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spirax sarco

IM-P323-25
CH Issue 3

SX25 Series Process Controller

Installation and Maintenance Instructions

CE

Printed in the UK

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General Index

1. Safety Information

1.1 General

Please carefully read through the following before proceeding with the installation of the controller.
Your attention is drawn to Safety Information leaflet IM-GCM-10.

If the controller is handled improperly or not used as specified, the resultant may:

- cause danger of the life and limb of the third party,
- damage the controller and other assets belonging to the owner,
- hinder the performance of the controller and control system.

1.2 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:-

i) Maintenance personnel must be suitably qualified in working with equipment containing hazardous live voltages.
ii) Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this manual.
iii) Isolate the controller from the mains supply before opening the unit.
iv) The controller is designed as an installation category II product, and is reliant on the building installation for over-current protection and primary isolation.
v) Wiring should be carried out in accordance with IEC 60364 or equivalent. For installations in the US and Canada, the controller must be wired in accordance with the Local and National Electrical Code (NEC) or the Canadian Electrical Code (CEC).
vi) Fuses should be fitted in all phases. The instrument is protected with an internal fuse PTC, thermal protective device. To protect the instruments internal circuits use 2A T fuses for Relay outputs and 1A T fuses for Triac outputs. The Relay contacts are already protected with varistors. Fuses should not be fitted in the protective earth conductor. The disconnection or removal of other equipment must not compromise the integrity of the installation protective earth system.
vii) The mains cable connection at the rear of the controller must be retained in position (by tie wrapping 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.

viii) 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 60947-1 and IEC 60947-3 or equivalent.

ix) The controller must not be located in such a way that the disconnecting device is made difficult to operate.

1.3 Safety requirements and electromagnetic compatibility

This product is CE marked. It complies with the requirements of 73/23/EEC as ammended by 93/68/EEC on the harmonisation of the law of Member States relating to electrical equipment designed for use within certain voltage limits, by meeting the standard EN 61010-1 (IEC 601010-1):90 +A1:92 + A2:95

This product complies with the requirement of 89 / 336/ EEC as amended by 92/ 31/ EEC on the approximation of laws of the Member States relating to Electromagnetic Compatibility, by meeting the standards of :

EN 50081-2 (Industrial Emissions)
EN 61000-6-2 (Industrial immunity)

The product may be exposed to interference above the limits of EN 61000-6-2 if:

- The product or its wiring is located near to 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.
- Power line protectors (ac) should be installed if mains supply noise is likely.
- Protectors can combine filtering, suppression, surge and spike arrestors.

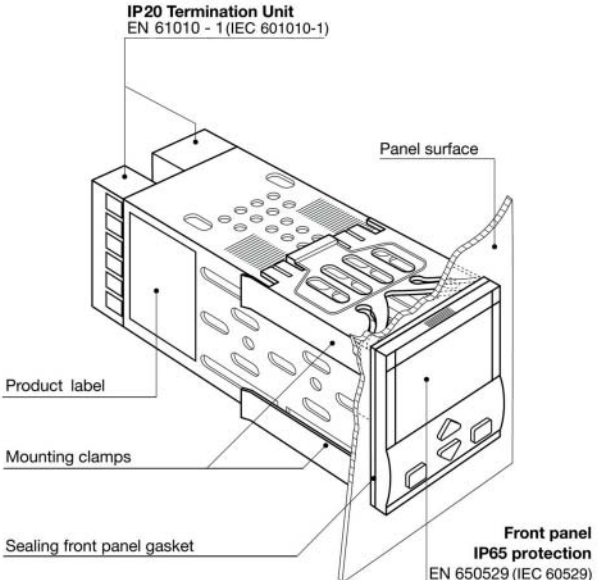
2.1 General description

Installation must only be carried out by qualified personnel.

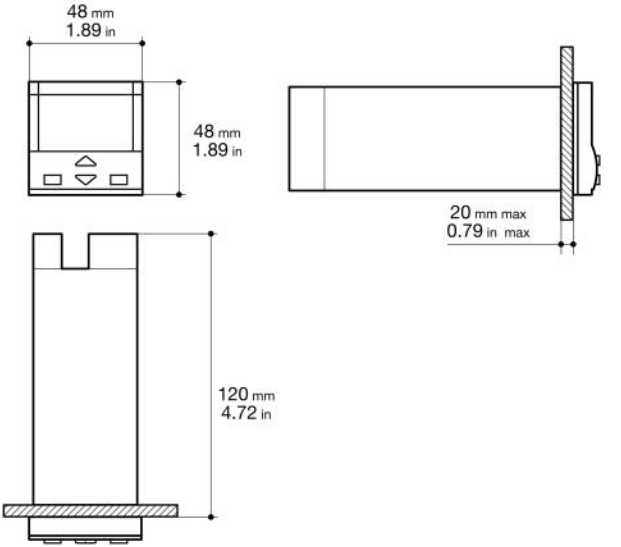
Before proceeding with the installation of this controller, follow the instructions illustrated in this manual and, particularly the installation precautions marked with the ⚠CE symbol, related to the European Community directive on electrical safety and electromagnetic compatibility.

⚠CE

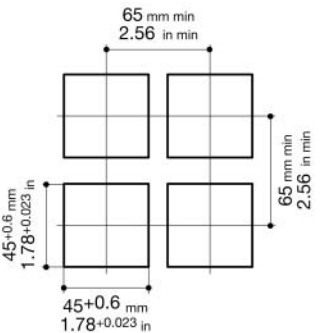
To prevent hands or metal touching parts that may be electrically live, **the controllers must be installed in an enclosure and/or in a cubicle.**



2.2 Dimensional details



2.3 Panel cut-out



2.4 Environmental ratings

Operating conditions	
	Altitude up to 2 000 m (6 561 ft)
	Temperature 0...50°C (32...122°F)
%Rh	Relative humidity 5...95% non-condensing

Special conditions		Suggestions
	Temperature >50°C	Use forced air ventilation
%Rh	Humidity > 95%	Warm up
	Conducting atmosphere	Use filter

Forbidden conditions	
	Corrosive atmosphere
	Explosive atmosphere

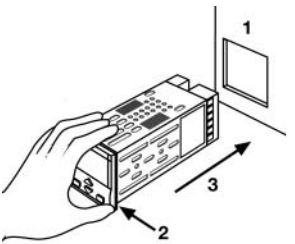
2.5 Panel mounting

2.5.1 Insert the instrument

1 Prepare panel cut-out

2 Check front panel gasket position

3 Insert the instrument through the cut-out

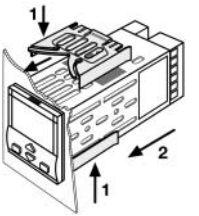


UL note:
For use on a flat surface of a Type 2 and Type 3 'raintight' enclosure.

2.5.2 Installation securing

1 Fit the mounting clamps

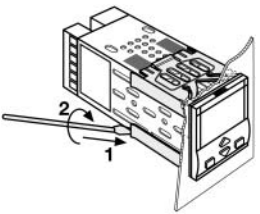
2 Push the mounting clamps towards the panel surface to secure the instrument



2.5.3 Clamps removing

1 Insert the screwdriver in the clips of the clamps

2 Rotate the screwdriver



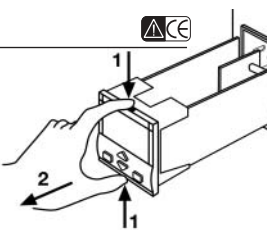
2.5.4 Instrument unplugging

1 Push and

2 pull to remove the instrument

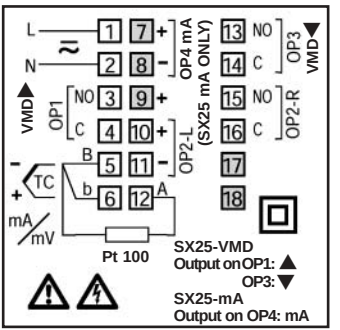
Electrostatic discharges can damage the instrument

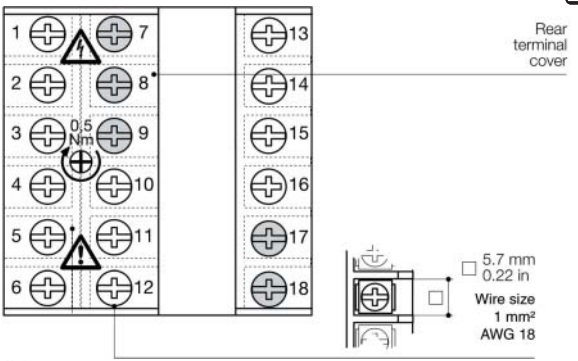
Before removing the instrument the operator must discharge himself to ground



3. Electrical connections

3.1 Termination Unit





	18 screw terminals
	Option terminals
	Holding screw 0.5 N m
+	Positive screw driver PH1
−	Negative screw driver 0.8 x 4 mm

Terminals

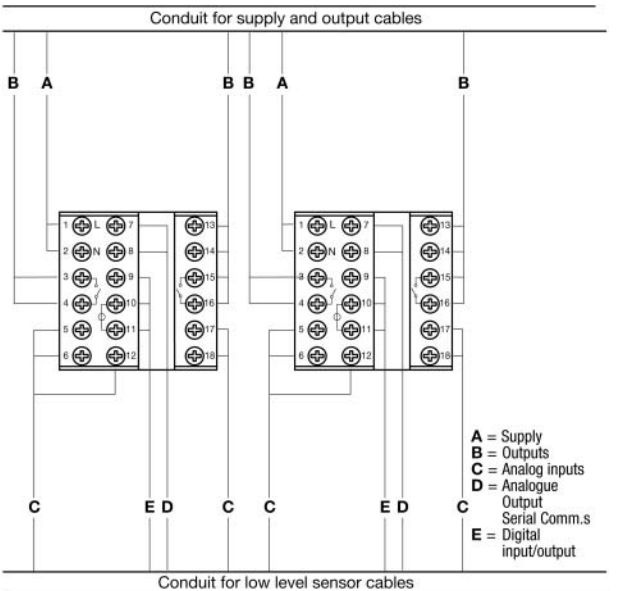
	Pin connector q 1.4 mm 0.055 in max
	Fork-shape AMP 165004 Ø 5.5 mm - 0.21 in
L	Stripped wire L 5.5 mm - 0.21 in

UL note:
Use 60/70°C (140/158°F)
copper (cu) conductor only.

3.2 Precautions and advised conductor course

Despite the fact that the instrument has been designed to work in an harsh and noisy environmental (level IV of the industrial standard IEC 60801-4), it is recommended to use the following suggestions.

All the wiring must comply with the local regulations.
The supply wiring should be routed away from the power cables.
Avoid to use electromagnetic contactors, power Relays and high power motors nearby.
Avoid power units nearby, especially if controlled in phase angle
Keep the low level sensor input wires away from the power lines and the output cables.
If this is not achievable, use shielded cables on the sensor input, with the shield connected to earth.

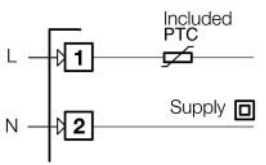


3.3 Wiring details

3.3.1 Power supply

Please read the safety information and the wiring notes before proceeding with the installation of the controller.
The controller provides switching power supply with multiple isolation and internal PTC

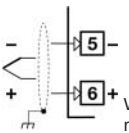
- Nominal voltage 100 - 240V~ (-15% +10%) Frequency 50/60Hz
- Power consumption 1.6 W max



3.3.2 PV control unit

A For L-J-K-S-T thermocouple type

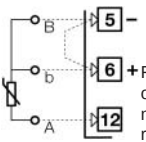
- Connect the wires with the polarity as shown
- Always use compensation cable of the correct type for the thermocouple used
- The shield, if present, must be connected to a proper earth



Wire resistance 150Ω max

B For Pt100 temperature sensor

- If a 3 wire system is used, always use cables of the same diameter (1 mm² min.) (line 20 Ω/lead maximum resistance)
- when using a 2 wire system, always use cables of the same diameter 1mm² (AWG 18) and link terminals 5 and 6

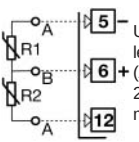


For 3 wires only 20Ω/lead maximum resistance

C For ΔT (2xRTD Pt100) Special

⚠ When the distance between the controller and the sensor and the sensor is 15 m, using a cable of 1mm² (AWG 18) diameter, produces an error on the measure of 1°C

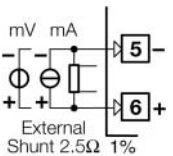
R1 + R2 must be <320Ω



Use wires of same length and 1mm² (AWG 18) size. 20Ω/lead maximum

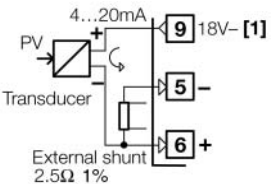
3.3.2 PV control unit

D For mA, mV

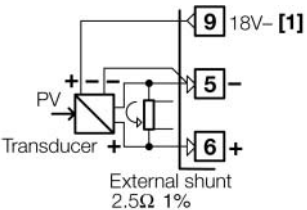


Rj >10MΩ

D1 With 2 wire transducer (SX25 mA only)



D2 With 3 wire transducer (SX25 mA only)



Note:
The auxiliary power supply is not available on the VMD controller.

[1] Auxiliary power supply for external transmitter 18 V ±20%/30 mA max. without short circuit protection

3.3.5 Output configuration

The functionality associated to each of the outputs is defined during the configuration of the instrument, index L (see section 4.1).
The suggested combinations are:

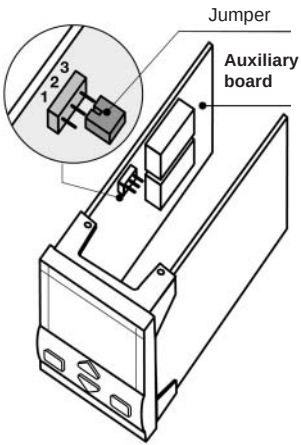
			Output				Alarms	
			Primary		Secondary		AL2	AL3
SX25 mA	A	Single Action	**Heat or Cool**	OP4	**none**	none	OP2	OP3
	B	Single Action	**Heat or Cool**	OP4	**none**	none	OP1	OP3
	C	Double Action	**Heat**	OP4	**Cool**	OP3	OP2	-
	D	Double Action	**Heat**	OP4	**Cool**	OP2	-	OP3
	E	Double Action	**Heat**	OP1	**Cool**	OP4	OP2	OP3
	F	Double Action	**Heat**	OP2	**Cool**	OP4	OP1	OP3
SX25 VMD	G	Valve Motor Drive	**Open**	OP1	**Close**	OP3	OP2	OP2
	H	Single Action	**Heat or Cool**	OP1	**none**	none	OP2	OP3
	I	Single Action	**Heat or Cool**	OP2	**none**	none	OP1	OP3
	J	Double Action	**Heat**	OP1	**Cool**	OP3	OP2	-
	K	Double Action	**Heat**	OP1	**Cool**	OP2	-	OP3
	L	Double Action	**Heat**	OP2	**Cool**	OP3	OP1	-

OP1 - OP3	Relay output
OP2 - L	Logic output
OP2 - R	Relay output

Note: With heat or cool control AL2 and AL3 share the same output.

OP2 output can be Relay or logic. The 'jumper' on the auxiliary board selects the output type:

Link Pins 1-2 for OP2-Relay (Factory set)
Link Pins 2-3 for OP2-Logic

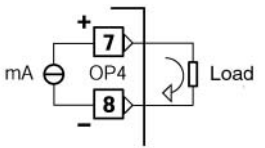


SX25 mA Output combination

3.3.5 – A, B

OP4 Analogue mA control output

- Galvanic isolation 500V~/1 min
- 0/4...20mA, (750Ω or 15V– max)



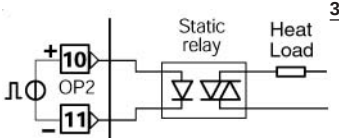
Relay output

- SPST Relay N.O., 2A/250 V~ for resistive load, fuse 2A ~ T

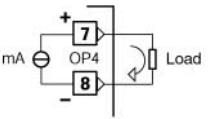
Logic output not isolated

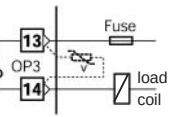
- 0...5V–, ±20%, 30 mA max

OP2, use Relay (terminals 15,16) or Logic (terminals 10,11)

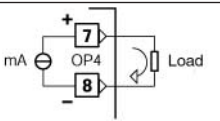


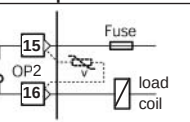
3.3.5 – C Double action analogue mA/relay control output



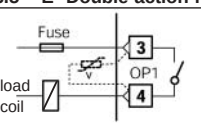


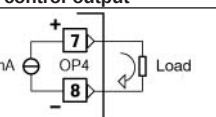
3.3.5 – D Double action analogue mA/relay control output



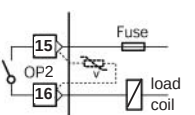


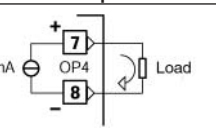
3.3.5 – E Double action relay/analogue mA control output





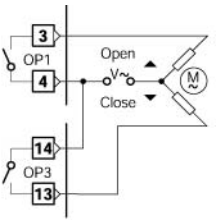
3.3.5 – F Double action relay/analogue mA control output





SX25 VMD Output combination

3.3.5 – G Valve Motor Drive Relay/Relay Control Output

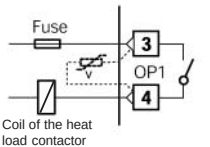


Valve drive PID without potentiometer (open,close,stop).

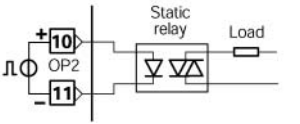
Relay output
- SPST Relay N.O., 2A/250 V~ for resistive load, fuse 2A ~ T

Logic output not isolated
- 0...5 V–, ±20%, 30 mA max

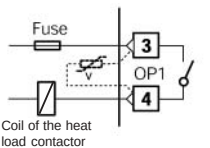
3.3.5 – H Single Action Relay Control Output

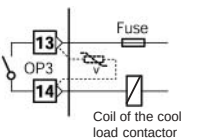


3.3.5 – I Single Action Logic Control Output

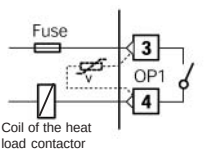


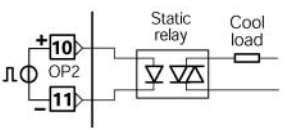
3.3.5 – J Double Action Relay/Relay Control Output



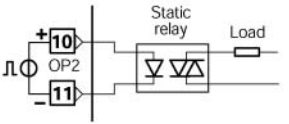


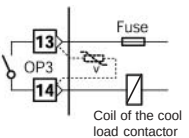
3.3.5 – K Double Action Relay/Logic Control Output





3.3.5 – L Double Action Logic/Relay Control Output





Relay output

- SPST Relay N.O., 2A/250 V~ for resistive load, fuse 2A ~ T

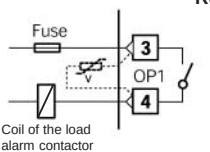
Logic output not isolated

- 0...5 V–, ±20%, 30 mA max

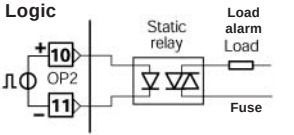
3.3.6 Alarms outputs

The outputs OP1, OP2 and OP3, can be used as alarm outputs only if they are not configured as control outputs.

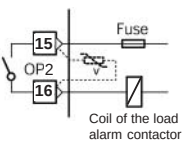
Relay



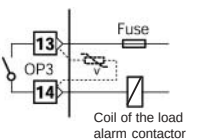
Logic



Relay



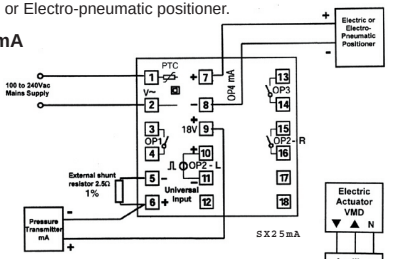
Relay



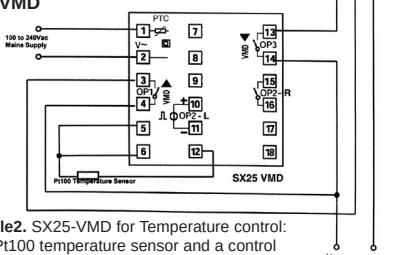
3.4 Wiring examples

Example 1. SX25-mA for Pressure control: Using a 4-20mA pressure transmitter and a control valve with 4-20mA Electric or Electro-pneumatic positioner.

SX25mA

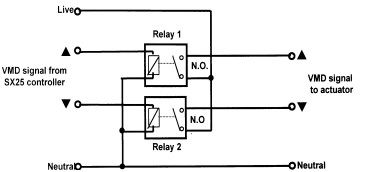


SX25 VMD



Example2. SX25-VMD for Temperature control: Using Pt100 temperature sensor and a control valve with a Valve Motor Drive Elctric Actuator.

3.5 Auxiliary Relays for Valve Motor Drive actuators



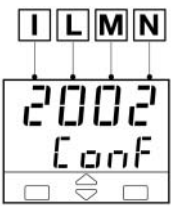
When using SX25 controller's to directly drive VMD electric actuator's, damage to the controller's internal relays might occur due to switching the relatively heavy electrical loads.

Auxiliary relays should therefore always be installed between the controller and the valve drive actuator. This will protect the controller from switching the actuators high current loads, avoid introducing high current loops within the proximity of the controller, and provide an easily replaceable switching element outside of the controller.

This advice is in line with that given by other manufacturers of similar equipment and is considered to be good working practice.

4.1 Configuration coding

The configuration code consists of 4 digits that identify the operating characteristic of the controller, as chosen by the user.
Refer to section 5.6 configuration menu and section 6, commissioning examples for additional help.



The configuration code can be displayed on the front panel, following the instructions on page 22 section 5.2.2.

†2.5Ω 1% shunt resistor must be fitted for mA input signal. See section 3.3.2

Input type and range			I
RTD Pt100 IEC 60751	-99.9...300.0 °C	-99.9...572.0 °F	0
RTD Pt100 IEC 60751	-200...600 °C	-328...1112 °F	1
TC L Fe-Const DIN43710	0...600 °C	-328...1112 °F	2
TC J Fe-Cu45% Ni IEC 60584	0...600 °C	32...1112 °F	3
TC T Cu-CuNi	-200...400 °C	-328...752 °F	4
TC K Cromel -Alumel IEC 60584	0...1200 °C	32...2192 °F	5
TC S Pt10%Rh-Pt IEC 60584	0...1600 °C	32...2912 °F	6
† 0...20mA/0...50 mV, linear	Engineering units		7
† 4...20mA/≈10...50 mV, linear	Engineering units		8
Custom input and range **[1]**			9

[1] For example, other thermocouples types, ΔT (with 2 PT 100), custom linearisation etc.

	SX25-VMD		SX25-mA		L
Control mode	**Output configuration**	**Alarms**	**Output configuration**	**Alarms**	
PID	Control OP1	OP2, OP3	Control OP4	OP2, OP3	0
	Control OP2	OP1, OP3	Control OP4	OP1, OP3	1
ON - OFF	Control OP1	OP2, OP3	Control OP4	OP2, OP3	2
	Control OP2	OP1, OP3	Control OP4	OP1, OP3	3
Heat/Cool Action	Control OP1-OP3	OP2	Control OP4-OP3	OP2	6
	Control OP1-OP2	OP3	Control OP4-OP2	OP3	7
	Control OP2-OP3	OP1	Control OP4-OP3	OP1	8
PID VMD	Control OP1-OP3	OP2	N/A	N/A	9

Control action type		M
Reverse (single action)	Linear Cool (Heat/Cool double action)	0
Direct (single action)	On-Off Cool (Heat/Cool double action)	1

⚠

When the controller is powered up for the first time, the display shows the following message.

This shows that the controller has not been configured.

Input the first code **ILMN**, using the up and down arrow keys, then press the enter key. The lower display will show Con2. Now input code **O** for alarm 3, then press enter.
The controller will remain in stand-by until the configuration code is set correctly (see section 5.6 page 36).

Alarm 2 type and function		N
Not active		0
Sensor break alarm/Loop Break Alarm		1
Process	active high	2
	active low	3
Deviation	active high	4
	active low	5
Band	active out	6
	active in	7

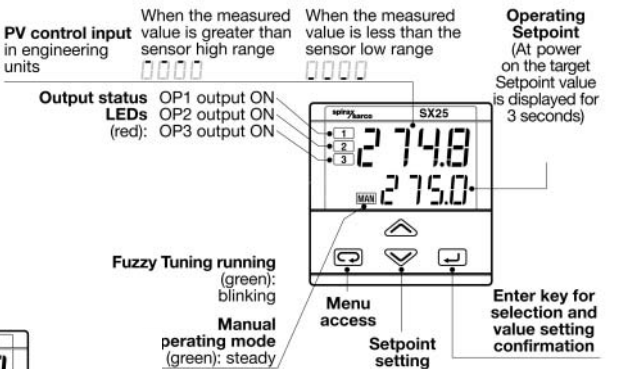
CON2

Alarm 3 type and function		O
Disabled		0
Sensor break alarm/Loop Break Alarm		1
Process	active high	2
	active low	3
Deviation	active high	4
	active low	5
Band	active out	6
	active in	7

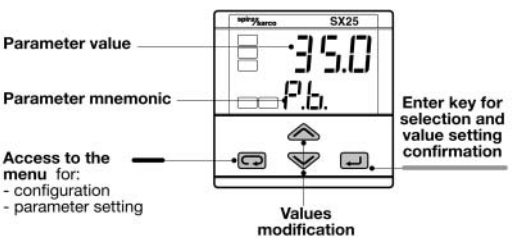
For alarm type and function see page 30.

5.1 Keys and display overview

5.1.1 Key functions and display in operator mode



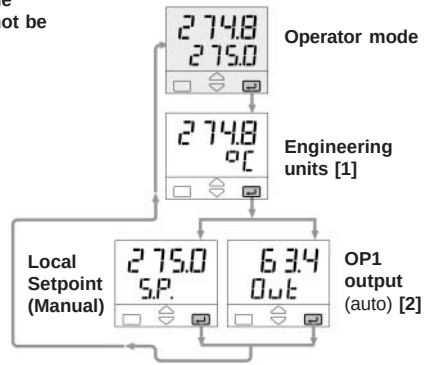
5.1.2 Key functions and display in programming mode



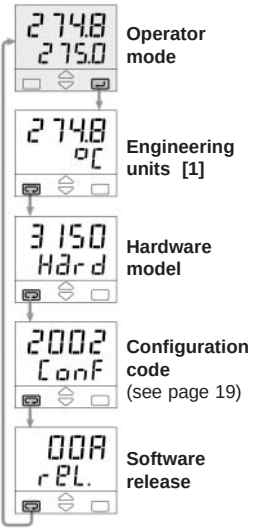
5.2 Display

During the operation, the parameters values cannot be modified by the user

5.2.1 Process variables



5.2.2 Configuration codes



Example: 3150 - 2002 / Release 00A

Note

[1] See table page 38

[2] This display is not shown if the instrument has been configured as an On - Off controller

5.3 Parameter setting

5.3.1 Numeric entry

(i.e. the modification of the Setpoint value from 275.0 to 240.0)

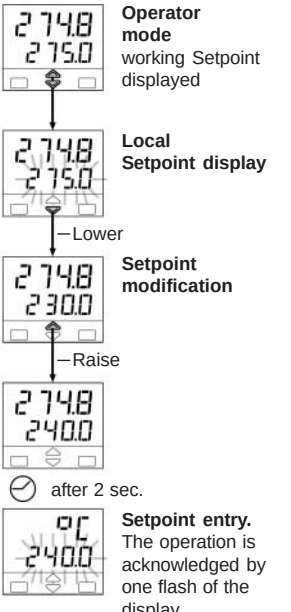
Press ⌃ or ⌄ momentarily to change the value of 1 unit every push.

Continued pressing of ⌃ or ⌄ changes the value, at a rate that doubles every second. Releasing the button causes the rate of change to decrease.

In any case the change of the value stops when it has reached the max/min limit set for the parameter.

In case of Setpoint modification: press ⌃ or ⌄ once to display the local Setpoint instead of working Setpoint.

To confirm this change the display flashes once. Then the Setpoint can be modified

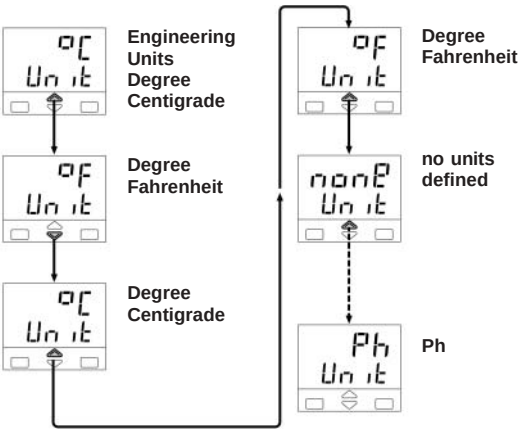


5.3.2 Mnemonic codes setting

(e.g. configuration see page 36)

Press the ▲ or ▼ to display the next or previous mnemonic for the selected parameter.

Continued pressing of ▲ or ▼ will display further mnemonics at a rate of one mnemonic every 0.5 sec.



5.3.3 Keypad lock

To lock/unlock the keypad press the keys [⟲] and [↵] simultaneously for 2 seconds.

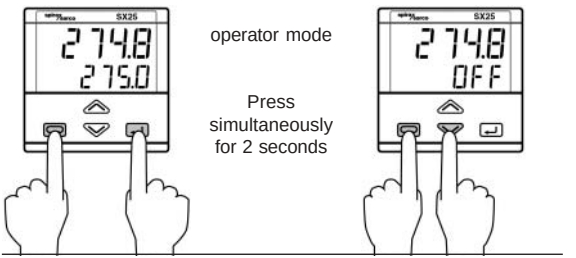
To confirm the keypad lock/unlock the display flashes once.

5.3.4 Outputs lock

The outputs are switched to the OFF status by pressing the keys [⟲] and [▽] together.

When the outputs are locked, the message [OFF] is displayed instead of the Setpoint value.

To unlock the outputs press both keys simultaneously (the Soft-start will be enabled).



⚠ The keypad lock is remembered during power failure.

⚠ The outputs lock/unlock is remembered during power failure.

5.3.5 Auto / Man

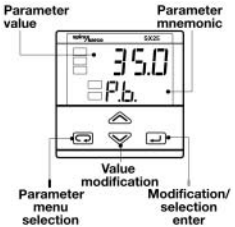
Operator mode

Select [Man] to switch to manual mode

Select [Auto] to switch to automatic mode

- Press [↵] to confirm. Back to operator mode.
- The [MAN] led shows the manual mode status.
- When manual mode is active, the Setpoint display shows the output value, that can be modified by [△] [▽]

5.4 Parameter menu



The parameter setting procedure has a timeout. If no key is pressed for 30 seconds, the controller automatically switches back to the operator mode.

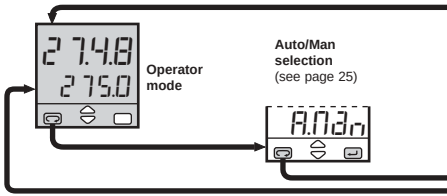
After having selected the parameter or the code, press ⌃ and ⌄ to display or modify the value (see page 24) The value is entered when the next parameter is selected, by pressing the ↵ key.

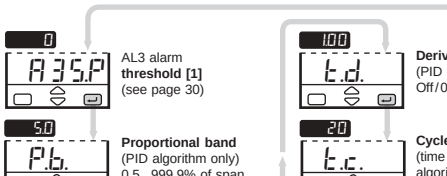
Pressing the ↻ key, the next group of parameters will be displayed.

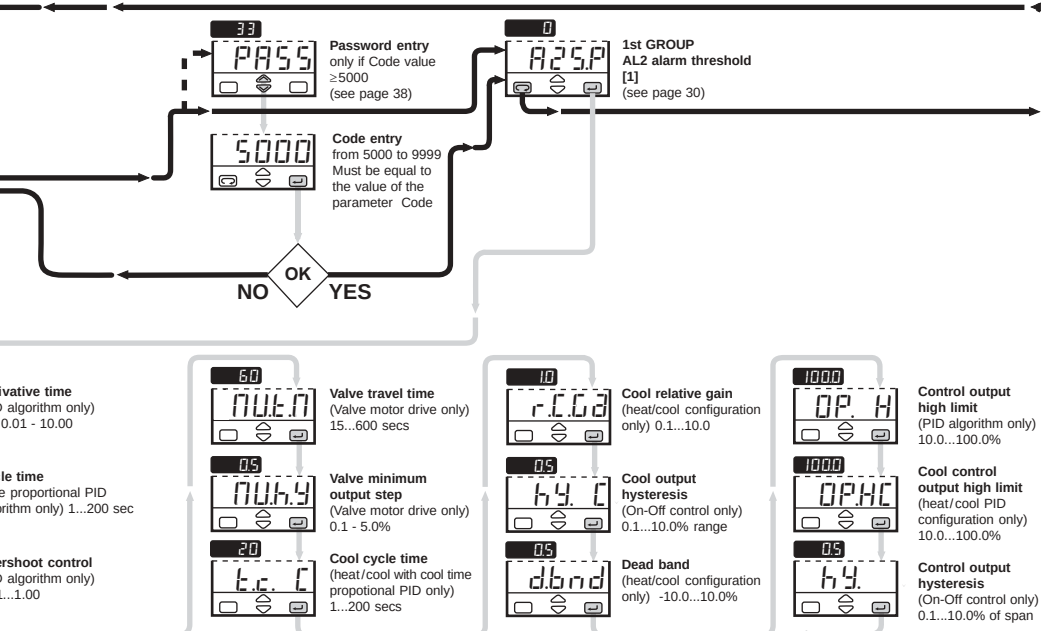
Note:

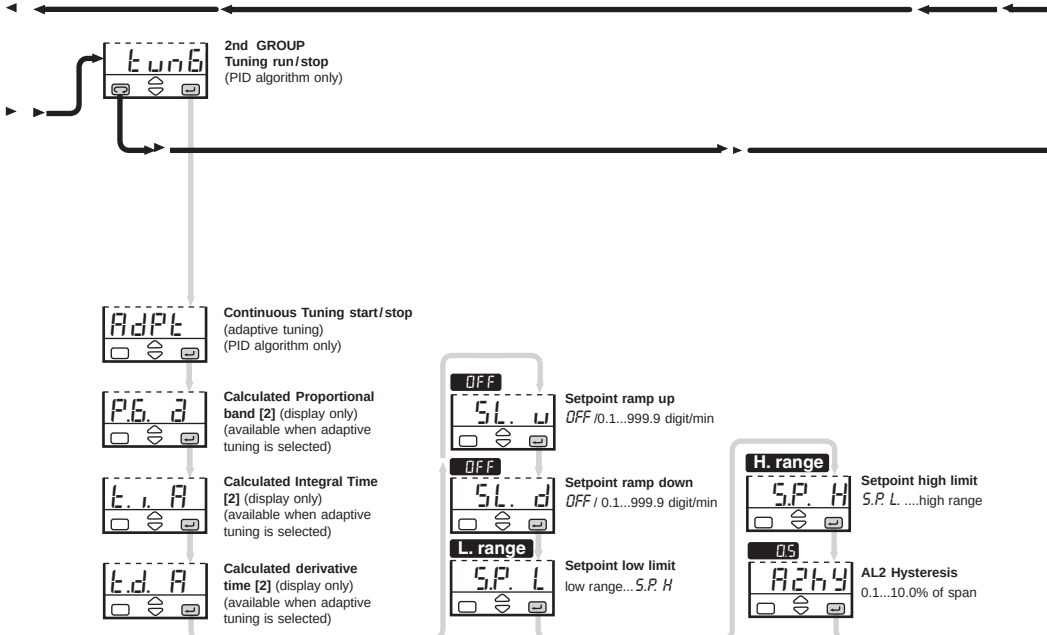
[1] This will not be displayed if the controller has been configured with alarm 2 not active or if sensor break type selected. Digit N/M of the configuration code is assigned to 0 or 1.

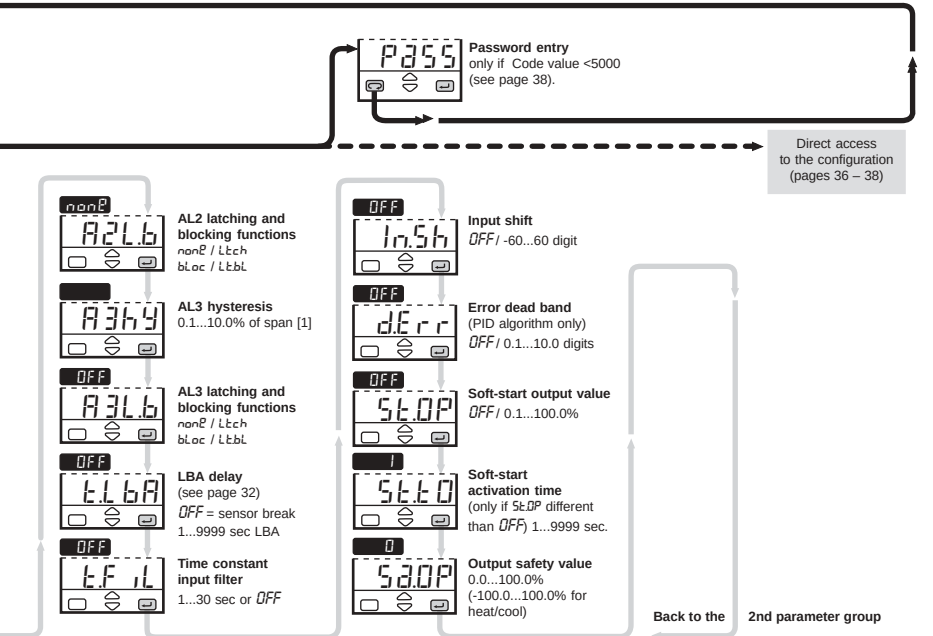
[2] Before rdPt is switched off, note down the calculated values. P.b., t. i, t.d. are not automatically stored.






33
PASS
Password entry
only if Code value
≥5000
(see page 38)
0
A2SP
1st GROUP
AL2 alarm threshold
[1]
(see page 30)
5000
Code entry
from 5000 to 9999
Must be equal to
the value of the
parameter Code
OK
NO
YES
ivative time
algorithm only)
0.01 - 10.00
le time
e proportional PID
rithm only) 1...200 sec
rshoot control
algorithm only)
...1.00
60
MVLM
Valve travel time
(Valve motor drive only)
15...600 secs
0.5
MVLY
Valve minimum
output step
(Valve motor drive only)
0.1 - 5.0%
20
LC. C
Cool cycle time
(heat/cool with cool time
propotional PID only)
1...200 secs
1.0
rCGA
Cool relative gain
(heat/cool configuration
only) 0.1...10.0
0.5
HY. C
Cool output
hysteresis
(On-Off control only)
0.1...10.0% range
0.5
dbnd
Dead band
(heat/cool configuration
only) -10.0...10.0%
1000
OP. H
Control output
high limit
(PID algorithm only)
10.0...100.0%
1000
OPHC
Cool control
output high limit
(heat/cool PID
configuration only)
10.0...100.0%
0.5
HY.
Control output
hysteresis
(On-Off control only)
0.1...10.0% of span

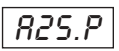

tunG
2nd GROUP
Tuning run/stop
(PID algorithm only)
AdPt
Continuous Tuning start/stop
(adaptive tuning)
(PID algorithm only)
P.b. 2
Calculated Proportional band [2] (display only)
(available when adaptive tuning is selected)
t. i. A
Calculated Integral Time [2] (display only)
(available when adaptive tuning is selected)
t.d. A
Calculated derivative time [2] (display only)
(available when adaptive tuning is selected)
OFF
SL. u
Setpoint ramp up
OFF /0.1...999.9 digit/min
OFF
SL. d
Setpoint ramp down
OFF / 0.1...999.9 digit/min
L. range
S.P. L
Setpoint low limit
low range...S.P. H
H. range
S.P. H
Setpoint high limit
S.P. L. ....high range
05
AL2H
AL2 Hysteresis
0.1...10.0% of span


PASS
Password entry
only if Code value <5000
(see page 38).
Direct access
to the configuration
(pages 36 – 38)
nonE
A2L.b
AL2 latching and blocking functions
nonE / Ltch
bLoc / LtbL
A3hy
AL3 hysteresis
0.1...10.0% of span [1]
OFF
A3L.b
AL3 latching and blocking functions
nonE / Ltch
bLoc / LtbL
OFF
t.LbA
LBA delay
(see page 32)
OFF = sensor break
1...9999 sec LBA
OFF
t.F iL
Time constant input filter
1...30 sec or OFF
OFF
In.Sh
Input shift
OFF / -60...60 digit
OFF
d.Err
Error dead band
(PID algorithm only)
OFF / 0.1...10.0 digits
OFF
St.oP
Soft-start output value
OFF / 0.1...100.0%
1
St.tO
Soft-start activation time
(only if St.oP different than OFF) 1...9999 sec.
0
Sa.oP
Output safety value
0.0...100.0%
(-100.0...100.0% for heat/cool)
Back to the
2nd parameter group

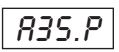
5.5 Parameter description

First Group

The controller parameters have been organised in groups, according to their functionality.



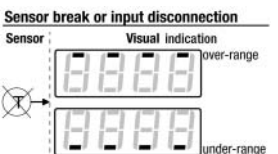
AL2 alarm threshold

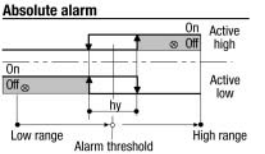


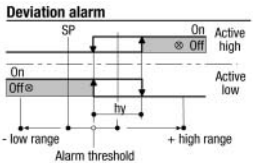
AL3 alarm threshold

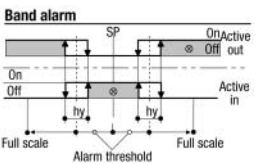
The alarms use OP1, OP2 and OP3 outputs in different ways, according to the configured types of alarms, as illustrated.

With double action control output, (VMD or heating and cooling). There is only one control output left. Alarm AL2 and AL3 will share the same output. (see table on page 14).



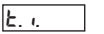






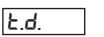
Proportional band

This parameter specifies the proportional band coefficient that multiplies the error (SP - PV)



Integral time

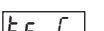
The integral time value specifies the time required by the integral term to generate an output equivalent to the proportional term. When Off the integral term is not included in the control algorithm.



Derivative time

The time required by the proportional term P to repeat the output provided by the derivative term D. When Off the derivative term is not included in the control algorithm.

Control output cycle time



Cycle time cool

This is the cycle time of the logic control output.

O.C. **Overshoot control**

(Automatically disabled when the adaptive tuning is running).
This parameter specifies the span of action of the overshoot control. The lower the O.C. value is, the smaller the overshoot will be during a set point change.The overshoot control doesn't affect the PID algorithm. If set to 1, the overshoot control is disabled.

d.bnd **Heat / Cool dead band**

This parameter specifies the width of the deadband between the Cool and the Heat channel.

nU.tn **Valve travel time**

nU.hY **Valve movement sensitivity**

OP. H **Control output high limit**

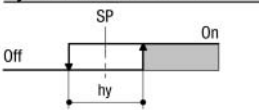
OP.HC **Cool output high limit**

This parameter specifies the maximum value the control output can be set

hY. **Control output hysteresis**

hY. C **Cool output hysteresis**

Hysteresis of the threshold



Control or alarm output hysteresis span, set in % of the full scale.

SL. u **Setpoint ramp up**

SL. d **Setpoint ramp down**

This parameter specifies the maximum rate of change of the Setpoint in digit / min. When the parameter is Off, this function is disabled.

A2hY **AL2 alarm hysteresis**

A3hY **AL3 alarm hysteresis**

Hysteresis of the threshold of both the alarms, that activate OP1 and OP2 control output. It is specified as a % of the full scale.

SP. L **Setpoint low limit**

SP. H **Setpoint high limit**

Low / high limit of the Setpoint value.

A2L.b **AL2, AL3 latching**

A3L.b **and blocking functions**

For each alarm it is possible to select the following functions

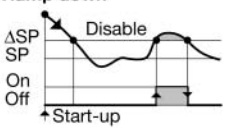
nonE none
LtcH latching
bLoc blocking
Lt.bL both latching and blocking

LtCh **Latch Alarm**

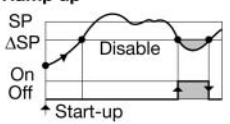
Using the latch function, the alarm will remain energised after the alarm condition is no longer present. To reset the latch, press any key and the alarm will switch off.

bLoc **Start up disabling**

Ramp down



Ramp up



ΔSP Threshold = SP ± range

Alarms with LBA (Loop Break Alarm) and Sensor Break Operation

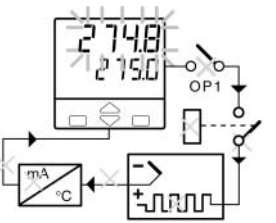
The Loop Break Alarm will detect faults in the input and output circuit of the controller.

Select the code 1 on **N** or **O** configuration indexes (see page 20) to select the Loop Break Alarm. The following parameter is then available.

t.LbA **LBA delay**

This parameter will provide a time delay [1] of 1 to 9999 sec to the Loop Break Alarm

The alarm condition is indicated by the red alarm LED and the flashing display.

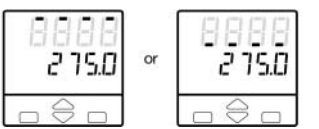


Loop Break Alarm Conditions

When the cause of the loop break disappears, the alarm staus stops.

With the parameter set to OFF, the alarm will work with no delay.

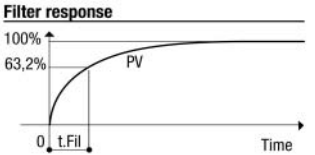
The alarm condition is indicated by the red alarm LED and the upper display will show the following:



Note [1] If the input sensor breaks the alarm will energise immediately.

tF iL — Input filter time constant

This input filter provides a time constant (in seconds) to the PV input.



In.Sh — Input shift

The value entered into this parameter will offset the PV input value. Its effect is to shift the whole PV scale by ± 60 digits.

dEr r — Error Dead Band

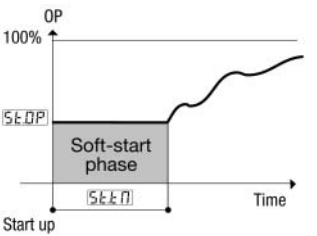
When the PV is within the error band, the control output will not change. This will help the life of the actuator by reducing the number of actuator starts.

ST.OP — Soft-start control output value

Set the value of the control ouput during the Soft-start activation time (in %). To de-activate the Soft-start, set to 'OFF'.

StEn — Soft-start activation time

Set the time duration (starting at power on) for the Soft-start function (in seconds).



The Soft-start function is a warm up phase after the controller is first powered up.
The Soft-start will set the control value to a desired position (*ST.OP*). for the set duration (*ST.TM*).

SAOP — Output Safety value

If the input signal fails, the control value can be set to a safe position (in %).

Using one PID control algorithm, the controller can handle two different outputs, one of these performs the Heat action, the other one the Cool action.

It is possible to overlap the outputs.

The dead band parameter dbnd is the zone where it is possible to separate or overlap the Heat and Cool actions.

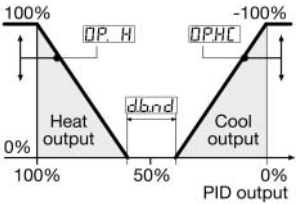
The Cool action can be adjusted using the relative cool gain parameter r.cGd.

To limit the Heat and Cool outputs the parameters Control Output High Limit OP. H and Cool Control Output High Limit OP.HC can be used.

When there is an overlap, the displayed output OUt shows the sum of the Heat and Cool outputs.

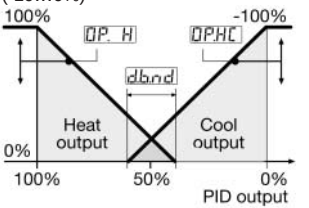
A Heat /Cool actions separated

Insert positive dbnd value (0…10%)



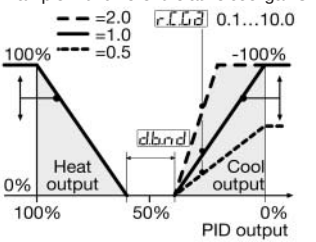
B Heat /Cool actions overlapped

Insert negative dbnd value (-10…0%)

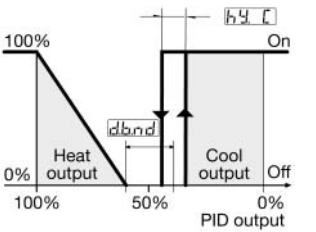


C Cool action adjusting

Example with different relative cool gains.



D On-Off Cool action



rPtr	**Analogue control output range**

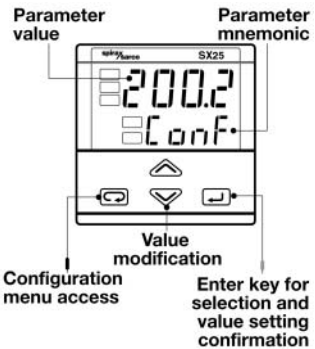
0-20 / 4-20

rt.H	**Control output selection**
nonE	**Not used**
H.U.	**Heat** (single action)
H.U. C.	**Cool**

With **SX25** mA Cycle Time tc
or Cool Cycle Time tc C
are not present.

5.6 Configuration menu

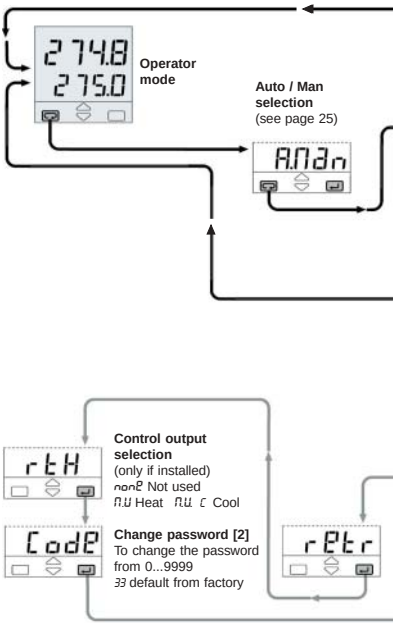
The configuration of the controller is specified through a 4 digit code that defines the type of input, of control output and of the alarms.
(section 4.1 page 19).

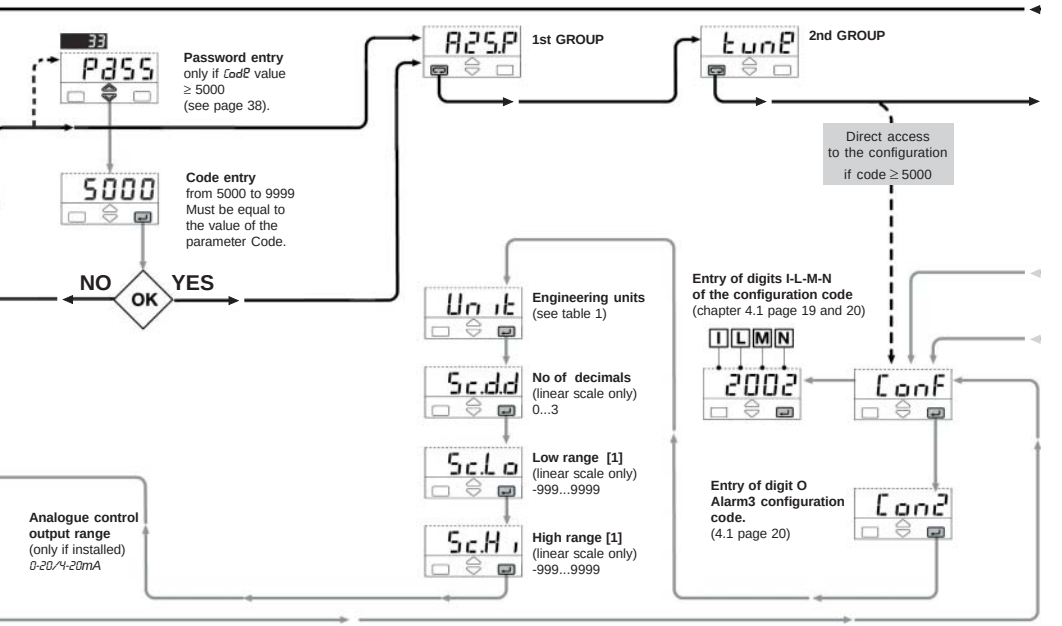


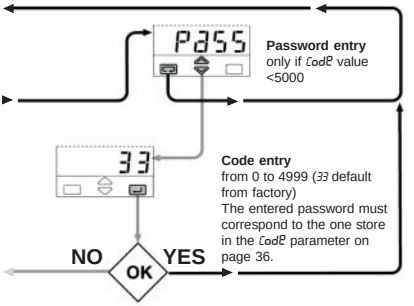
Press ⌃ or ⌄ to display the next parameter or the next code and change its value.
The new value entered is stored into the controller when the next parameter is selected by pressing ↵.

Pressing the ⟲ will display the next group of parameters.

Note:
You must remember the password code. If the code is changed from 33, and the operator forgets the code, he will be locked out of the controller.




PASS
Password entry
only if CodE value
≥ 5000
(see page 38).
5000
Code entry
from 5000 to 9999
Must be equal to
the value of the
parameter Code.
NO
OK
YES
A2S.P
1st GROUP
tunE
2nd GROUP
Direct access
to the configuration
if code ≥ 5000
Unit
Engineering units
(see table 1)
Sc.d.d
No of decimals
(linear scale only)
0...3
Sc.Lo
Low range [1]
(linear scale only)
-999...9999
Sc.H1
High range [1]
(linear scale only)
-999...9999
Analogue control
output range
(only if installed)
0-20/4-20mA
Entry of digits I-L-M-N
of the configuration code
(chapter 4.1 page 19 and 20)
I L M N
2002
ConF
Entry of digit O
Alarm3 configuration
code.
(4.1 page 20)
Conf2



Direct access to the configuration

A From parameter menu, "PASS" (see page 29).

B At the first power on when the controller is not configured:

In this situation, the controller has its outputs and inputs not active. This situation ends when a correct configuration code is entered.

Table 1 -
Supported Engineering Units.

Centigrade degrees*	°C
Fahrenheight degrees*	°F
no units	nonE
mV	nU
Volt	U
mA	mA
Ampere	A
Bar	bAr
PSI	PS I
Rh	rh
pH	Ph

* For inputs from thermocouple or resistance thermometer, the choice is between °C and °F only.

Notes

[1] Minimum Range 100 digits.

[2] To hide the parameters, change the password to a number between 5000 to 9999.

6. Commissioning Examples

When the controller is first powered up the display will show:

This indicates that the controller is not configured (the controller will not function without being configured).

If on power up the display does not show the above, but instead the operator mode (process variable and set point) is shown it signifies that the controller has already been configured. If this is the case it is unlikely that the pre-set configuration will be suitable for your application.

To change the configuration code it is necessary to access the configuration menu. Section 5.6 shows how to access this menu.

To configure the controller a code number must be entered into the controller. The configuration code ILMNO, covers the input type, the control type, and the alarms.

Refer to Configuration Coding, in section 4.1 to select the desired configuration settings. Selected codes should be recorded in the customer configuration and parameter record sheet.

The following show examples of commissioning the SX25 controller providing guidance for similar applications.

6.1 Example of pressure control for SX25-mA

The SX25-mA controller is monitoring system pressure with a pressure transmitter, and provides a 4-20mA control signal to the control valve.

Configuration Code and parameters:

- Pressure transmitter 0 to 50 barg, producing a 4-20mA output signal.
- Control Valve with Electric or Electro-pneumatic positioner accepting a 4-20mA input signal.
- Two Event alarms are required. Event Y2 set for active high process alarm at 25 bar with the Latch function. Event Y3 set for active outside band alarm set at 5 bar.
- This process requires only one set point. The local set point is 20 bar

Configuration code

Using the ^ and v keys, enter the first part of the configuration code '**ILMN**', conf.

I	L	M	N
8	0	0	2

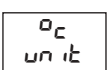
Then press the enter key ↵

Enter the last digit for code '**O**' CON2.

O
4

Then press the enter key ↵

The configuration code is now entered, and the display will show:



This selects engineering units for the input signal. Using the table below enter the following values into these parameters.

Parameter	Description	Default Value	New Value
Unit	Input Eng. units	C	bar
Sc.d.d	Number of decimals	0	1
Sc.Lo	Low input value	-999.9	0.0
Sc.Hi	High input value	999	50.0
rert	Analogue output range	4 - 20 mA	4 - 20 mA
rtH	Output Heating/Cooling	nu	nu
Code	Change Security code	33	33

Press the enter key ↵ to review the data you have entered or press the scroll key ⟲ to exit the configuration menu.

First group parameters

Press the scroll key
The display will show

which provides the option of selecting Automatic or manual control.

Press the scroll key again.
The display will show

Alarm 2 threshold value.

Using the table opposite, enter the following values into the parameters.

Parameter	Description	Default Value	Customer set Values
A2S.P	Alarm 2 set point	Stop	Stop
A3S.P	Alarm 3 set point	Stop	Stop
P.b.	Proportional band	5.0	5.0
t.i.	Integral time	5.0	5.0
t.d.	Derivative time	1.00	1.00
O.C.	Overshoot Control	1.00	1.00
nu.tn	Valve travel time	60	40
nu.hy	Valve Minimum output step	0.5	.05
OP.H	Control output high limit	100.0	5.0

Press the enter key to save the value entered and to move to the next parameter.

When the last parameter has been entered, press the enter key to save this value.

Now press the scroll key to edit the second group parameters.

Second group parameters

The display will show 

This is used to start the automatic tuning. Using this table enter the following values into these parameters.

Press the enter key ↵ to save the value entered and to move to the next parameter.

When the last parameter has been entered, press the enter key ↵ to save this value.

To exit press the scroll key ⟲.

The display will show: PASS

Press the scroll key ⟲ again and the display will return to the normal operating mode.

The controller is ready to operate. Now enter the required set point of 20.0 bar by using the ^ and v keys.

Parameter	Description	Default Value	Customer set Values
tune	Tuning PID	Stop	Stop
AdPt	Adaptive tuning PID	Stop	Stop
SL. u	Set point ramp up	Off	Off
SL. d	Set point ramp down	Off	Off
S.P. L	Set point low limit	0.0	0.0
S.P. H	Set point high limit	50.0	25.0
A2hy	Alarm 2 hysteresis	0.5	0.5
A2L.b	Alarm 2 latching and blocking	none	Ltch
A3hy	Alarm 3 hysteresis	0.5	0.5
A3L.b	Alarm 3 latching and blocking	none	none
t.F iL	Time constant input filter	Off	Off
In.Sh	Input shift	Off	Off
d.Err	Error dead band	Off	Off
St.OP	Soft start output value	Off	Off
Sa.OP	Control output high limit	0.0	0.0

To improve control of the application, adjust the proportional band and integral time accordingly.

6.2 Example of temperature control for SX25-VMD

The SX25-VMD controller is monitoring system temperature with a RTD Pt100, and provides a Valve Motor Drive control signal to the electric control valve.

Configuration Code and parameters:

- Temperature sensor with an effective range from 0°C to 100°C.
- Control Valve with 20mm stroke and Valve Motor Drive electric actuator, speed 0.5mm/s .
- Two Event alarms are required. Event Y2 set for active low process alarm set at 35°C with the blocking function. Event Y3 set for an active high deviation alarm set at 10°C.
- The process temperature required is 60°C is the control temperature.

Configuration code

Using the ∧ and ∨ keys, enter the first part of the configuration code 'ILMN'.

I	L	M	N
8	0	0	2

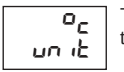
then press the enter key ↵

Enter the last digit for code 'O'

O
4

then press the enter key ↵

The configuration code is now entered,and the display will show:



This selects Celsius or Fahrenheit for the temperature units.

Using the table below enter the following values into the parameters.

Parameter	Description	Default Value	New Value
Unit	temperature units	°C	°C
Code	Change Security code	33	33

Press the enter key ↵ to save the value entered and to move to the next parameter.

Use the enter key ↵ to review the data you have entered or press the scroll key ↻ to exit the configuration menu.

When the configuration menu is exited, the display will now show the normal operating mode, with the process variable at the top and the set point at the bottom.

For example:

With the controller configured, the parameters can now be entered.

First group parameters

From the normal operating mode press the scroll key. The display will show

which provides the option of selecting Automatic or manual control.

Press the scroll key again.

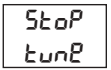
The display will show A2S.P Alarm2 set point. Using the table opposite, enter the following values into the parameters.

Press the enter key to save the value entered and to move to the next parameter.

Parameter	Description	Default Value	Customer set Values
A2S.P	Alarm 2 set point	0.0	35.0
A3S.P	Alarm 3 set point	0.0	10.0
P.b.	Proportional band	5.0	5.0
t.i.	Integral time	5.0	5.0
t.d.	Derivative time	1.00	1.00
O.C.	Overshoot Control	1.00	1.00
nu.tn	Valve travel time	60	40
nu.hy	Valve Minimum output step	0.5	.05
OP.H	Control output high limit	100.0	5.0

When the last parameter has been entered, press the enter key to save this value.
Now press the scroll key.

Second group parameters

The display will show 

This is used to start the automatic tuning. Using the table opposite, enter the following values into these parameters.

Press the enter key ↵ to save the value entered and to move to the next parameter.

When the last parameter has been entered, press the enter key ↵ to save this value.

Press the scroll key ⟲.

The display will show: PASS
Press the scroll key ⟲ again and the display will return to the normal operating mode.

Parameter	Description	Default Value	New Values
tune	Tuning PID	Stop	Stop
AdPt	Adaptive tuning PID	Stop	Stop
SL. u	Set point ramp up	Off	Off
SL. d	Set point ramp down	Off	Off
S.P. L	Set point low limit	-99.9	5.0
S.P. H	Set point high limit	300.0	80.0
A2hy	Alarm 2 hysteresis	0.5	0.5
A2L.b	Alarm 2 latching and blocking	none	bloc
A3hy	Alarm 3 hysteresis	0.5	0.5
A3L.b	Alarm 3 latching and blocking	none	none
t.F iL	Time constant input filter	Off	Off
In.Sh	Input shift	Off	Off
d.Err	Error dead band	Off	Off
St.OP	Soft-start output value	Off	Off
Sa.OP	Output safety value	0.0	0.0

The controller is ready to operate. Now enter the required set point of 60°C by using the ∧ and ∨ keys.
And read section 5 (Automatic tuning), for the self-setting of the PID values.

7. Automatic tuning

Two tuning methods are provided:

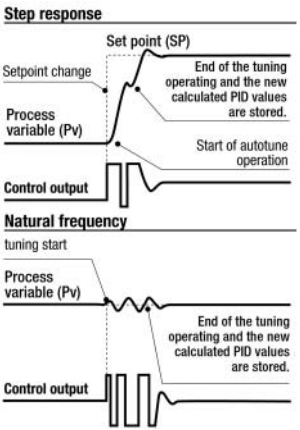
- Initial one shot **Fuzzy-tuning**
- Continuous, self learning **Adaptive Tuning**

Fuzzy-Tuning allows the calculation of the optimal PID parameters by monitoring the response of the process.
The controller provides 2 types of tuning algorithms, that are selected automatically according to the process condition when the operation is started.

Step response
This type is selected when the process is started.
There must be a difference between the set point and the PV of more then 5% of the input scan.
This method has the big advantage of fast calculation, with a reasonable accuracy in the PID calculation.

Natural frequency
This is selected when the Process Variable (PV) is close to the Setpoint (SP).

This method provides a more accurate PID calculation but will take more time to complete.
If the natural frequency tune is taking too long to complete, try the step response time.



Operator mode

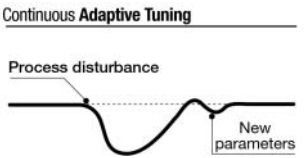
press until

To start select StrE

To stop select StoP

The green led MAN will flash when the Fuzzy Tuning is in operation. At the end of this operation, the calculated PID values are stored and used by the control algorithm and the controller automatically returns to the operator mode. The green led MAN will switch off.

The self-learning Adaptive Tuning is non-intrusive. It doesn't affect the process during the calculation of the optimal PID values.



It is particularly suitable for controlling process whose control characteristics change with time or are not linear in relation to the Setpoint values. It doesn't require any operation by the user. It works by continuously sampling the process response to the various process disturbance, determining the frequency and the amplitude of the signals.

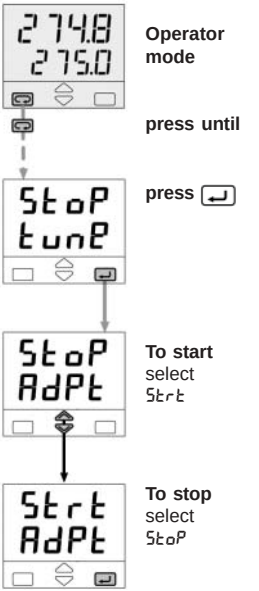
On the basis of this data and their statistical values, stored in the instrument, it automatically modifies the PID values.

The new calculated PID values are stored in the controller's menu, under Adaptive Selection (see page 28).

Note:
Before the Adaptive is switched off, note down the calculated PID values.

If the Adaptive is switched off the new PID values will be lost

If the power fails during Adaptive Tuning, the PID values are lost. At power on, the Adaptive Tuning starts automatically and will re-calculate the PID values.



8. Technical specifications

Features (at 25°C environmental temp.)	**Description**			
Total configurability (see section 4.1 page 19 section 5.6 page 36)	From the keypad the user can select: - type of input - type of control algorithm - type and functionality of the alarms - associated functions and the corresponding outputs - type of output and the safe conditions - values of all the control parameters.			
PV Input (see page12, 13 and 19)	Common characteristics	A/D converter with resolution of 50.000 points Update measurement time: 0.2 seconds Sampling time: 0.5 seconds Input bias: - 60…+ 60 digit Input filter with enable/disable: 1…30 seconds		
	Accuracy	0.25% ± 1 digits for temperature sensors 0.1% ± 1 digit for mV 1.25% ± 1 digits for mA 1.25% ± 1digit for mA		Between 100…240V~ the error is minimal
	Resistance thermometer (for ΔT: R1+R2 must be <320Ω)	Pt100Ω at 0°C/32°F (IEC 60751) °C/°F selectable	2 or 3 wires connection Burnout (with any combination)	Max. wire Res: 20Ω max (3 wires) Input drift 0.35°C/10° Env. Temp. <0.35°C/10Ω Wire Res.
	Thermocouple	L,J,T,K,S (IEC 60584) Rj >10MΩ °C/°F selectable	Internal cold junction compensation con NTC Error 1°C/20°C ±0.5°C Burnout	Line: 150Ω max Input drift: <2µV/°C.Env. Temp <5µV / 10Ω Wire Res.
	DC input (current)	4…20mA, 0-20mA with external shunt 2.5Ω 1% Rj >10MΩ	Engineering units Conf. decimal point position Init. Sc -999…9999 Full Sc. -999…9999 (min. range of 100 digits)	Input drift: <0.1% / 20°C Env. Temp. <0.5µV / 10Ω Wire Res.
	DC input (voltage)	10…50mV, 0-50mV Rj >10MΩ		

Features (at 25°C environmental temp.)	**Description**					
Operating modes and outputs	1 double action PID loop or On/Off with 1 or 2 alarms	Single action	Control output		AL2 alarm	AL3 alarm
			OP1-Relay /Triac		OP2-Relay or logic	OP3-Relay/Triac
			OP2 -Logic		OP1-Relay /Triac	OP3-Relay/Triac
		Double action Heat/cool	OP1-Relay /Triac	OP3-Relay /Triac	OP2-Relay or logic	
			OP1-Relay /Triac	OP2 Logic		OP3-Relay/Triac
			OP2 Logic	OP3-Relay /Triac	OP1-Relay /Triac	
Control mode	Algorithm		PID with overshoot control or On-off			
	Proportional band (P)		0.5...999.9%			PID algorithm
	Integral time (I)		0.1...100.0 min		OFF = O	
	Derivative time (D)		0.01...10.00 min			
	Error band		0.1...10.0 digit			
	Cycle time		1...200 sec			
	Dead band		-10.0...10.0%			Heat / cool control action
	Cool relative gain		0.1...0.10			
	Cool cycle time		1...200 sec			
	Overshoot control		0.01...1.00			PID algorithm
	High limit		100.0...10.0% (heat) -100.0...-10.0%(cool)			
	Hysteresis		0.1...10.0%			On-Off algorithm

Features (at 25°C environmental temp.)	Description				
OP1 output	SPST Relay N.O., 2A/250V~ for resistive load Triac, 1A/250V~ for resistive load				Protection by varistor for 220V ~ and capacitor
OP2 output	Logic not isolated: 5V–, ± 10%, 30mA max SPST Relay N.O., 2A/250V~ for resistive load			Jumper selectable (page 13)	
OP3 output	SPST Relay N.O., 2A/250V~ for resistive load Triac, 1A/250V~ for resistive load				
OP4 countinuous control output (option)	Galvanic isolation: 500 V~/1 min Resolution 12bit (0.025%) Accuracy: 0.1 %			In current: 0/4...20mA 750½/15V max	
AL2 - AL3 alarms	Hysteresis 0.1...10.0% c.s.				
	Action	Active high	Action type	Deviation threshold	±range
				Band threshold	0...range
		Active low		Absolute threshold	whole range
		Sensor break, heater break alarm, Latching/Blocking, Loop Break Alarm			
Setpoint	Ramp up and down. User inhibited.			0.1...999.9 digit/min	
	Low limit			from low range to high limit	
	High limit			from low limit to high range	
Tuning	**Fuzzy-Tuning** The controller selects automatically the best method according to the process conditions			Step response	
				Natural frequency	
	Adaptive Tuning self-learning, not intrusive, analysis of the process response to perturbations and continuously calculation of the PID parameters				
Auto/Man station	Standard with bumpless function				
Auxillary supply	+18V- ±20%, 30mA max. for external tranmitter supply				

Features (at 25°C environmental temp.)	**Description**	
Operational safety	Measure input	Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display
	Control output	Safety value: -100%...100%
	Parameters	Parameter and configuration data are stored in a non volatile memory for an unlimited time
	Access protection	Password to access the configuration and parameters data, keypad lock, output lock
General characteristics	Power supply (PTC protected)	100 - 240V~ (- 15% + 10%) 50/60 Hz or 24V~ (- 25% + 12%), 50/60 Hz and 24V– (- 15% + 25%) Power consumption 2.6 W max.
	Safety	Compliance to EN 61010-1 (IEC 601010 – 1), installation class 2 (2500V) pollution class 2, instrument class II
	Electromagnetic compatibility	Compliance to the CE standards (see page 5)
	Protection EN60529 (IEC 529)	IP65 front panel
	Dimensions	1/16 DIN - 48 x 48, depth 120 mm, weight 130 gr. apx. 1.89 x 1.89, depth 4.72 in, weight 4.6 oz. apx.