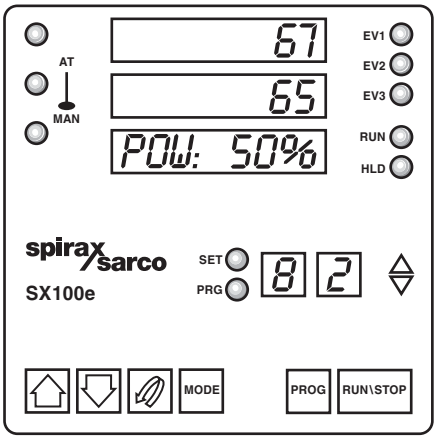
SX100e Controller
Quick Set-up Manual
Installation and Maintenance Instructions



1. Introduction

Note: This manual should be read in conjunction with the standard SX100 Operator's and Site manuals

The SX100e is a development of the SX100 controller with enhanced features, which have been incorporated to simplify and improve the programming and operation of the controller, particularly when used with heat exchange packages.

The differences in specification and operation of the SX100e in comparison to the SX100 are outlined below.

2. General product information

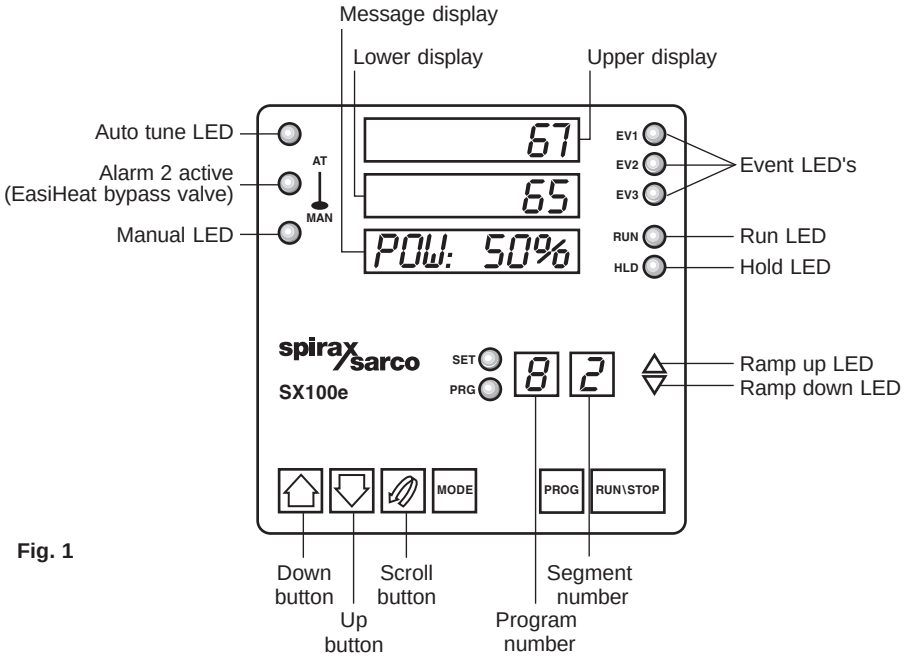


Fig. 1

2.1 Front facsia

1. In the top left of the controller front there are now only three LED's instead of five - these are:
   - **AT** - indicating if auto tune is active
   - **Thermometer Symbol** - showing that Alarm 2 is active (EasiHeat bypass valve energized)
   - **MAN** - indicating if the controller is in manual mode
2. The 'PROF' button has been renamed 'PROG'
3. The 'RUN/HOLD' button has been renamed 'RUN/STOP' as it more accurately describes its new function.
4. In the top right of the controller front there are now only three LED's instead of four - these are:

   EV1 - Pump output

   EV2 - Alarm 1 active - EasiHeat volt-free contact for remote high temperature alarm indication

   EV3 - Loop Alarm active

2.2 Functional changes

1. The creation of two security levels (note that to enter from Base Mode it is necessary on the SX100e to press the PROG and UP buttons together before entering the appropriate security code):

   Level 1 security code (Factory set to 10 and not changeable)

   Allows access to:

   - Operator Edit mode

   This is best used for day - to - day changes to program run times etc. Only the basic temperature selection and running times are available in this mode, which simplifies any alterations, reducing the possibility of mistakes being made.

   Level 2 security code (Factory set to 100 and not changeable)

   Allows access to:

   - Operator Edit Mode
   - Controller Define Mode
   - Program Define Mode

   This is for engineers and more experienced personnel who have sufficient expertise to alter the major settings within the controller such as PID and hardware options etc.

2. Real time clock now works in actual time, not elapsed time from the start of a program.
3. Digital Input Board now fitted as standard
4. Linear Output Board now fitted as standard (to output 3). Note - this replaces the relay output on the SX100.

   It is vital when substituting an SX100e for an SX100 - that any power supply connection to terminals 10, 11, or 12 are removed first - otherwise the controller will be severely damaged. (Output 2 on the SX100e can be used instead of Output 3 on the SX100).

5. Output power is now continually shown on the controller display, expressed as a percentage (unless the controller is in one of the programming modes)
6. The 'Control setpoint' on the SX100 has now been renamed 'Fallback' temperature for the SX100e. This is now only available for configuration in CONTROLLER DEFINE mode.

   This is the temperature the controller will attempt to maintain should the process value fall below this level, even if a program is not running. This should normally be set to zero or no more than 5 deg C, otherwise it may override a running program, or allow the control valve to open at times when the heating should not be active.

7. 'Final Setpoint' is now renamed 'Target Set Point'
8. There are now three effective external options for the controller. Refer to Table 1 page 4.

Table 1 Hardware configuration - external options

Mode	Description
OUT	Stand-alone mode The controller works independently.
BOTH	Stand-alone mode - with feedback to SX100e terminal 29 (RUN INPUT) If a high limit controller is used then this function can be used to ramp the heating down when a high limit trip occurs. After resetting the high limit, the SX100e will then restart the heating, ramping up to set point automatically. This feature can also be used in conjunction with feedback of say flow switch or pump running input, to inhibit the running of programs if no water flow is indicated. Refer to appropriate EasiHeat Wiring Diagram.
BMS	Building Management System control of controller This feature can also be used in conjunction with feedback of say flow switch or pump running input, to inhibit the running of programs if no water flow is indicated. Refer to appropriate EasiHeat Wiring Diagram.
NONE	Stand-alone mode Essentially identical to 'OUT'. This should not be used in normal circumstances - use 'OUT' instead.

9. The SX100e has only two heating programs offered when running in each of the stand alone modes:

- PROG 1 - TIMED
- PROG 2 - CONTINUOUS

10. Each program now has only three segments. These are:

- SEGMENT 1 RAMP UP
- SEGMENT 2 DWELL (MAINTAINS TEMPERATURE AT TARGET SET POINT)
- SEGMENT 3 RAMP DOWN (TO FINAL SET POINT)

11. In BMS mode - only programs 2 to 8 are available. These can be configured for temperatures and ramp times, but heating start and heating finish control is from the external building management system.

***12.** If power to the controller is switched off and then subsequently turned back on, any program which is set to run at that time will re-start automatically and ramp up to the target set point.

***13.** If External option is set to 'BOTH' a feedback to the run input on the controller can be used to terminate a program should, for instance the circulating water pump fail. When the feedback signal is re-established the program will then ramp back up to the target set point.

14. When changing from one program to another in stand alone or in BMS mode, the set point temperature will ramp up or down as appropriate to the new value. It is not now necessary to stop running the current program before changing to the next.

***Note:** there may be a delay of up to a minute before the program starts automatically

15. If changes have been made to parameters in either of the CONFIGURATION MODES, then when returning to BASE MODE, four LED dots may appear on the upper display beneath the main digits.

This indicates that the configuration changes have now invalidated any previously set up parameters in Program Define mode.

No programs will be able to run until changes have been made in Program Define or Operator Edit modes.

The 4 LED dots will then disappear showing that the operator has recognized this condition and taken the appropriate action.

3. Controller modes

The programmer has four operating modes (plus normal configuration mode and hardware configuration mode):

Base Mode (No security level)	**Display status - RUN, SET, PRG indicators Off.** No program is running in this mode
Operator Edit Mode (Security level 1 or 2)	**Display status - 'Op.Edit' message**
Program Run Mode (Security level 2)	**Display status - RUN, EV1 indicators on** Selected Program running
Program Define Mode (Security level 2)	**Display status - 'Def.Prog' message** Used to view and edit programs
Controller Define Mode (Security level 2)	**Display status - 'Def.Ctrl' message** Used to define the controller characteristics
Configuration Mode (Config. security code)	**Display status - 'Conf' message**

Additional information and details of factory settings when used for the EasiHeat application are detailed in the following sections

4. Selecting, defining, running and stopping a program

4.1 Selecting a program

In order to change the selection of a program when the SX100e is operating as a stand-alone controller, it is necessary to enter 'OPERATOR EDIT' mode.

If it is necessary only to change the program selected, refer to Table 2 below.

Table 2 SX100e Operator edit mode

To enter from base mode:
Press **PROG** and **UP** together ('Password' message is displayed)
Use **UP** or **DOWN** button to select either Level 1 or Level 2 Security code
Press **SCROLL** button

Description	Message display	Value range	Factory setting	Availabile in security level	
				1	2
Select appropriate program by pressing the PROG button until the required program no. to be edited is displayed in the window adjacent to the SET and PRG led's)	1 to 2	1 to 2 (if Ext option = 'out' or 'both') 2 to 8 (if Ext option = 'bms')	N/A	Yes	Yes

To exit from Operator Edit Mode:Press the **MODE** button repeatedly until the desired mode message is displayed, e.g. 'BASE' Then press **SCROLL**.

4.2 Defining a program

Follow the instructions on Table 3 below to select a new program, and/or to change the parameters of the required programs as indicated.

Table 3 SX100e Operator edit mode

To enter from base mode: Press **PROG** and **UP** together ('Password' message is displayed) Use **UP** or **DOWN** button to select either Level 1 or Level 2 Security code Press **SCROLL** button					
Description	**Message display**	**Value range**	**Factory setting**	**Availabile in security level**	
				1	**2**
(Firstly - select appropriate program by pressing the PROG button until the required program no. to be edited is displayed in the window adjacent to the SET and PRG led's)	1 to 2	1 to 2 (if Ext option = 'out' or 'both') 2 to 8 (if Ext option = 'bms')	N/A	Yes	Yes
Target Set Point	TargetSP	0 to 300 °C	65	Yes	Yes
Program Start Time	Start at	0:00 to 23:59	08.00	Yes	Yes
Program End Time	End at	0:00 to 23:59	17.00	Yes	Yes
Program run days	Run Days	Sun, Mon, Tues, Wed, Thu, Fri, Sat, 5 dy (Mon - Fri), 6 dy (Mon - Sat), ALL (7 Days a week)	5 dy	Yes	Yes
Set time function	SetTime?	Yes, No	N/A	Yes	Yes
Adjust/check Time Setting	Time	0:00 - 23:59	N/A	Yes	Yes
Adjust/check day of week	Day	Sun, Mon, Tues, Wed, Thu, Fri, Sat	N/A	Yes	Yes
To exit from Operator Edit ModePress MODE button repeatedly until the required mode is displayed, then press SCROLL button	Middle display-Goto Lower display-Mode	Op, Edit, Base Def. Ctrl, Def. Prog,	N/A	Yes No	Yes Yes
To exit from Operator Edit Mode: Press the **MODE** button repeatedly until the desired mode message is displayed, e.g. 'BASE' Then press **SCROLL**.					

4.3 Running a program

Program 1 (timed) - if the controller is set to run on the current day and time, the program will start automatically once the controller has been switched on (there may be a delay of up to a minute for this to happen after initial power up)

Program 2 (constant) - having selected program 2, it is necessary to press the RUN/STOP button once.

4.4 Overriding a program

In program 1 (timed) or program 2 (constant) the program can be started or stopped by using the RUN/STOP button.

Program 1 - (Timed)

Stopping Program 1:

- If program 1 is running, it can be stopped by pushing the RUN/STOP button for approximately 5 seconds.
- The segment no. will then change to '3' and the target temperature will be seen to ramp down, before finally terminating.
- The RUN LED will then go off.
- The program will then restart at the next scheduled start time.

Starting Program 1:

- If program 1 is not running, it can be started by pushing the RUN/STOP button briefly.
- Segment no. 1 will then be indicated on the display.
- The RUN LED will then illuminate and desired temperature will be seen to ramp up towards the target temperature.
- When target temperature is reached , the segment no. will change from 1 to 2.
- The program will then stop at the next scheduled stop time.

Program 2 - (Constant)

Stopping Program 2 :

- If program 2 is running, it can be stopped by pushing the RUN/STOP button for approximately 5 seconds.
- The segment no. will then change to '3' and the target temperature will be seen to ramp down, before finally terminating.
- The RUN LED will then go off.
- The program will NOT restart until the RUN/STOP button is pressed again.

Starting Program 2:

- If program 2 is not running, it can be started by pushing the RUN/STOP button briefly.
- Segment no. 1 will then be indicated on the display.
- The RUN LED will then illuminate and desired temperature will be seen to ramp up towards the target temperature.
- When target temperature is reached , the segment no. will change from 1 to 2.
- The program will then continue running.

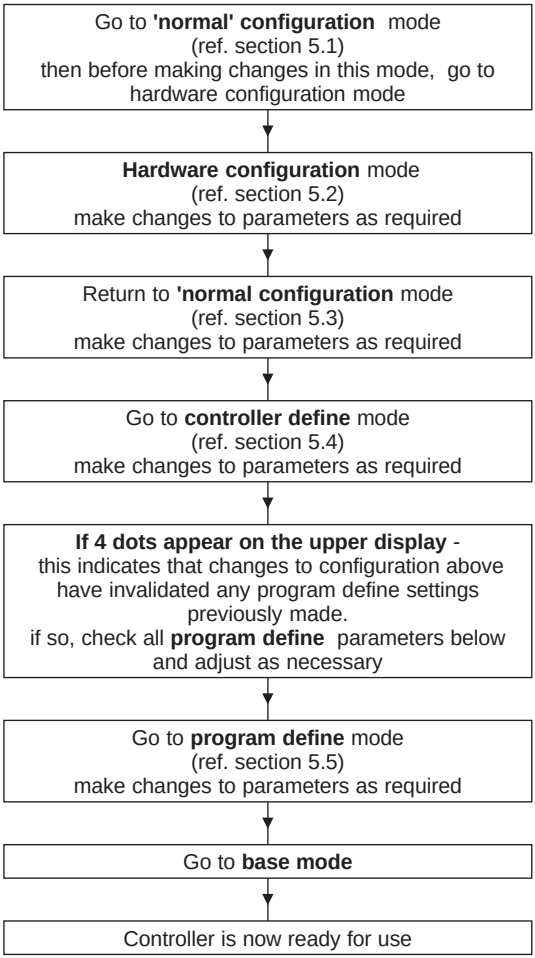


Fig. 2 Initial commissioning sequence

Follow the steps below (5.1 to 5.5) to ensure that controller is configured correctly. (Each table describes how to enter and exit from the appropriate mode)

5.1 Normal configuration

- Table 4 - 'Normal' configuration mode parameters.

(N.B. - If changes are to be made to hardware configuration, do these first. otherwise the expected options may not be displayed – ref. 5.2 below)

5.2 Hardware configuration:

- Table 6 - hardware configuration parameters.

Reference:

- Diagram 3 - sx100e hardware definition code.
- Diagram 4 - sx100e external options.
- Diagram 5 - digital inputs.

5.3 Return to normal configuration:

- Table 4 - 'normal' configuration mode parameters

Reference:

- Table 5 - primary input ranges.

5.4 Controller define:

- Table 8 - controller define parameters.

5.5 Program define:

- Table 9 - program define parameters.

Table 4 SX100e normal configuration mode

To enter normal configuration mode:
Turn power off and then back on.
Press **SCROLL** and **UP** buttons and hold until the display changes to show 'ConF' in upper display.
Then press **SCROLL** button to move through the list below.
(**Note** that any changes have to be accepted by pressing the **MODE** button):

Description	Message display	Function	Available settings and values (Lower main display)	Factory setting
Primary input range	Input	Displayed Code defines input type and range	Ref. Table 5 below	**2251**
Control action	Control	Specifies control action of Output 1	STdr - Standard Reverse acting	Stdr
Alarm 1 type	Alarm 1	Specifies Alarm 1 operation	**P_Hi** - Process High **P_Lo** - Process Low **dE** - Deviation **band** - Band **none** - None	bAnd
Alarm 2 type	Alarm 2	Specifies Alarm 2 operation	**P_Hi** - Process High **P_Lo** - Process Low **dE** - Deviation **band** - Band **none** - None	dE
Alarm inhibit	Inhibit	Inhibits the specified alarm(s) during ramp up and ramp down (segments 1 and 3)	**none** - No Inhibit **ALA1** - Alarm 1 **ALA2** - Alarm 2 **both** - Both Alarms	none
Output 2 usage	Out2 Use	Specifies usage of Output 2	**A2_d** - Alarm 2 (direct)	A2_d
Output 3 usage	Out3 Use	Specifies usage of Output 3	**none** - no re-transmission **recP** - re-transmission of Process Value temperature (PV) **recS** - re-transmission of Target SetPoint Temperature (SP)	none (Also ref. Table 6 and Diagram 2 below)
End of program relay	EOPrelay	Selects when End of Program Relay is energised	End - not changeable on SX100e	End
Baud rate	BaudRate	Selects Baud Rate for RS485 Communications	**1200** **2400** **4800** **9600**	**4800**

To exit from Configuration Mode back to Base Mode:
Press **UP** and **SCROLL** buttons together (the controller will re-start and return to BASE mode)

Table 5 Primary input ranges (normal configuration mode)

Resistance temperature detector (rtd)		dc linear input range	
Input range	**Displayed code**	**Input range**	**Displayed code**
32 - 571 °F	**2229**	0 - 50 mV	**4443**
-100.9 - 100.0 °C	**2230**	10 - 50 mV	**4499**
-149.7 - 211.9 °F	**2231**		
0 - 300 °C*	**2251***		
0.0 - 100.9 °C	**2295**		
32 - 213.6 °F	**2296**		
-200 - 206 °C	**2297**		
-328 - 402 °F	**2298**		
0 - 800 °C	**7220**		
32 - 1 472 °F	**7221**		
-100.9 - 537.3 °C	**7222**		
-149.7 - 999.1 °F	**7223**		

*** Default setting**

Table 6 SX100e hardware configuration mode (ref Figure 3)

To enter hardware configuration mode:From configuration mode (Ref.Table 4). Press scroll and down buttons together. Then use SCROLL button to move through the list below (note that any changes have to be accepted by pressing the MODE button):			
Description	**Message display**	**Function**	**Factory setting**
Hardware definition code **Ref. Figure 3 below**	Hwdefine	N/A	**1 7 1 0** This equates to: Input = **1** (process temperature sensor) = Pt 100. Output 1 = **7** (control output) = 4-20 mA. Output 2 = **1** (alarm 2) = relay. Output 3 = **0** (re-transmission of process value or set point) = not selected. Re-transmission board is fitted as standard on output 3 and is available for use.
External options Ref. table 1 and diagram 4	Ext optn	none*, out, both, bms (use 'out' instead of 'none' on SX100e)	**out**
Communications	comms	none, **SLA, MAS**	**none** (communications option board is not fitted as standard)
Digital inputs type (N.B.only visible if bms selected in external options)	Inputs	cont, ttl	**cont** (contacts - i.e. switches)
To exit from Hardware Configuration Mode back to Configuration Mode: Press DOWN and SCROLL button together.			

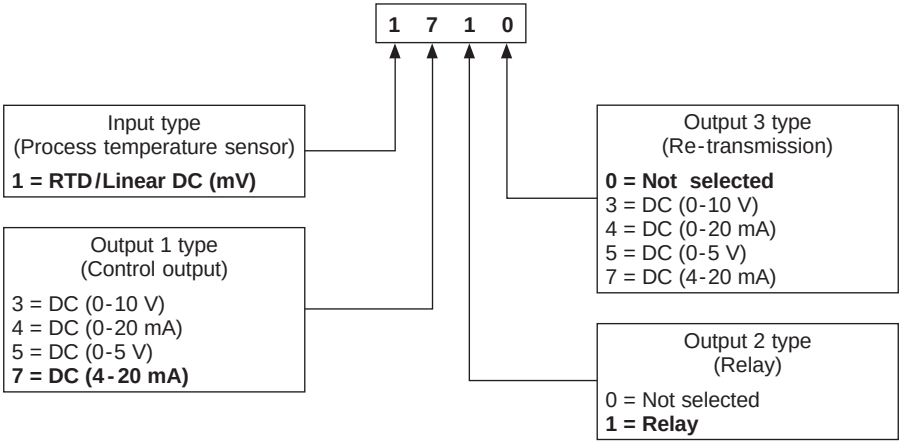


Fig. 3 SX100e hardware definition code (default value is 1710 as indicated)

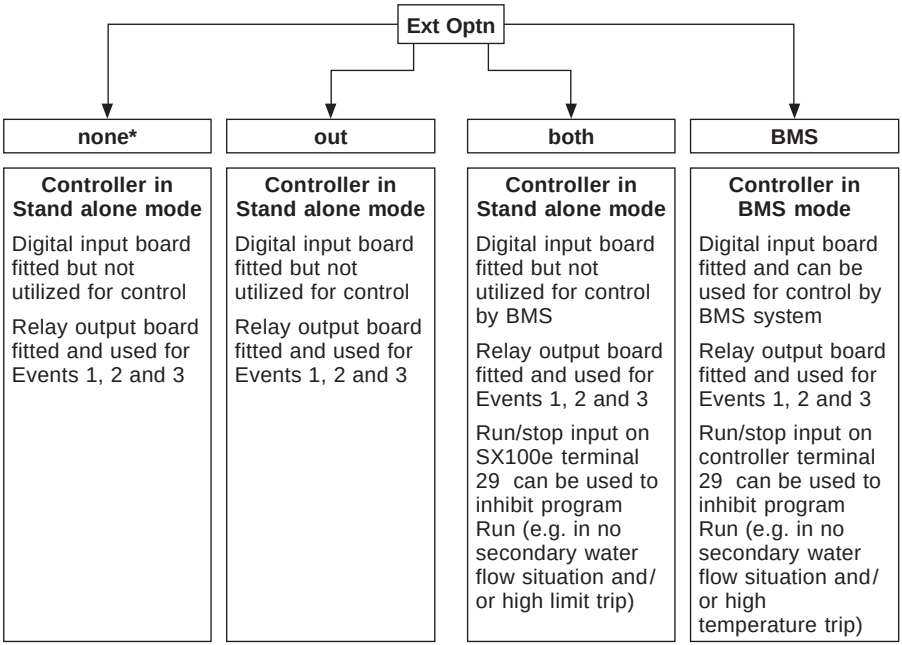


Fig. 4 SX100e External options

***** Use **'out'** instead. ('None' is **not** normally used on the SX100e)

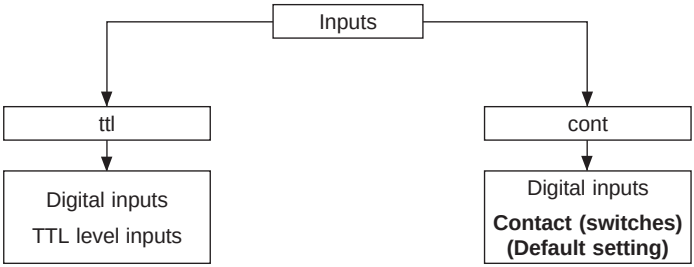


Fig. 5 Digital inputs

The programs are selected as described in Table 7 below.

The input combinations on R0, R1, R2, decide the program that will run.
Note that when there are no inputs to these terminals, the program will halt.

Table 7 SX100e BMS program selection chart

(Note – this is different to the SX100. Also Prog 1 is not available in BMS mode on the SX100e)

Inputs = 'ttl' (0 = logic 0, 1 = logic 1)				**Inputs = 'cont' (C = closed, O = open)**			
R0	**R1**	**R2**	**Prog**	**R0**	**R1**	**R2**	**Prog**
0	0	0	**Halt**	O	O	O	**Halt**
1	0	0	**2**	C	O	O	**2**
0	1	0	**3**	O	C	O	**3**
1	1	0	**4**	C	C	O	**4**
0	0	1	**5**	O	O	C	**5**
1	0	1	**6**	C	O	C	**6**
0	1	1	**7**	O	C	C	**7**
1	1	1	**8**	C	C	C	**8**

Table 8 SX100e controller define mode

To enter from base mode: Press **PROG** and **UP** together ('Password' message is displayed). Use **UP** or **DOWN** button to select Level 2 Security code. Press **SCROLL** button ('TargetSP' message is displayed). Press **MODE** button twice ('Goto' and 'Def.Ctrl' messages are displayed). Press **SCROLL** button.			
Description	**Message display**	**Value range**	**Factory setting**
Fallback Temperature	Fallback	0 - 300	0
Power Output	Power	0 - 100 %	N/A
Self Tune	SelfTune	ON, OFF	OFF
Proportional Band (%)	PropBand	0 - 100	12.0
Integral Time (mins/secs)	Integral	0 - inf	0.12
Derivative Time (mins/secs)	Deriv.	0 - inf	0.03
Bias	Bias	Bias applied to output power	2
Output Power Limit (%)	Out High	Limits power level of Output 1	100
Set Point High Limit (°C)	SP High	Maximum limit for setpoint adjustment	100
Set Point Low Limit (°C)	SP Low	Minimum limit for setpoint adjustment	0
Alarm 1 value (°C)	Alarm 1	Alarm level	10 (band alarm)
Alarm 1 Hysteresis	Al 1.Hyst	Hysteresis band	1
Alarm 2 value (°C)	Alarm 2	Alarm level	2 (deviation alarm)
Alarm 2 Hysteresis	Al 2.Hyst	Hysteresis band	1
Input Filter Time Constant	Filter	Defines time constant for input filter	0.5
Offset (°C)	Offset	Offset of measured value	0
Program Lock	LockProg	If selected 'ON' Inhibits changes whilst a program is actually running	OFF
Recorder Output High (If output 3 used for re-transmission) (°C)	Rec High	100	
Recorder Output Low (If output 3 used for re-transmission) (°C)	Rec Low	0	
To exit from Controller Define Mode: Press the **MODE** button repeatedly until the desired mode message is displayed. Then press **SCROLL.**			

Table 9 SX100e program define mode

To enter from base mode: Press **PROG** and **UP** together ('Password' message is displayed) Use **UP** or **DOWN** button to select Level 2 Security code Press **SCROLL** button ('TargetSP' message is displayed) Press **MODE** button repeatedly until ('Goto' and 'Def.Prog' messages are displayed) Press **SCROLL** button			
Description	**Message display**	**Value range**	**Factory setting**
Ramp up rate	UP (°C/m)	N/A	30
Target set point	TargetSP	N/A	Ref. Table 10
Ramp down rate	Dn (°C/m)	N/A	30
Final set point	Final SP	N/A	N/A
Run days	Run Days	Sun, Mon, Tue,Wed,Thu, Fri, Sat, Sun, 5 dy, 6 dy, All	N/A
Start time	Start at	0.00 to 23.59	8.00
Finish time	End at	0.00 to 23.59	17.00
To exit from program define mode: Press the **MODE** button repeatedly until the desired mode message is displayed. Then press **SCROLL**.			

Table 10 SX100e factory default settings in program define mode

Description	**Message display**	**Program number**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		Timed	**Constant/ BMS**	**BMS**	**BMS**	**BMS**	**BMS**	**BMS**	**BMS**
Ramp up rate	Up (°C/m)	30	30	30	30	30	30	30	30
Target set point	TargetSP	65	65	65	65	65	65	65	65
Ramp down rate	Dn (°C/m)	30	30	30	30	30	30	30	30
Final set point	Final SP	20	20	20	20	20	20	20	20
Run days	Run days	5 Dys	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Start time	Start at	8.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Finish time	End at	17.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program available in which External Option (Hardware Configuration)		**OUT and BOTH**	**OUT, BOTH and BMS**	**BMS**					

6. Record of settings

(All parameters should be recorded here when commissioning is complete, and when any subsequent changes are made)

Table 11 Operator edit mode settings

Message display	Factory setting	Program number							
		1	2	3	4	5	6	7	8
Target SP	65								
Start At	8.00		Const						
End at	17.00		Const						
Run Days	5 dY		Const						

Table 12 Normal configuration mode settings

Message display	Factory setting	Actual setting			
		date:	date:	date:	date:
Input	2251				
Control	Stdr				
Alarm 1	bAnD				
Alarm 2	dE				
Inhibit	none				
OUT2 USE	A2_d				
OUT3 USE	none				
EOPRelay	END				
Baud rate	4800				

Table 13 Hardware configuration mode settings

Message display	Factory setting	Actual setting			
		date:	date:	date:	date:
Hw define	1710				
Ext optn	Out				
Comms	None				
Inputs	Cont				

Table 14 Controller define mode settings

Message display	Factory setting	Actual setting			
		date:	date:	date:	date:
Fallback	0				
Self tune	OFF				
Propband	12.0				
Integral	0.12				
Deriv.	0.03				
Bias	2				
Out high	100				
Sp high	100				
Sp low	0				
Alarm 1	10				
Al 1 hyst.	1				
Alarm 2	2				
Filter	0.5				
Offset	0				
Lockprog	OFF				
Rec high	100				
Rec low	0				

Table 10 SX100e factory default settings in program define mode

Description	Message display	Program number							
		1	2	3	4	5	6	7	8
		Timed	Constant/ BMS	BMS	BMS	BMS	BMS	BMS	BMS
Ramp up rate	Up (°C/m)	30	30	30	30	30	30	30	30
Target set point	TargetSP	65	65	65	65	65	65	65	65
Ramp down rate	Dn (°C/m)	30	30	30	30	30	30	30	30
Final set point	Final SP	20	20	20	20	20	20	20	20
Run days	Run days	5 Dys	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Start time	Start at	8.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Finish time	End at	17.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program available in which External Option (Hardware Configuration)		**Out and both**	**Out, both and BMS**	**BMS**					

Table 15 SX100e actual program define mode settings

Description	Message display	Program number							
		1	2	3	4	5	6	7	8
		Timed	Constant/ BMS	BMS	BMS	BMS	BMS	BMS	BMS
Ramp up rate	Up (°C/m)								
Target set point	TargetSP								
Ramp down rate	Dn (°C/m)								
Final set point	Final SP								
Run days	Run days		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Start time	Start at		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Finish time	End at		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program available in which External Option (Hardware Configuration)		**Out and both**	**Out, both and BMS**	**BMS**					