures (see note below).

To start the auto-tune with 'At' in the top display, press the right hand ▲ or ▼ key for 2 seconds. If this does not work, ensure that the controller is in Auto control, and the proportional band is greater than 0.0. When the auto-tune has been activated the bottom display of the controller will flash 'At'. During the auto-tune, the output action will oscillate around the set value, by changing the valve position from fully open to fully closed (similar to on/off control).

**Note:** The process value will over-shoot the set value during the auto-tune. Figure 2 (page 18) shows how the controller performs the tune. After the controller has cycled 3 times, the internal algorithms will calculate and enter the PID values automatically. The auto-tune will end, and the SX65 will begin to control with its new PID values.

To terminate the auto-tune at any time, select the auto-tune parameter, by pressing the mode key. With 'At' in the top display, press one of the ▲ or ▼ key for 2 seconds. The lower display should stop flashing 'At', and will show 'oFF'.



**Fig. 2:** This shows an example of a typical auto-tune. The auto-tune must be performed at a temperature that is lower than the desired set value for your process.

**Time 'A'**, the operator increases the set value to the desired auto-tune temperature.

**Time 'B'**, the auto-tune is activated, and calculates the PID values.

**Time 'C'**, the auto-tune is complete, the operator changes the set value to the desired value for the process, and the SX65 begins to control at that temperature.

**Alarm threshold:** The threshold settings will not be displayed if the alarms have not been configured (See 'Configuration mode'). Enter a value into the alarm threshold using the ▲ and ▼ keys. Press the mode key to move to the next parameter.

### 4.3 Level 2: Configuration mode

To enter the configuration mode, with the controller in the operator mode, depress the mode key for more than 2 seconds. To enter a value in one of these parameters, use the ▲ and ▼ keys. To accept the value, and move to the next parameter, press the mode key once. To leave the configuration mode at any time, depress the mode key for more than 2 seconds.

For descriptions of the following parameters, see Section 4.4.

The SX65 controller has been preconfigured at the factory prior to despatch; generally the preset values will be sufficient for most applications with the exception of application specific parameters, e.g. alarms.

Parameter	Display	Adjustment range	Original settings
<b>Proportional band</b> P	P 3.0	0.1 to 200 % of set value span (SLL to SLH)	3.0
<b>Integral time</b> I	I 80	1 to 3 600 seconds. If I = 0, Integral action is off	80
<b>Derivative time</b> d	d 20	1 to 3 600 seconds. If d = 0, Derivative action is off	20
<b>4-20 mA On / off control dead band</b> C	C 0	Only available when P = 0.0 The range is within the set value span (SLL to SLH) <b>Note:</b> Valid for mA outputs only	0.0
<b>VMD Dead band</b> db	db 5	1 to 50 % setting range <b>Note:</b> Valid for VMD outputs only	5
<b>VMD stroke time</b> tSun	tSun 40	6 to 180 seconds <b>Note:</b> Valid for VMD Outputs only	40
<b>Hardware type</b> I/O	I / o I0_I	This is read only: I 0 _ I = Pt100 input ; mA output I 0 F F = Pt100 input ; VMD output 3 0 = mA retransmission	Depends on the variant ordered
<b>4 mA control offset</b> nLL	nLL 0.0	-10 % to nLH of the mA output <b>Note:</b> Valid for mA outputs only	0.0
<b>20 mA control offset</b> nLH	nLH 100.0	nLL to +110 % of the mA output <b>Note:</b> Valid for mA outputs only	100.0
<b>Fail-safe position</b> bnu	bnu 0.0	0 for close valve 100 for open valve	0

Parameter	Display	Adjustment range	Original settings
<b>Low set value SLL</b>	SLL 0.0	-1 999 to SLH in ° (no decimal point) -199.9 to SLH in ° (decimal point)	0.0
<b>High set value SLH</b>	SLH 200.0	SLL to 9 999 in ° (no decimal point) SLL to 999.9 in ° (decimal point)	200.0
<b>Type of control Cnt</b>	Cnt 4	1 = PID and OSP (Direct) control 2 = PID and OSP (Reverse) control 3 = PID (Direct) control 4 = PID (Reverse) control	4
<b>Offset process value PuS</b>	PuS 0.0	Set value span (SLL to SLH) in ° (C or F)	0.0
<b>VMD initial position ASP</b>	ASP 50.0	0.0 to 100.0 % of the valve stroke <b>Note:</b> Valid for VMD outputs only	50.0
<b>Power fail initial position Pbb</b>	0.0	0.0 % to 100.0 % <b>Note:</b> Valid for mA outputs only	0.0
<b>Process value digital filter PdF</b>	PdF 1	0 to 99 seconds sample filtering	1

Parameter	Display	Adjustment range	Factory settings
<p data-bbox="113 417 273 531">Event 1 and Event 2 configuration</p> <p data-bbox="171 627 215 710">A1F and A2F</p>	<p data-bbox="361 417 404 469">A1F 000</p> <p data-bbox="368 510 397 531">or</p> <p data-bbox="361 596 404 648">A2F 000</p>	<p data-bbox="492 177 744 197"><b>Event code selection</b></p> <div data-bbox="481 228 739 265"> <input type="checkbox"/> X    <input type="checkbox"/> X    <input type="checkbox"/> X         </div> <div data-bbox="481 348 797 462"> <p data-bbox="492 358 744 379"><b>Input signal fail alarm</b></p> <p data-bbox="492 389 583 410">0 = OFF</p> <p data-bbox="492 420 569 441">1 = ON</p> </div> <div data-bbox="481 503 1096 689"> <p data-bbox="492 513 729 534"><b>Main alarm selection</b></p> <p data-bbox="492 544 583 565">0 = None</p> <p data-bbox="492 576 773 596">1 = Deviation high and low</p> <p data-bbox="492 607 685 627">2 = Deviation high</p> <p data-bbox="492 638 685 658">3 = Deviation low</p> <p data-bbox="492 669 685 689">4 = Deviation band</p> <p data-bbox="802 576 1078 596">5 = Process high and low</p> <p data-bbox="802 607 976 627">6 = Process high</p> <p data-bbox="802 638 976 658">7 = Process low</p> <p data-bbox="802 669 991 689">8 = Process band</p> </div> <div data-bbox="481 715 1141 897"> <p data-bbox="492 726 656 746"><b>Alarm options</b></p> <p data-bbox="492 757 583 778">0 = None</p> <p data-bbox="492 788 583 809">1 = Latch</p> <p data-bbox="492 819 583 840">2 = Audio</p> <p data-bbox="492 850 627 871">3 = Sequence</p> <p data-bbox="802 757 1006 778">4 = Latch and audio</p> <p data-bbox="802 788 1064 809">5 = Latch and sequence</p> <p data-bbox="802 819 1064 840">6 = Sequence and audio</p> <p data-bbox="802 850 1064 891">7 = Latch and sequence and audio</p> </div>	<p data-bbox="1239 539 1282 560">000</p>

Parameter	Display	Adjustment range	Factory settings
Alarm hysteresis <b>ALC</b>	ALC 0	0 to 999°	0
<p>mA Retransmission trn</p> <p><b>Note: Valid for retransmission mA controllers only</b></p>	trn 101	<p><b>Retransmission code selection</b></p> <p>1 = mA output</p> <p>0 = Normal 4-20 mA 1 = Reverse 20-4 mA</p> <p>1 = Process variable output 2 = Set value output 3 = % of control output</p>	101

Parameter	Display	Adjustment range	Factory settings
<b>2nd set value Sv2</b>	Sv2 0.0	Between SLL and SLH (set value span), in °C or °F	0.0
<b>Decimal point position dP</b>	dP 0.0	<b>0</b> =None <b>0.0</b> =One decimal place	0.0
<b>Temperature scale C / F</b>	C / F	°C=Celsius °F=Fahrenheit	°C
<b>Key audio confirm bU</b>	bU on	<b>On</b> =Audio sound on <b>Off</b> = Audio sound off	on
<b>Security lock out LoC</b>	LoC oFF	<b>Off</b> = No lock out. <b>All</b> = Locks all level 1 and level 2 parameters. <b>Pra</b> = Locks all level 2 parameters. <b>EsV</b> = With the exception of the set value, this locks all level 1 and level 2 parameters.	oFF

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## 4.4 Configuration mode descriptions

### 'P' Proportional band

This parameter is the proportional band setting. This can be edited by the operator, or automatically set by the auto-tune facility. The settings range between 0.1 to 200 % of the set value span. The set value span is from the low set value (SLL) to the high set value (SLH). The factory setting is 3.0 %. If the P band is set to zero %, the output action will be on/off control.

### 'I' Integral time

This parameter is the integral time setting. This can be edited by the operator, or automatically set by the auto-tune facility. This parameter is adjustable between 1 second and 3 600 seconds. This parameter will be omitted if the proportional band has been set to zero %. If the integral time is set to zero, the integral action will be off.

### 'd' Derivative Time

This parameter is the derivative time setting. This can be edited by the operator, or automatically set by the auto-tune facility. This parameter is adjustable between 1 second and 3 600 seconds. This parameter will be omitted if the proportional band has been set to zero %. If the derivative time is set to zero, the derivative action will be off.

### 'C' 4-20 mA on/off control dead band

This parameter is valid for the mA output controllers, and is only available when the proportional band has been set to zero %. The setting range is between the set value span (from SLL to SLH), in °C or °F.

### 'db' VMD dead band

This parameter is valid for the VMD output controllers. The setting range is 1 to 50 %. The factory setting is 5 %.

### 'tSun' VMD stroke time

This parameter is valid for the VMD output controllers. Enter the time duration for the actuator to travel from the fully closed position to the fully open position. Setting range is 6 to 180 seconds. The factory setting is 40 seconds.

### 'I/O' hardware type

This is a 'read only' parameter, and shows the type of input and output cards that are installed. The type of hardware your controller has must be specified when ordering, and cannot be changed afterwards.

---

### **'nLL' control signal low limit**

This parameter allows the user to offset the 0% value of the control output. This value can be offset from -10 % (2.4 mA) to 100 % (20 mA) of the mA span (16 mA). The factory setting is 0.0 %, which represents 4 mA. This parameter is valid for the mA output controllers.

### **'nLH' control signal high limit**

This parameter allows the user to offset the 100 % signal of the control output. This value can be offset from 100 % (20 mA) to 110 % (21.6 mA) of the mA span (16 mA). The factory setting is 100.0 %, which represents 20 mA. This parameter is valid for the mA output controllers.

### **'bnu' fail safe position**

In the event of the input signal failing, the valve can be driven to a safe position. The valve can be fully closed or fully opened. 0 denotes close valve, 100 denotes open valve. The factory setting is 0, for close valve.

### **'SLL' low set value**

This parameter is used to set the lowest value possible for the set value. This can be set to prevent the operator from accidentally changing the set value below your lowest process temperature limits. The setting range is from -1 999° to high set value (for no decimal place), or the setting range is -199.9° to high set value (for one decimal place). Together, the low set value and the high set value make the set value span. For no decimal place display the lowest set value span is 50°. For a one decimal place display, the lowest set value span is 5.0°.

### **'SLH' high set value**

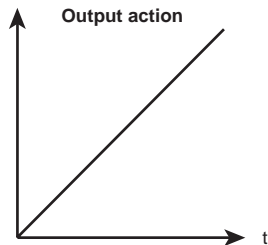
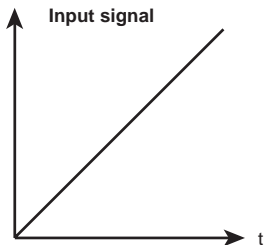
This parameter is used to set the highest value possible for the set value. This can be set to prevent the operator from accidentally changing the set value above your highest process temperature limits. The setting range is from low set value to 9 999° (for no decimal place), or the setting range is from low set value to 999.9° (for one decimal place). Together, the low set value and the high set value make the set value span. For no decimal place display the smallest set value span is 50°. For a one decimal place display, the smallest set value span is 5.0°.

### **'Cnt' type of control**

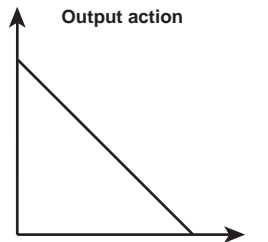
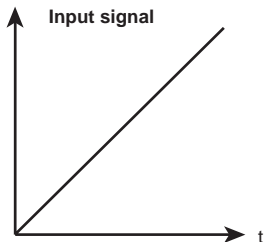
This parameter is used to select 1 of 4 modes of control, all of which use the PID algorithms. The selection is between using reverse or direct action, and OSP (Overshoot protection) on.

---

**Direct or reverse  
action:**



**Direct action: Used for cooling applications**



**Reverse action: Used for heating applications**

Reverse action is generally used for heating applications. The control output decreases when the input signal increases.

**Fig. 3**

### OSP (Overshoot protection)

This is a function that can prevent a possible overshoot of the process value. But, the time it takes for the process value to reach the set value is increased, with the OSP on.

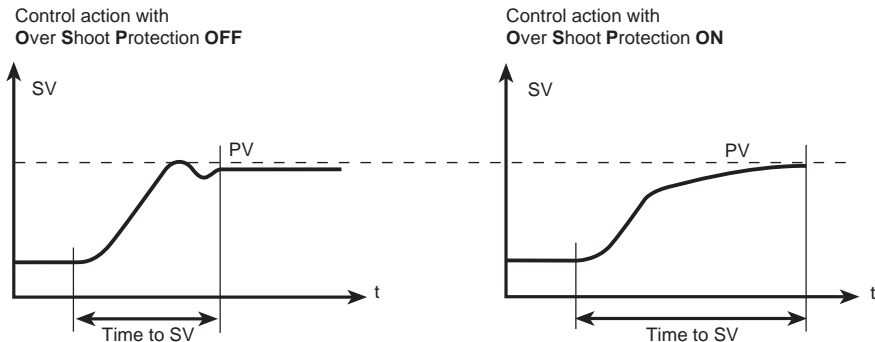


Fig. 4

### 'PuS' offset process value

This parameter allows the user to adjust the PV reading on the display, if so desired. The value entered into this parameter will be used to offset from the PV. The range is between SLL to SLH (set value span), and can be positively or negatively biased.

e.g. If PV = 50°C, and -3° is enter into the PuS (offset process value) parameter, the new PV reading will be 47°C.

---

### **'ASP' VMD initial position**

After the auto-tune has been performed the controller will first move to the initial valve position (ASP) to start controlling from that point. This can be set from 0 % (fully closed) to 100 % (fully open). After this position has been achieved the controller will begin controlling normally. The default setting is 50 %. If the controller appears to be slow reaching the set point, this value could be increased, for example to 70 %. With a value of 70 %, the valve will open to this position first (instead of 50 %) which will reduce the time it takes to reach the set point.

### **'Pbb' power fail initial position**

This parameter is valid for the mA output controllers. This feature is used when the controller's power supply is returned after a power failure. The function will look at the value entered into this parameter and will move the valve to this position first, to help regain control of your system. Ideally the value entered here should be the valve position that the controller uses to maintain the temperature. e.g. With your system under normal use and the temperature stable, the valve position could be, for example around 65 % open. If 65 % is entered into this parameter, and the power were to fail for a short time, when the power is restored the controller will move the valve to 65 % open first. This should help reduce the time it would usually take to achieve the set point.

### **'PdF' process value digital filter**

This parameter is used to slow the rate of change of the process value, to produce an overall smoother PV path. This can help prevent the control valve from hunting, when the input signal is behaving erratically. The adjustment range is 0 to 99 seconds, and the factory setting is 1 second.

### **'A1F / A2F' event 1 and event 2**

These parameters are used to configure the 2 alarms. The setting requires a 3 digit code to be entered. Each number represents a different setting.

First digit, allows the 'input signal fail alarm' to be activated. If this is on, the alarm will be triggered if the input signal fails.  
1 = on, 0 = off.

---

**Second digit**, selects the type of main alarm.

0	None	No alarm
1	Deviation high & low	The alarm will trigger when the PV temperature moves away from the SV temperature by the value entered into the threshold.
2	Deviation high	
3	Deviation low	
4	Deviation band	The alarm will trigger when the PV temperature moves within the 2 values (band) entered within the SV temperature.
5	Process high & low	The alarm will trigger when the PV temperature moves above or below the values entered in the threshold
6	Process high	
7	Process low	
8	Process band	The alarm will trigger when the PV temperature moves within the 2 values entered into the threshold

**The third digit**, selects the alarm options available.

0) **None** Activates no options.

1) **Latch** An alarm is triggered when the PV temperature enters the alarms threshold value. With no latch the alarm will then switch off when the PV temperature returns to normal. But, if the latch is active, the alarm once triggered, will remain on even after the PV temperature returns to normal. To reset the latch, modify this digit of the alarm code to 0, and then back to 1.

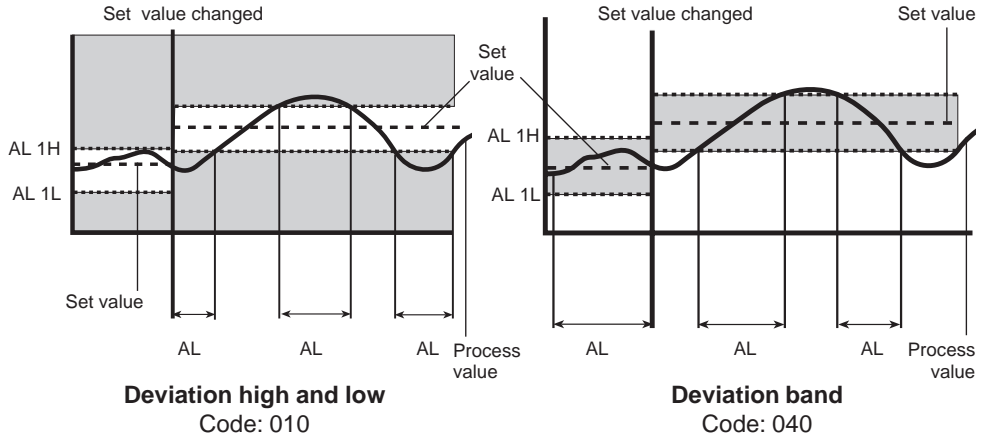
2) **Audio sound** When an alarm is triggered, an audio sound will emit from the controller. This can be reset by pressing any key.

3) **Sequence** This could be used to prevent the alarm from triggering during the warm up of a system. For example, process low alarm is configured, the threshold is set to 30°C, and the controller PV temperature is 16°C when the controller power is first switched. The PV temperature is less than the process low alarm setting, the alarm would normally be triggered unnecessarily. But, if the sequence option is selected, this initial alarm condition will be ignored. But, when the PV temperature rises above the process low alarm threshold, the alarm will then be made live, and will be triggered the next time it drops into the process low alarm region. The following examples shown on pages 21, 22 and 23 are where an SX65 is installed and commissioned, for mA output and VMD output. Both examples are used for heating hot water to 70°C, with different alarms set-up.

## Alarm examples

### Deviation alarms

The alarm threshold entered for 'AL 1L' and 'AL 1H', will follow the set value, if and when it is changed (as shown below).



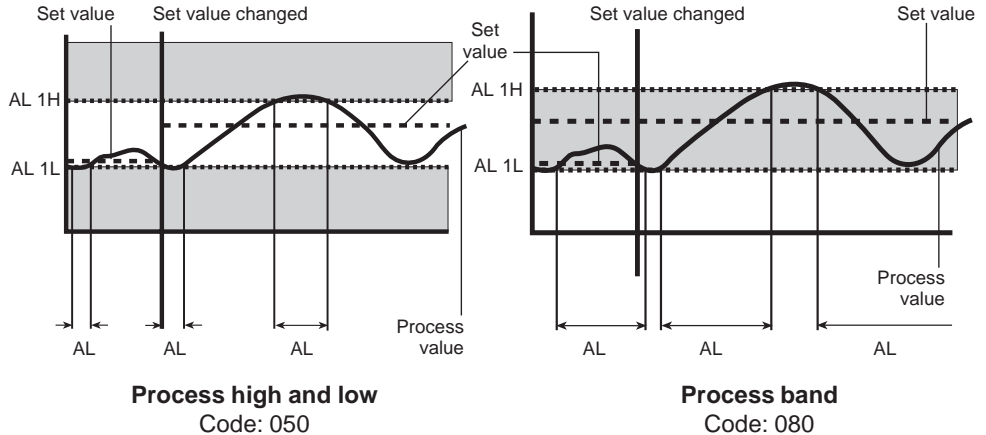
■ Indicates alarm trigger area

AL = Alarm triggered

## Alarm examples

### Process alarms

The alarm threshold entered for the process alarms do not follow the set value.



■ Indicates alarm trigger area

AL = Alarm triggered



---

### 'ALC' alarm hysteresis

This is used keep the alarm condition triggered, after the PV temperature moves out of the threshold value, by the number entered into this parameter. e.g. If 5° is entered into the ALC parameter, and an alarm has been triggered, the PV temperature will have to move 5° away from the threshold before the alarm is switched off.

### 'trn' mA retransmission

This option is only available for SX65 with retransmission output. This parameter is used to configure the retransmission output. The setting requires a 3 digit code to be entered. Each number represent a different setting.

**First digit** This displays that the mA output is available.

**Second digit** 1 = Selects normal mA output (4-20 mA)  
2 = Selects reverse mA output (20-4 mA)

**Third digit** This selects which variable will be retransmitted.  
1 = Process value  
2 = Set value  
3 = % of control output

**'SV2' 2nd set value** Enter the value of the second set value in°, between SLL and SLH (set value span) values.

**'DP' decimal point position** Enter either one decimal place or no decimal place. Factory setting is one decimal place.

**'C / F' temperature scale** Select either °celsius or °fahrenheit. Factory setting is °C.

**'bU' key audio confirm** With the audio confirm on, the controller will beep, when you press a key.  
Select either on or off. Factory setting is audio confirm on.

**'LoC' security lockout** This parameter is used to select which level of security the controller should be left in.  
**Off** = No lock out.  
**All** = Locks all Level 1 and Level 2 parameters.  
**Pra** = Locks all Level 2 parameters.  
**Esv** = With the exception of the set value, this locks all level 1 and level 2 parameters.

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## 5. Commissioning examples

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The following shows 2 examples of where an SX65 is installed and commissioned, for mA output and VMD output. Both examples are used for heating a process to 70°C, with different alarms set-up.

### 5.1 mA output example

The components used are: SX65-mA controller; Pt100 temperature sensor, Spirax Sarco pneumatic control valve with electro-pneumatic positioner, and has been wired as shown in Section 3.4.4.

#### 5.1.1. Switch power on

When the power is switched on to the controller, the display will show the type of hardware that is installed (see I/O in Section 4.4). After several seconds the display will change to the normal view in the operator mode. The PV will show the temperature of the process in °C, and the SV will be set to 0°C.

#### 5.1.2. Enter configuration mode

Press the mode key for more than 2 seconds to enter the configuration parameters.

#### 5.1.3. Change SV span

The first parameter you will see in the configuration mode is the proportional band (shown as P with the number 3.0 below). To modify the SV span, the SLL and SLH parameters must be viewed. Keep pressing the mode key to view the SLL parameter. The value in this parameter should be 0.0°C. Press the mode key once to view the SLH parameter.

Change this value from 200° to 90°. Setting this parameter to 90°C, will limit the set value temperature to a maximum of 90°C. This will prevent the operator from accidentally entering a set value higher than 90°, because the process must not reach 100°C.

#### 5.1.4. Configure alarm 1

Press mode key until the A1F parameter is shown. This alarm is required to trigger at 80°C, and once activated the alarm will remain on even after the process variable drops to the safe level. Select the code 061 for process high alarm with the latch option.

#### 5.1.5. Configure alarm 2

Press mode key once to view A2F parameter. This alarm is required to trigger when the temperature input signal fails. When it does trigger the controller will also emit an audio sound. Select the code 102 for input signal fail alarm with the audio option.

---

#### 5.1.6. Enter operator mode

All the necessary parameters have been changed. The controller is now ready for auto-tuning. Press the mode key for more than 2 seconds to change back to the operator mode.

#### 5.1.7. Enter your auto-tune SV

When the controller is changed to operator mode, the display will show the set value parameter (as shown in Section 4.1). Use the ▲ or ▼ key to select a set value of 55°C for the auto-tune.

Press the mode key once. The lower display should show 'AUto' if it does not, press the right hand ▲ or ▼ key to select auto.

Press the mode key again, until the display shows 'At OFF'. This indicates that the auto-tune is off.

#### 5.1.8. Initiate auto-tune

Now press either the ▲ or ▼ key on the right hand side of the button pad for more than 2 seconds to initiate the Auto tune. The display should change to 'At on', and the auto-tune cycle will now begin. Whilst the controller is performing this, it is important that the process is not interfered with as this will give the controller false readings when calculating the PID values. To understand how the controller performs the auto tune, see Section 4.2.

#### 5.1.9. Auto-tune complete

When the controller has completed the auto-tune, the bottom display will stop flashing 'At', and will return to normal view. Once the auto-tune has been performed for your installation, it is not necessary to run though this again, unless circumstances change or there appears to have been a disturbance with your system during auto-tune. The PID values will be stored in memory and all the parameter will be saved even if the power is switched off.

#### 5.1.10. Enter your system SV

The set value can now be increased to 70°C, and the controller will now control at this temperature.

#### 5.1.11. Enter the alarm threshold

Now set the alarm threshold for alarm 1, by pressing the mode key several times until the display shows AL1H. Use the ▲ and ▼ keys to select 80°C. Then press the mode key once to confirm.

#### 5.1.12. Commissioning complete

The controller has now been commissioned for this system.

---

## 5.2 VMD output example

The components used are: SX65-VMD controller; Pt100 temperature sensor, Spirax Sarco electric control valve with VMD inputs, and has been wired as shown in Section 3.4.3

### 5.2.1. Switch power on

When the power is switched on to the controller, the display will show the type of hardware that is installed (see I/O in Section 4.4). After several seconds the display will change to the normal view in the operator mode. The PV will show the temperature of the process in °C, and the SV will be set to 0°C.

### 5.2.2. Enter configuration mode

Press the mode key for more than 2 seconds to enter the configuration parameters.

### 5.2.3. Set control valves stroke time

The first parameter you will see in the configuration mode is the proportional band (shown as P with the number 3.0 below). To modify the valve stroke time the parameter tSun must be viewed. Keep pressing the mode key to view the tSun parameter (VMD stroke time). Enter using the ▲ and ▼ keys, the time in seconds that it takes for the control valve to drive from fully closed to fully open.

### 5.2.4. Change SV span

To modify the SV span, the SLL and SLH parameters must be viewed. Keep pressing the mode key to view the SLL parameter. The value in this parameter should be 0.0°C. Press the mode key once to view the SLH parameter. Change this value from 200° to 90°.

Setting this parameter to 90°C, will limit the set value temperature to a maximum of 90°C. This will prevent the operator from accidentally entering a set value higher than 90°, because the process must not reach 100°C.

### 5.2.5. Configure alarm 1

Press mode key until the A1F parameter is shown. The alarm is required to trigger if the process value rises by 5°C over the set value. When the alarm does trigger the controller must emit an audio sound. Select the code 022, for deviation high alarm with the audio option.

### 5.2.6. Configure alarm 2

Press mode key once to view A2F parameter. The alarm required must trigger when the temperature drops below 50°C, but must not trigger when the system is cold, after it is first switched on. Select the code 073., for process low alarm with the sequence option.

---

### 5.2.7. Enter operator mode

All the necessary parameters have been changed. The controller is now ready for Auto-tuning. Press the mode key for more than 2 seconds to change back to the operator mode.

### 5.2.8. Enter your auto-tune SV

When the controller is changed to operator mode, the display will show the set value parameter (as shown in Section 4.1). Use the ▲ or ▼ key to select a set value of 55°C for the auto-tune.

Press the mode key once. The lower display should show 'AUto' if it does not, press the right hand ▲ or ▼ key to select auto.

Press the mode key again, until the display shows 'At OFF' (This indicates that the auto-tune is off).

### 5.2.9. Initiate auto-tune

Now press either the ▲ or ▼ key on the right hand side of the button pad for more than 2 seconds to initiate the auto tune. The display should change to 'At on', and the auto-tune cycle will now begin. Whilst the controller is performing this, it is important that the process is not interfered with as this will give the controller false readings when calculating the PID values. To understand how the controller performs the auto tune, see Section 4.2.

### 5.2.10. Auto-tune complete

When the controller has completed the auto-tune, the bottom display will stop flashing 'At', and will return to normal view. Once the auto-tune has been performed for your installation, it is not necessary to run though it again, unless circumstances change or there appears to have been a disturbance with your system during the Auto-tune. The PID values will be stored in memory and all the parameter will be saved even if the power is switched off.

### 5.2.11. Enter your system SV

The set value can now be increased to 70°C, and the controller will now control at this temperature.

### 5.2.12. Enter the alarm 1 threshold

Now set the alarm threshold for Alarm 1, by pressing the mode key several times until the display shows AL1H. Use the ▲ and ▼ keys to select 5°C. Then press the mode key once to confirm.

### 5.2.13. Enter the alarm 2 threshold

Now set the alarm threshold for Alarm 2, by pressing the mode key once to display AL2L. Use the ▲ and ▼ keys to select 50°C. Then press the mode key once to confirm.

### 5.2.14. Commissioning complete

The controller has now been commissioned for this system.

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## 6. Error messages

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LoC

This message indicates that this parameter cannot be modified because of the security lockout setting (Loc). For more information see Section 4.4 on 'Loc' security lockout.

Su2

This message will show if the user tries to modify the first set value in user mode, whilst the second set value has been activated.

To adjust the first set value, de-activate the second set value by opening the terminals 4 and 5, then with the controller in user mode, the first set value can be adjusted.

To adjust the second set value, set the controller into configuration mode, and press the mode key to view SV2. This can now be modified.

- - - -

This indicates that there is a problem with the Pt100 sensor, and the value measured by the controller is over the normal range.

The sensor could be damaged or incorrectly wired to the controller or there is an open circuit in one or more of the three wires.

Check the installation and try again.

- - - -

This indicates that there is a problem with the Pt100 sensor, and the value measured by the controller is under the normal range.

The sensor could be damaged or incorrectly wired or there is a short circuit with two of the wires.

Check the installation and try again.

---

*Err0*

This is a memory error message. Switch the power to the controller off and leave for ten seconds. Then switch the power back on. If the message is still present, the controller will need repairing. Please return the controller, see Section 7.

*Err1*

This an error with the controller analogue to digital converter. Switch the power to the controller and leave for ten seconds. Then switch the power back on. If the message is still present, the controller will need repairing. Please return the controller, see Section 7.

*Err2*

This is an error with the auto-tune function. This will occur if there is an over or under value whilst tuning, or the function will time-out after 3 hours, and show this message. Press any key to acknowledge this message, and try the auto-tune again.

