IM-S27-06
CH Issue 2

SX100 Controller
Quick Set-up Manual

1. Introduction

The purpose of this manual is to allow quick set-up of the SX100 controller, providing information on the most commonly used functions when used for control of the EasiHeat unit. See the SX100 Operator's Manual and Site Manual.

2. Controller

Please use this manual as a guide, in conjunction with the Controller Site Manual and Operator's Manual supplied.

The programmer has four operating modes (plus a configuration mode):

Base mode	**Display status - RUN, HOLD, SET, PRG indicators Off** This is for PID control operations with no program running. In this mode a program may be selected to run.
Program run mode	**Display status - Run indicator On** A selected program is running, held or waiting for a pre-defined delay before starting. In this mode the operator can view status and program information.
Program define mode	**Display status - SET and PRG indicators On** Used to view/create/edit programs. This mode is entered from BASE MODE or from PROGRAM RUN MODE.
Controller define mode Refer to SX100 Site Manual	**Display status - SET indicator On** Used to define the controller characteristics.
Configuration mode	**Display status - 'ConF' visible in top display** Used to configure the controller for different hardware and input/output options.

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

2.1 Setting the correct time and day of the week for the Real Time Clock (RTC)

From BASE MODE:

- Press **UP** and **SCROLL** buttons together.
- Use **UP** button to display the correct Lock Code value (Factory set to 10).
- Press **SCROLL** button.
- Press **PROF** button repeatedly until 'A' is displayed in the 'P No.' window.
- Press the **SCROLL** button repeatedly until 'RTC Time' is displayed in lower window.
- Press the **UP** or **DOWN** buttons to change the time to the correct value. **Note:** if the time setting is wrong by a large amount, keep the **UP** or **DOWN** button depressed rather than pushing repeatedly: the speed at which the display increments will increase after a short time.
- Press the **SCROLL** button until 'RTC Day' is displayed in the lower window.
- Press **UP** or **DOWN** buttons to change the day.
- If time and day are now correct, press **MODE** key twice until 'Exit?' appears in the lower window.
- Press **SCROLL** key to return to BASE MODE.

2.2 Selecting and running a program

(Refer to SX100 Operator's Manual)

Note: if a program is already running, (i.e the 'RUN' indicator is lit), first press the RUN/HOLD key for more than 5 seconds to return unit to BASE MODE.

From BASE MODE (RUN, HOLD, SET, PRG indicators off):

- Hold down the **PROF** key until the required program (profile) number (1-8) is displayed in the lower right hand 'P No.' window.
- Press the **RUN/HOLD** key once to start the program. The RUN indicator will then go ON; the programmer is now in PROGRAM RUN MODE.

To exit from PROGRAM RUN MODE, hold down the **RUN/HOLD** key for more than five seconds. The program will be aborted and a return is made to BASE MODE.

2.3 Adjusting the setpoint

(Refer to SX100 Operator's Manual)

Note: This setting is normally set to 0°C . It does not represent the running setpoint temperature. Setting the temperature at this level will prevent the steam valve opening with no circulating pump running.
The actual running temperature is normally set from the 'Program settings', and is set for each segment of the program (Refer to Tables 2 and 3, and 'Example of how to set a program', page 8).
With the setpoint programmer in BASE MODE (i.e with the RUN, HLD, SET and PRG indicators OFF), the two main displays will show the process variable value (upper display) and the setpoint value (lower display – Read only).

To change the setpoint value:

- Press the **SCROLL** key until the message area displays one of ;
  Ctr SP °C, Ctr SP °F or Ctr SP (according to input range)
  (Note: Factory set to indicate 'Ctr SP 0°C').
- Use the **UP** and **DOWN** keys to change the setpoint value (in the lower display) as required.
- When the setpoint value is set as desired, press the **SCROLL** key again to return to the initial display. The controller will remain in BASE MODE.

2.4 Defining and viewing a program

(PROGRAM DEFINE MODE)

The setpoint programmer may be put into PROGRAM DEFINE MODE from either BASE MODE or PROGRAM RUN MODE i.e. with a program currently running.

Entry into PROGRAM DEFINE MODE:

- Press the **SCROLL** and **UP** keys simultaneously. The lower main display will show '0' and the message display will show: 'Unlock'.
- Use the **UP** and **DOWN** keys to set the value in the lower main display to the PROGRAM DEFINE MODE lock value and then press the **SCROLL** key.
  (**Note:** This value is initially factory set to 10).

The setpoint programmer will now enter PROGRAM DEFINE MODE, i.e the SET and PRG indicators will go ON and the operator will be able to edit programs and segments.

- The **PROF** button should then be used to either select 'A' in the 'P No.' window if choosing to view/modify settings common to all programs, or to select Nos.,1 to 8 for viewing/modifying settings which apply to those program Nos., only (Refer to Tables 1, 2 and 3).
- The **MODE** key can then be used:
  i - to switch to CONTROLLER DEFINE MODE
  (i.e PRG led goes off, SET led stays on.) refer to Table 4.
  ii - to show a message display.
- To return to PROGRAM DEFINE MODE press the **MODE** key; to return to BASE MODE, press the **SCROLL** key.
- After entering PROGRAM DEFINE MODE the **SCROLL** key can be used to step through the sequence.
- The displayed Program Number may be changed using the **PROG** key and the displayed Segment Number may be changed using the **RUN/HOLD** key.

Table 1
Parameters common to all programs
('P No.' = A)
(PROGRAM DEFINE MODE)

To enter from BASE MODE:

- Press **UP** and **SCROLL** buttons together.
- Press **UP** button to select unlock code.
- Press **SCROLL** button.
- Press **PROF** button repeatedly until '**A**' is visible in the **'P No.'** display. This permits the user to view/modify parameters common to all programs. (refer to the Table below).
- Press the **SCROLL** button as required to select the required parameters.

Note: If wishing to view/modify parameters which are for a specific program No. (e.g. 1 - 8), press the PROF button until the required program No. is visible in the 'P No.' window, (see Table 2).

Parameters common to all programs
('P No.' = 'A', 'SEG' = 'blank', SET and PRG leds on)

Parameter	Message display	Function	Available settings (Lower main display)	Factory settings
Start on	Start on	Setpoint value at start of each program	SEtP Proc	SetP
End on	End on	Setpoint value at end of each program	F_SP SEtP	SetP
Delay time	Delay	Delay (hrs / mins) between program initiation and program start	Numerical value	0.00
Program lock	Lockprog	Operator changes permitted / not permitted whilst program is running	On – not Permitted OFF - Permitted	ON
Power fail recovery	Recovery	Response to restoration of power after power failure	Refer to the Operators Manual Section 8.2	0.00
RTC Time	RTC Time	Real time clock initial setting (hrs/mins)	0.10 – 24.00	Various
RTC Day	RTC Day	Real Time Clock intial setting (day of week)	Days of week	Various

To return to BASE MODE:

- Press **MODE** button twice until 'Exit?' appears in lower window.
- Press **SCROLL** button.

Table 2
Parameters which apply to a specific program No.
('P No.' = 1 - 8)
(PROGRAM DEFINE MODE)

To enter from BASE MODE:

- Press **UP** and **SCROLL** buttons together.
- Press **UP** button to select unlock code.
- Press **SCROLL** button.
- Press **PROF** button repeatedly until required program no. is visible in the 'P No.' display.
- Then refer to the Table below.

(To modify the SEGMENTS which apply to each of these programs, press the **RUN / HOLD** button to show the required SEGMENT No. in the 'SEG' window, then refer to Table 3)

Parameters which apply to a specific program No.
('P No.' = 1 - 8, 'SEG' = blank)

	Program number							
Parameter	**1***	**2***	**3**	**4**	**5**	**6**	**7**	**8**
Cycles	1	inF	1	1	1	1	1	1
Auto Hold	off	off	off	off	off	off	off	off
Hold Band	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hold On	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pre x 60	none	none	none	none	none	none	none	none
Timer	on	off	off	off	off	off	off	off
Start Hr	08.00	24.00	24.00	n/a	n/a	n/a	n/a	n/a
Start Dy	5 dy	ALL	sat	n/a	n/a	n/a	n/a	n/a

***Note:** Program No. 1 is set for a 5 day week.
Program No. 2 is set for constant mode.
Program Nos. 3 to 8 are free for setting to the requirements of the user.

To return to BASE MODE:

- Press **MODE** button twice until 'Exit?' appears in lower window.
- Press **SCROLL** button.

Table 3
Parameters which apply to segments in a specific program
('P No.' = 1 - 8, SEG No. = 1 - 5)
(PROGRAM DEFINE MODE)

To enter from BASE MODE:

- Start from Table 2, with SEG window blank, then to move on to the Segment No. parameters, press the **RUN/HOLD** button (Segment No. will be displayed in lower right hand 'SEG' window).

Parameters in any / each segment in a specific program
('P No.' = 1 - 8, 'SEG' = 1 - 5)

	Program number							
Parameter	**1***	**2***	**3**	**4**	**5**	**6**	**7**	**8**
Segment 1								
Final SP	65	65	0	0	0	0	0	0
Time (hrs / mins)	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Event	0001	0001	000	000	000	000	000	000
Segment 2								
Final SP	- - - -	- - - -	END	END	END	END	END	END
Time (hrs / mins)	8.30	8.30	END	END	END	END	END	END
Event	0001	0001	END	END	END	END	END	END
Segment 3								
Final SP	20	END						
Time (hrs / mins)	0.15	END						
Event	0001	END						
Segment 4								
Final SP	END	END						
Time (hrs / mins)	END	END						
Event	END	END						
Segment 5								
Final SP								
Time (hrs / mins)								
Event								

***Note:** Program No. 1 is set for a 5 day week.
Program No. 2 is set for constant mode.
Program Nos. 3 to 8 are free for setting to the requirements of the user.

To return to BASE MODE:

- Press **MODE** button twice until 'Exit?' appears in lower window.
- Press **SCROLL** button.

2.5 Example of how to set a program:

In this example we wish to create a program which will turn on domestic hot water heating in a building. (This example is the same program as is factory set in Program No. 1).

The required settings are that:

- Start time = 0800 hrs
- Days hot water is required = Monday to Friday
- Temperature setting = 65°C
- The time domestic hot water heating is required for is 9 hours. (**Note**: There is no time setting for the switch off time, the heating period is hours and minutes, beginning at the Start time).

We will allow the bypass circulating pump to operate for 5 minutes after switch off, to dissipate the residual heat in the heat exchanger. This prevents any nuisance tripping of high limit temperature devices).

To enter these details, first of all put the programmer into BASE MODE (i.e. RUN, HLD, SET, PRG indicators are all off) If a program is running (RUN indicator is lit), then press the **RUN / HOLD** button for more than 5 seconds to return the unit to BASE MODE.

Please refer to Table 2 (PROGRAM DEFINE MODE)

To enter from BASE MODE:

- Press **UP** and **SCROLL** buttons together.
- Press **UP** button to select unlock code.
- Press **SCROLL** button.
- Press **PROF** button repeatedly until the required Program No. is visible in the 'P No.' display.

Then make sure the following parameters are set:
(Important: Make sure the SEG window is blank, if it isn't then use the RUN / HOLD button to do this).

- 'Cycles 'should be set to **1**.
- 'Auto Hold 'should be **OFF**.
- 'Pre x 60' should be **NONE**.
- 'Timer 'should be **ON**.

Now we can enter the times and temperatures:

- Start Hr should be set to **08.00** (i.e. 08.00 Hrs)
- Start Dy should be set to '**5 Dy**' (i.e. MONDAY – FRIDAY)

We now need to enter the settings for the individual segments in the program (Refer to Table 3)

Important note: If an 'END', 'J01-J08', or 'rEP' message appears in the middle window, when trying to enter the following settings, it can be changed by:

- Pressing **SCROLL** button until 'Time' is shown in lower window.
- Using **UP** and **DOWN** buttons to select either a time setting or 'END' as required.

Segment 1

- Press the **RUN/HOLD** button so that '1' appears in the SEG window (This means we are programming the settings for Segment No. 1).
- Use **UP** and **DOWN** buttons to set the required 'Final SP', i.e. 65. This is the desired temperature for the end of the segment. The setpoint will ramp **UP** from the measured temperature at start to the Final SP over the 30 minute period.
- Press **SCROLL**.
- Use the **UP** and **DOWN** buttons to set the required 'Time', i.e. 0.30. (This means 30 minutes from start time to end of Segment No. 1).
- Press **SCROLL**.

Use the **UP** and **DOWN** buttons to set 'Event' to 0001. (This means that the bypass pump, if fitted, designated 'Event 1', actually runs for the whole segment time).

Segment 2

We now wish to maintain a temperature of 65°C for 8½ hours:

- Press **RUN/HOLD** button to indicate '2' in the 'SEG' window (We are now programming the settings for Segment No. 2)
- Press **SCROLL** button twice (until 'Final SP' appears in lower window, check that 'SEG' No. is still 2).
- Use **UP** and **DOWN** buttons together to set the 'Final SP' to **- - - -** (This means the heating will 'dwell' i.e. remain at the previous Final SP setting of 65°C).
- Press **SCROLL**.
- Use **UP** and **DOWN** buttons to set time to 8½.
- Press **SCROLL**.
- Use **UP** and **DOWN** buttons to set 'Event' to 0001.

Segment 3

We now wish to ramp the temperature DOWN over a 15 minute period at the end of the heating period with the bypass pump running, to remove residual heat from the system:

- Press **RUN/HOLD** button to change to Segment No. 3.
- Press **SCROLL** key until 'Final SP' appears in lower window.
- Press the **DOWN** button until the display shows '20' (i.e. setpoint of 20°C).
- Press **SCROLL**.
- Use the **UP** and **DOWN** buttons to set the Time setting to 0.15 (i.e. 15 minutes).
- Press **SCROLL.**
- Use the **UP** and **DOWN** buttons to set 'Event' to 0001.

Segment 4

We now need to end the program, by entering the 'END' command in Segment No. 4:

- Press **RUN/HOLD** button to change to Segment No. 4.
- Press **SCROLL** key repeatedly until 'Time' appears in lower window.
- Press the **DOWN** button until the display shows 'END'.
- Press the **MODE** button twice until 'Exit?' appears in lower window.
- Press **SCROLL** to exit the program.

The Program has now been set as required.

Table 4
CONTROLLER DEFINE MODE

To enter from BASE MODE:

- Press **UP** and **SCROLL** buttons together.
- Press **UP** button to select unlock code.
- Press **SCROLL** button.
- Press **MODE** button.

Controller parameters

These are independent of Program or Segment Nos. ('P No.' 1 - 8), SET led on, SEG display blank.

Parameter	Message display	Function	Factory setting
Input filter time constant	Filter	Defines time constant for input filter	1.0
Process variable offset	Offset	Modifies actual PV value	0
Output 1 power	Out 1	Indicates current output 1 power level	100
Output 2 power	Out 2	Indicates current output 2 power level	N/A
Proportional band 1 (% span)	P. Band 1	Proportional band	8.0*****
Proportional band 2	P. Band 2	Proportional band	N/A
Reset (mins / secs)	Reset	Integral time	0.12*****
Rate (mins / secs)	Rate	Derivative time	0.03*****
Overlap	Overlap	Overlap of two PB's	N/A
Bias	Bias	Bias applied to output power	2
On/off differential	Diff1 Diff2 Diff	Switching differential	N/A
Setpoint high limit	SP High	Maximum limit for setpoint adjustment	100
Setpoint low limit	SP Low	Minimum limit for setpoint adjustment	0
Motor travel time	MT time	Valve travel time	N/A
Minimum motor 'on' time	MinDrive	Minimum drive effort to initiate movement in a stationary valve	N/A
Recorder output scale maximum	Rec High	Value for which recorder output is maximum	N/A
Recorder output scale minimum	Rec Low	Value for which recorder output is minimum	N/A
Output power limit	Out High	Limits power level of output 1	100
Output 1 cycle time	CycTime1	Limits frequency of operation of output relay	N/A
Output 2 cycle time	CycTime2	Limits frequency of operation of output relay	N/A

***** Factory setting to set PID. Please see Database DB-S27-08.

Table 4 (Cont'd)
CONTROLLER DEFINE MODE

Parameter	Message display	Function	Factory setting
Process high alarm 1 value	HiAlarm1	Alarm level	85
Process low alarm 1 value	LoAlarm1	Alarm level	N/A
Band alarm 1 value	BaAlarm1	Band alarm	N/A
Deviation alarm	DeAlarm1	Deviation alarm	N/A
Alarm 1 hysteresis value	All Hyst	Hysteresis band	1
Process high alarm 2 value	HiAlarm2	Alarm level	N/A
Process low alarm 2 value	LoAlarm2	Alarm level	10
Band alarm 2 value	BaAlarm2	Alarm level	N/A
Deviation alarm 2 value	DeAlarm2	Alarm level	N/A
Alarm 2 hysteresis	Al2 Hyst	Alarm 2 hysteresis	1
Loop alarm enable	Loop Alm	Enables / disable loop alarm	OFF
Loop alarm time	Lpatime	For on / off control loop alarm	N/A
Scale range decimal point	Range Pt	For linear inputs, defines the decimal point position	N/A
Scale range maximum	Range Hi	For linear inputs defines scaled input value	N/A
Scale range minimum	Range Lo	For linear inputs defines scaled input value	N/A
Manual control enable / disable	Auto PT	Enables / disables operator selection of manual control	OFF
Auto pre-tune enable / disable	Auto PT	Determines whether the pre-tune facility is automatically activated on power-up	OFF
Manual control enable / disable	A/M enable	Enables / disables operator selection of manual control	ON
Communications write enable / disable	ComWrite	Enables / disables changing of parameters / settings via RS485 link	N/A
Lock value	Lock or Lock C	Defines the 4 digit code required to enter controller / program define mode	10

To return to BASE MODE:

- Press **MODE** button once, or until 'Exit?' appears in lower window.
- Press **SCROLL** button.

2.6 Example of how to set the PID settings

(Refer to Table 4, pages 10 and 11)

It is a good idea to set the PID values to their optimum values, using for example, the Ziegler-Nicholls frequency response method (see DB-S27-08).

In order to adjust the settings, from BASE MODE, or RUN MODE:

- Press **UP** and **SCROLL** buttons together.
- Press **UP** button to select unlock code.
- Press **SCROLL** button.
- Press **MODE** button.
- Press **SCROLL** until 'P. Band1' appears in lower window. (Proportional band value).
- Use **UP** or **DOWN** buttons to set the desired value for Proportional band.
- Press **SCROLL** until 'Reset' appears in lower window. (Integral/reset time value).
- Use **UP** or **DOWN** buttons to set the desired value for the Integral time.
- Press **SCROLL** until 'Rate' appears in lower window. (Derivative Time/Rate value).
- Use **UP** or **DOWN** buttons to set the desired value for the Derivative time.

To return to the previous mode:

- Press **MODE** button once, or until 'Exit?' appears in lower window.
- Press **SCROLL** button.

2.7 Entry into configuration mode

(Refer to the Site Manual - Section 4)

Step 1 Power **DOWN** the instrument.

Step 2 Power **UP** the instrument. All LED's and indicators will come on temporarily (automatic test routine) then the normal BASE MODE displays will appear.

Step 3 Within 30 seconds of power-up, hold down the **UP** and **SCROLL** keys for approximately five seconds. (The display will shortly change to 'Unlock', but keep pressing the **UP** and **SCROLL** keys until the top display indicates 'ConF').

The setpoint programmer is then in configuration mode:

Step 1 Select desired parameter with **SCROLL** key.

Step 2 Adjust parameter to desired value using **UP/DOWN** keys. Value display will flash.

Step 3 Confirm new value by pressing **MODE** key. Value display will cease to flash.

Table 5
Configuration mode parameters

Parameter	Message display	Function	Factory setting
Primary input range	Input	Code displayed defines input type/range	7220
Control action	Control	Specifies control action of output 1	Stdr
Alarm 1 type	Alarm 1	Specifies alarm 1 operation	P_hi
Alarm 2 type	Alarm 2	Specifies alarm 2 operation	P_Lo
Alarm inhibit	Inhibit	Specifies which alarms are inhibited	nonE
Output 2 usage	Out 2 Use	Specifies use of output 2	A2_d
Output 3 usage	Out 3 Use	Specifies use of output 3	A1_d
Segment mode	Seg Mode	Defines parameter used to specify duration of each segment (along with final setpoint value)	t1
End of program relay	EOPRelay	Selects when end of program relay is energised	End
Event state	Ev State	Selects whether event output states are held or reset at end of program	OFF
Number of lock codes	Locks	Selects one or two lock codes to be used	1
Lock code	LockCode	Displays current lock code value	10

To exit from CONFIGURATION MODE depress the **UP** and **SCROLL** keys together. The controller will then return to BASE MODE.

Note: the unit will return to BASE MODE if when in CONFIGURATION MODE there is no front panel activity for five minutes.

2.8 Hardware definition parameters

(Refer to SX100 Site Manual)

This is a special facility which specifies the hardware fitted (input type, output types etc.); this must be compatible with the hardware actually fitted.

It can be accessed, in CONFIGURATION MODE by pressing the DOWN and SCROLL keys together. The message display will then show 'HwDefine', and the lower display will show a four digit number.

To view the other parameters press the **SCROLL** key.

Table 6
Hardware definition parameters

Parameter	Message display	Function	Factory setting
Hardware definition code	HwDefine	Specifies hardware fitted	1711
External options	Ext Opt	Specifies which external option devices are fitted	OUT
Communications	Comms	Specifies which communications options are fitted	NONE

To exit from HARDWARE DEFINITION MODE , press the **DOWN** and **SCROLL** keys together to return to CONFIGURATION MODE.

2.9 Self-tune

(Refer to SX100 Operator's Manual)

We do not recommend the use of self-tune on the EasiHeat package especially when used as an instantaneous water heater. It is normally preferable to adjust the PID settings to match the system manually.

2.10 Pre-tune

(Refer to SX100 Operator's Manual)

Not required.

2.11 Manual control

(Refer to SX100 Operator's Manual)

Not required.