

MARSHALL HE

BOILER SEQUENCE CONTROL PANEL

INSTALLATION, COMMISSIONING AND MAINTENANCE INSTRUCTIONS

IMPORTANT NOTE

**THESE INSTRUCTIONS MUST BE READ
AND UNDERSTOOD BEFORE INSTALLING,
COMMISSIONING, OPERATING OR
SERVICING EQUIPMENT**

Customer Services

Technical Enquiries



01202 662527/662528

To supplement the detailed technical brochures, technical advice on the application and use of products in the Hamworthy Heating range is available from our technical team in Poole and our accredited agents.

Site Assembly



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Hamworthy offer a service of site assembly for many of our products in instances where plant room area is restricted. Using our trained staff we offer a higher quality of build and assurance of a boiler built and tested by the manufacturer.

Commissioning



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Commissioning of equipment by our own engineers, accredited agents or specialist sub – contractors will ensure the equipment is operating safely and efficiently.

Maintenance Agreements



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Regular routine servicing of equipment by Hamworthy service engineers inspects the safety and integrity of the plant, reducing the risk of failure and improving performance and efficiency. Maintenance agreements enable our customers to plan and budget more efficiently.

Breakdown service, repair, replacement



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Hamworthy provide a rapid response breakdown, repair or replacement service through head office at Poole and accredited agents throughout the UK.

Spare Parts



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A comprehensive spare parts service is operated from our factory in Poole, providing replacement parts for both current and discontinued products. Delivery of parts and components is normally from stock within seven days. However, a next day delivery service is available for breakdowns and emergencies.

MARSHALL HE

BOILER SEQUENCE CONTROL PANEL

INSTALLATION, COMMISSIONING AND MAINTENANCE INSTRUCTIONS

**NOTE: THESE INSTRUCTIONS SHOULD BE READ AND UNDERSTOOD BEFORE
ATTEMPTING TO INSTALL, COMMISSION OR OPERATE THE MARSHALL HE SYSTEM.**

**THE MARSHALL HE SYSTEM IS INTENDED FOR USE ONLY IN COMMERCIAL/LIGHT
INDUSTRIAL APPLICATIONS.**

THIS BOILER SEQUENCE CONTROL SYSTEM COMPLIES WITH THE ESSENTIAL REQUIRE-
MENTS OF THE LOW VOLTAGE DIRECTIVE 73/23/EEC AMENDED BY 93/68/EEC, AND THE
ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 89/336/EEC AMENDED BY 91/263/EEC
AND 92/31/EEC.

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1.0 INTRODUCTION

1.1 This boiler sequence control system must be installed by a competent person.

All installations must conform to the relevant IEE and Building Regulations as well as any local regulations which apply. HSE requirements must also be taken into account when installing any equipment.

Failure to comply with the above may lead to Prosecution.

1.2 The Marshall HE is a microprocessor based control system designed for use with the Hamworthy modular boiler range. Each Marshall HE system consists of a wall mounted control panel located in the boiler house or alternatively if required located anywhere within the building. The Marshall HE controller can control a combination of on/off and high low boilers up to a maximum 8 sequence steps, as well as providing circulation pump control.

The boilers and circulation pump contactor are individually wired to the Marshall HE panel. The insertion flow temperature sensor (or optional strap-on sensor) and optional room temperature and external temperature sensors are individually wired to the panel using shielded, twisted pair cable.

Note! An optional power relay panel is available to allow connection of boilers with high electrical power ratings (refer to Figure 1/Page 6 for electrical rating information).

1.3 Control Features

1.3.1 Time Clock - 7 day timer with 4 'Active' (on) period settings per day. An external time clock can be connected to override the in-built clock.

1.3.2 Programmable Override - The Marshall HE system can be programmed on screen to override to 'Active' or 'Standby' for a given period of time.

1.3.3 Remote Override Facility - A remote switch can be connected to the Marshall HE controller, which when closed will cause the Marshall HE system to override to 'Active' for the duration that the switch is closed.

1.3.4 Weekly Shift Sequencing - The lead boiler is shifted every 7 days (at midnight on Sunday), to ensure even usage of the boilers. The correct firing sequence for both on/off and high/low boilers is maintained whichever is the lead boiler. This function can be disabled to maintain a fixed sequence.

1.3.5 Outside Temperature Compensation - This function requires the optional external temperature sensor. The compensation function adjusts the water flow temperature setting in relation to the

outside air temperature. As the outside air temperature falls the heat loss from a building increases, so to compensate for this the Marshall HE controller will increase the water flow temperature, thus increasing the heat input to the building and maintaining the desired comfort level. If this function is not utilised, the Marshall HE will control to a fixed water flow temperature.

1.3.6 Optimiser - This function requires the optional room temperature sensor. The optimiser function adjusts the heating start time in relation to the difference between the actual room temperature and the desired room temperature. The colder the actual room temperature is, so the earlier the heating is started. In this way the heating is switched on as late as possible to achieve the desired room temperature at the required time (the timeclock settings represent the time at which the desired room temperature is to be achieved).

The optimiser includes a self-learning function to tune the system to each installation. The self-learning function can be disabled.

The optimiser also provides a 'Standby' (night-setback) temperature setting, such that the room temperature is prevented from falling below this point overnight.

A further feature provided by this function is the ability to adjust the 'Active' or 'Standby' room temperature setting for the current timeclock period, after which it will revert to its programmed setting.

If the optimiser function is not utilised the heating is started at the times specified by the timeclock.

1.3.7 Summer Shutdown Function - When the outside air temperature exceeds an adjustable limit the heating system is automatically shut down. Normal operation continues when the outside air temperature falls below the limit. This function can be disabled.

1.3.8 Frost Protection - When the Marshall HE is in Standby (off/night-setback) mode, this function fires the boilers to maintain a minimum flow water temperature, to prevent freezing of the heating system water.

Additionally, if an external temperature sensor is connected the circulation pump will be started when the outside air temperature falls below an adjustable set point, thus providing two stage frost protection.

1.3.9 Pump Overrun - A circulation pump overrun timer function is included to make use of the residual boiler heat when the heating is switched off at the end of an Active period, or when the desired room temperature is achieved (Optimiser function only).

1.3.10 Holiday Override - This function overrides the timeclock during the selected holiday periods, preventing the heating system from operating. Up to

5 holiday periods can be programmed.

Additionally, a manual Holiday override function is provided for simple switching between holiday and normal operating modes via the Marshall HE keypad.

1.3.11 Remote Holiday Override Facility - A remote switch can also be connected to the Marshall HE which when closed will put the control into a holiday shutdown mode. Normal operation continues when

the switch is opened.

1.3.12 Safety Interlock Circuit - This function allows the connection of external system safety devices, such as flue exhaust fan proving switch, pressurisation unit safety circuit, etc, to the Marshall HE System. If the circuit is broken by any of the safety devices the Marshall HE controller prevents the boilers from firing.

Fig 1 - Technical Data Table

ELECTRICAL DATA	
Supply Voltage	~230V 50 Hz
Power Consumption	12W max.
Control Relay Rating	~250V, 3A resistive
GENERAL DATA	
Dimensions	199 x 62 x 290mm
Weight	1.6 kg
Data Memory and Timeclock Battery Back-up	10 years minimum at 25°C
SENSOR DATA	
Sensors	Use Marshall HE sensors only
Sensor Connection Cable	Shielded 2 core (Beldon 8451)
Maximum Sensor Cable Run	500m

1.3.13 Service Function - This function switches all of the boiler steps and also the circulation pump to 'on', for the purposes of boiler commissioning and servicing.

Note! The boiler thermostats **MUST** be adjusted to a safe control temperature, if this function is utilised.

2.0 TECHNICAL DATA

2.1 Technical data information is shown in Figure 1/ Above.

2.2 Overall dimensions are shown for in Figure 2/ Page 19.

3.0 DESCRIPTION OF OPERATION

Figure 3/Page 20 shows the schematic layout of a typical Marshall HE installation.

3.1 Basic Operation (Compensation and Optimiser Functions Not Utilised)

3.1.1 When the internal (or external) timeclock calls for the heating system to operate the controller changes from 'Standby' (off) to 'Active' mode. This is indicated on the controller's 'system information' screen (refer to section 1.0: Run Mode Display

Screens, of the Marshall HE Users Operating Instructions - HHL No. 500001066). The heating circulation pump is started and the lead boiler is switched on (at low fire if the boiler has high/low controls). This is indicated on the controller's 'system information' screen by a large flame symbol (small flame symbol if the boiler starts at low fire).

3.1.2 The boilers sequence on at intervals determined by the 'boiler on delay' setting (see Section 5.2.3 step 47). The firing of the boilers is indicated on the controller's 'system information' screen. If the weekly shift function is utilised, the lead boiler is shifted every 7 days. Figure 4/Below shows the firing sequence for a six boiler application. In this example the first two boilers could be high/low controlled, in this case the controller treats the high and low steps as a pair when determining which is the lead step, ensuring correct sequencing.

3.1.3 When the required fixed flow temperature is achieved the boilers are sequenced off at intervals determined by the 'boiler off delay' setting (see Section 5.2.3 step 49). The boilers then sequence on and off to maintain the required flow temperature.

3.1.4 At the end of the 'Active' period, as determined by the internal or external timeclock, all of the boilers

Fig 2 – Boiler Firing Sequence

	Lead	2	3	4	5	6
Week 1	Blr 1	Blr 2	Blr 3	Blr 4	Blr 5	Blr 6
Week 2	Blr 2	Blr 3	Blr 4	Blr 5	Blr 6	Blr 1
Week 3	Blr 3	Blr 4	Blr 5	Blr 6	Blr 1	Blr 2
Week 4	Blr 4	Blr 5	Blr 6	Blr 1	Blr 2	Blr 3
Week 5	Blr 5	Blr 6	Blr 1	Blr 2	Blr 3	Blr 4
Week 6	Blr 6	Blr 1	Blr 2	Blr 3	Blr 4	Blr 5

are switched off. The circulation pump overrun function operates, allowing the pump to continue running for a period determined by the 'pump overrun time' setting (see Section 5.2.3 step 45). A countdown time is displayed on the controller 'system information' screen, when this reaches zero the circulation pump is switched off.

3.2 Outside Air Compensation Function Operation

With the compensation function utilised the controller also continuously monitors the outside air temperature by interrogating the external temperature sensor. The controller automatically adjusts the water flow temperature set point in relation to the outside air temperature, between the maximum and minimum flow temperature settings (user adjustable, see Section 5.2.3 steps 41 to 44). The relationship between the outside air temperature and the water temperature set point is determined by the 'flow temperature slope' and 'flow temperature offset' settings (see Section 5.2.3 steps 37 to 40). Figure 11/ Page 27 shows the compensation function outside air temperature to water flow temperature relationship.

3.3 Optimiser Function Operation

3.3.1 The optimiser function provides two room temperature comfort level settings - 'Active' and 'Standby' (night setback temperature). Refer to Section 3:Program Mode Functions, of the Marshall HE Users Operating Instructions (H.H.L. Pt. No. 500001066) for setting information.

Whilst in Standby mode, if the room temperature, as measured by the room temperature sensor, falls below the Standby temperature setting the heating system operates as described in Section 3.1:Basic Operation. When the required Standby temperature is achieved the boilers are shut down and the pump overrun function operates.

3.3.2 When the optimiser function is utilised the internal timeclock settings become the times at which the building is to reach the required Active temperature, rather than the times at which the

heating is switched on.

At a set time before the Active period start time (determined by the 'maximum preheat time' setting, see Section 5.2.3 step 29) the controller notes the current room temperature. Based on this and the required Active temperature setting, the controller determines when to start the heating system such that the Active temperature is just reached at the start of the Active period.

The heating start time is determined by the 'rate of change' setting (see Section 5.2.3 step 31) which allows a time (in minutes) per °C of required temperature rise.

Example:

Maximum preheat time setting = 3 hours
 Active period start time = 8.00 am
 Rate of change setting = 20 mins/°C
 Active temperature setting = 21°C
 Current room temperature (ie at 5.00 am) = 15°C

Required temperature rise = 21-15=6°C
 Preheat time = 6 x 20 = 120 mins = 2 hrs
 Heating start time = 6.00 am

If the calculated preheat time is equal to or greater than the 'maximum preheat time' setting the heating is started immediately.

3.3.3 Once started the heating system operates as described in Section 3.1:Basic Operation, until the Active temperature is achieved, when the boilers are shut down and the pump overrun function operates.

For the remainder of the Active period the Marshall HE system operates to maintain the room temperature at the Active temperature setting.

3.3.4 The optimiser self-learning function adjusts the 'rate of change' setting each day, dependent on whether the Active temperature was achieved by the Active period start time or not. If the Active temperature was achieved the 'rate of change' setting is reduced by 1 minute/°C, if not the setting is increased by 1 minute/°C. In this way the optimiser function tunes itself to each installation.

The self-learning function can be disabled, to maintain a constant 'rate of change' setting.

3.3.5 If an external timeclock is utilised the optimiser preheat function is disabled and the heating starts at the external timeclock settings. The Active and Standby room temperature control functions are retained.

3.4 Override Function Operation

Refer to section 2.0:Run Mode Functions of the Marshall HE User's Instructions for details of the operation of the override functions -

Override comfort level setting (optimiser only)
Override timeclock
Remote override switch (optional)
Holiday override
Remote holiday override switch (optional)

3.5 Summer Shutdown Function Operation

When the outside air temperature reaches an adjustable set point (see Section 5.2.3 step 23) the heating system is shut down and the system status reads 'SUMMER MODE' on the system information screen. When the outside air temperature falls below the set point the heating system automatically restarts and resumes normal operation.

3.6 Frost Protection Function Operation

If the outside air temperature falls below the 'two stage frost protection' setting (see Section 5.2.3 step 35) the circulation pump is started in order to prevent the freezing of remote sections of the heating system pipework. When the outside air temperature rises above this setting the pump overrun function will operate and the pump will stop. This function will only operate if an external temperature sensor is fitted.

If the water flow temperature falls below the 'flow frost protection' setting (see Section 5.2.3 step 33) the heating system is operated to raise the water temperature above the 'flow frost protection' temperature setting. When this is achieved the boilers are shutdown and the pump overrun function operates.

3.7 Safety Interlock Circuit Operation

If any of the devices connected to the safety interlock circuit break the circuit, the boilers are immediately shutdown and prevented from firing until the fault condition is removed. The safety interlock circuit automatically resets itself and allows the boilers to fire. When the safety circuit operates the legend 'LOCKED' is displayed on the controller's 'system information' screen.

4.0 INSTALLATION

4.1 Controller Location

The controller is designed for direct wall mounting. It should be positioned at a point of easy access at an approximate height of 1.5m.

4 off mounting holes are provided in the rear of the control's enclosure (refer to Figure 2/Page 19 for hole positions).

To mount the enclosure remove the clips on the front left and right sides of the enclosure by inserting a small flat bladed screwdriver into the slot and twisting. Unscrew and retain the four screws exposed. The front half of the enclosure can then be

lifted off, carefully disconnect the ribbon cable connecting the keypad and display pcb's to the main control pcb, from the socket on the main control pcb, taking note of the orientation of the connector. Place the front half of the enclosure and the gland plate aside.

The rear half of the enclosure can then be fixed in position using suitable fixings for the type of construction of the wall to which it is to be mounted.

Prepare the gland plate by drilling suitably sized holes to suit the required cable glands and/or conduit connectors for the cable connections, using a suitable cone or tank cutter.

4.2 Electrical Connections

All wiring to the Marshall HE controller must be in accordance with the IEE Regulations, and any local regulations which apply.

NOTE! IF IN ANY DOUBT CONSULT A QUALIFIED ELECTRICIAN.

The site wiring connection terminals are shown in Figure 5/Page 21.

4.2.1 Electrical Supply

The electrical mains connection must be via a double pole, fused isolator with a contact separation of at least 3mm in all poles, positioned adjacent to the controller.

Note! The supply to the controller must not be interrupted by any other controls, such as external timeclocks or building management systems.

4.2.2 Boiler Control Connections

All Hamworthy Heating Limited boilers are fitted with remote on/off (and high/low where applicable) control connection terminals. Refer to the individual boiler's Installation, Commissioning and Maintenance Manual for the correct wiring connections.

As a convention it is recommended that the left hand boiler be connected as the number one boiler.

If a combination of on/off and high/low control boilers are to be connected, the high/low boiler(s) must be connected first in the sequence. Refer to Figure 6/Page 22

for example boiler control connection schemes.

4.2.3 Circulation Pump

The circulation pump must be connected to the electrical supply via a fused isolator with a minimum contact separation of 3 mm in all poles.

The Marshall HE circulation pump control relay is used to control the circulation pump contactor. A Hand/Off/Auto switch should also be incorporated into this control circuit. Refer to Figure 5/Page 21 for details.

4.3 Control Inputs Connections

4.3.1 Safety Interlock Circuit

This circuit operates at safety extra low voltage and MUST only be connected to volt free switching devices.

Connect all of the required safety devices in series (see Figure 5/Page 21) between terminals '+' and 7 of the 'inputs' terminal rail.

Note! If no safety devices are to be connected these two terminals must be linked to allow correct operation of the controller.

A minimum cable size of 0.75 mm² is recommended for this circuit. Refer to the IEE Regulations for the correct cable specification.

4.3.2 External Timeclock (Optional)

This circuit operates at safety extra low voltage and MUST only be connected to a volt free switching timeclock.

Connect the timeclock to terminals '+' and 1 of the 'inputs' terminal rail (see Figure 5/Page 21). A minimum cable size of 0.75 mm² is recommended for this circuit.

Refer to the IEE Regulations for the correct cable specification.

4.3.3 Remote Override Switch (Optional)

The remote override feature is not available when an external timeclock is connected to the Marshall HE system.

This switch is connected across terminals '+' and 1 of the 'inputs' terminal rail (see Figure 5/Page 21). A minimum cable size of 0.75mm² is recommended for this circuit.

Refer to the IEE Regulations for the correct cable specification.

Note! This circuit operates at safety extra low voltage, mains voltages MUST NOT be fed onto these terminals.

4.3.4 Remote Holiday Override Switch (Optional)

This switch is connected across terminals '+' and 8 of the 'inputs' terminal rail (see Figure 5/Page 21). A minimum cable size of 0.75mm² is recommended for this circuit.

Refer to the IEE Regulations for the correct cable specification.

Note! This circuit operates at safety extra low voltage, mains voltages MUST NOT be fed onto these terminals.

4.4 Temperature Sensors

4.4.1 General

The temperature sensors are wired using 2 core,

screened cable (Beldon 8451 specification), HHL Part No. 533901259).

PVC cable sleeving should be used to insulate the shield conductor to prevent the possibility of it contacting the other conductors or any of the sensor or controller pcb components.

The flow and external sensor housings incorporate a cable inlet threaded to accept a 20 mm cable gland or conduit connector. When fitted with such a connector the external sensor is IP65 rated.

It is strongly recommended that the sensor cables are routed separately from mains power cables.

4.4.2 Water Flow Temperature Sensor

The standard flow sensor is an insertion type consisting of a brass probe mounted to a plastic housing. The sensor is supplied with a brass pocket with a ½" BSP parallel thread (see Figure 7/Page 23).

The sensor must be installed at the outlet of the flow header from the boiler system. There must be no connections taken from the flow header between the boilers and the sensor position.

Fit the sensor pocket to a ½" BSP socket welded to the flow header, allowing an insertion depth to the centre line of the pipe (see Figure 7/Page 23). Alternatively, the sensor can be installed at a pipe bend as shown in Figure 7/Page 23.

Insert the sensor probe into the pocket and fix in place with the locking screw on the side of the pocket.

An optional 'strap on' type sensor is available as an alternative to the standard sensor. If this sensor is utilised it must be firmly fixed to the flow header pipe with the strap and hooks supplied (See Figure 8/Page 24), to ensure a good contact between the surface of the pipe and the sensor.

When fitted, wire the sensor as shown in Figure 5/Page 21 and replace the sensor housing cover.

4.4.3 External Temperature Sensor

The optional external sensor should be mounted on an outside, north facing wall, away from any air vents, pipes, illuminated signs or any other device that could affect the ambient temperature of the outside air.

The sensor can be fixed to the wall utilising the mounting holes in its plastic housing, or held in place by the cable conduit (see Figure 9/Page 25).

Note! Ensure that a suitable cable gland or conduit connector is utilised to provide the required sealing of the sensor housing.

When fitted, wire the sensor as shown in Figure 5/Page 21 and replace the sensor housing cover.

4.4.4 Room Temperature Sensor

The optional room sensor should be mounted on an internal wall at a point where it will not be subject to draughts from outside and also where it will not be exposed to direct sunlight, in order to ensure that the sensor reading is representative of the actual ambient room temperature.

The sensor should be mounted at a height of approximately 1.5 m above floor level. It can be mounted directly to the wall or be mounted to a standard flush mounting switchbox. Refer to Figure 10/Page 26).

Note! When mounting directly to the wall countersunk screws should be used.

When fitted, wire the sensor as shown in Figure 5/Page 21, and replace the sensor housing cover.

4.5 Completion

When all of the required connections have been made replace the front half of the controller enclosure by carefully reconnecting the ribbon cable to the connector on main pcb ensuring correct alignment of the pins. Fix the front half of the enclosure with the four screws and replace the four clips.

5.0 COMMISSIONING

5.1 Pre-Commissioning Checks

5.1.1 Carry out the electrical and gas installation and water circulation system checks as detailed in the commissioning section of the boilers' Installation, Commissioning and Maintenance Manuals.

5.1.2 Ensure that the electrical supplies to the Marshall HE controller, the boilers and the circulation pump are isolated.

Remove the front cover of the controller enclosure as described in Section 4.1. Remove the door panels from the boilers and obtain access to the control terminals.

Check that the electrical supply connections to the controller, the boiler control connections and the circulation pump control connections are correct as described in Section 4:Installation.

Note! Wiring MUST be checked by a suitably competent person.

5.1.3 Check the external timeclock, remote override switch, remote holiday override switch and safety interlock circuit connections (as applicable).

5.1.4 Check the sensor wiring connections for polarity (see Figure 5/Page 21) and check that the shield conductor of the cable is not in contact with any of the sensor or controller pcb components.

Replace the sensor housing covers after these checks.

5.1.5 Replace the front cover of the controller enclosure as detailed in Section 4.5.

Ensure that the boilers are switched off (where applicable) or isolated. Switch on the electrical supplies to the Marshall HE controller and the circulation pump. The controller will start normal operation and the pump may run dependent on the settings of the controller.

Put the controller into service mode by pressing the 'PROG' key, the legend 'A SECURITY CODE IS REQUIRED TO PROGRAM THIS UNIT. Please enter the code : ' will be displayed. Press the 'OVERRIDE' key four times, four asterisks will appear on the display, then press the 'ENTER' key. All of the boiler steps and the circulation pump will switch on and the 'system information' screen will display the legend 'SERVICE MODE'.

The boilers can now be commissioned as detailed in their Installation, Commissioning and Maintenance Manuals.

5.1.6 When the boilers have been commissioned, ensure that they are switched off or isolated and then set the boiler control and high/low (if applicable) thermostats to 100°C, so that they do not affect control of the boilers. Replace the boiler front door panels.



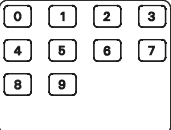



5.1.7 When the boilers have been commissioned return the Marshall HE controller to run mode by pressing the 'PROG' key, the legend 'A SECURITY CODE IS REQUIRED TO PROGRAM THIS UNIT. Please enter the code : ' will be displayed. Press the 'OVERRIDE' key four times, four asterisks will appear on the display, then press the 'ENTER' key.

5.1.8 The Marshall HE system can now be programmed.

5.2 Programming

5.2.1 General

Most of the settings are entered using the numerical keypad. If a mistake is made it can be corrected by pressing the 'DEL' key and retyping the number before pressing the 'ENTER' key to enter the new setting value. Nearly all of the settings are two digit numbers. When entering a value less than 10 the first digit MUST be entered as a zero, an invalid setting will not be accepted by the control.

Key	Display	
5.2.2 Enter Program Mode		
1) To enter program mode press the PROG key and the code entry screen will be displayed.		
		
2) Enter the four digit code using the numerical keypad. The code entered is not displayed, asterisks are used to represent each digit of the code. Note! The engineers code is factory preset and is written on a label attached to the controller fascia. Remove and dispose of this label after commissioning the system.		
		
3) To enter the code press the ENTER key. If the code entered is incorrect an error message is displayed and the unit will return to Run mode.		
		

5.2.3 Setup Option

1) To input the Setup option settings press the '1' key. The 'number 1 sensor calibration' setting screen is displayed.

1



```
Enter calibration setting Number 1 <10>
THE SENSOR IS NOW READING      :18 C
```

2) To calibrate sensor 1 - the room sensor (if installed), a calibrated digital thermometer with an air temperature probe is required. Take a temperature reading at the installed room sensor position, eg 21°C. Note the Marshall HE sensor reading, eg 18°C. In this example the sensor is reading 3°C too low. The sensor calibration setting works in ½°C steps, therefore in this example the setting must be increased by 6 to correct the sensor reading. Use the up/down cursor keys to adjust the calibration setting. The sensor reading will slowly adjust to the required temperature. If necessary readjust the calibration setting up or down by increments of 1 until the sensor reading is correct.



```
Enter calibration setting Number 1 <16>
THE SENSOR IS NOW READING      :21 C
```

3) Press ENTER to enter the new setting. The 'number 2 sensor calibration' setting screen is displayed.

ENTER



```
Enter calibration setting Number 2 <10>
THE SENSOR IS NOW READING      :14 C
```

4) Sensor 2 - the flow sensor, is calibrated using the same procedure used to calibrate the room sensor. Use a calibrated digital thermometer with a surface temperature probe to obtain a water flow temperature reading.



```
Enter calibration setting Number 2 <14>
THE SENSOR IS NOW READING      :16 C
```

5) Press the ENTER key to enter the new setting. The 'number 8 sensor calibration' setting screen is displayed.

ENTER



```
Enter calibration setting Number 8 <10>
THE SENSOR IS NOW READING      :20 C
```

6) Sensor 8 - the external sensor (if installed), is calibrated using the same procedure used to calibrate the room sensor.



```
Enter calibration setting Number 8 <06>
THE SENSOR IS NOW READING      :18 C
```

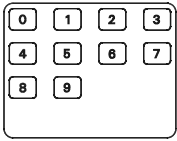
7) Press the ENTER key to enter the new setting and display the 'maximum override' setting screen.

ENTER



```
Enter the MAXIMUM OVERRIDE you want from
the override button. (00=disabled):00
```

8) Use the numerical keypad to set the maximum override time, in hours. This is the maximum duration that the user can override the internal timeclock. (See also section 2.4:Override Timeclock, in the Marshall HE Users Operating Instructions).



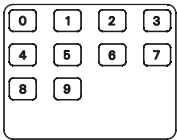
Enter the MAXIMUM OVERRIDE you want from the override button. (00=disabled):08

9) Press the ENTER key to enter the new setting and display the 'upper temperature offset' setting screen.



Enter the temperature offset upper limit you want from the 'UP' button. :02

10) Use the numerical keypad to set the upper temperature offset limit, in °C. This is the maximum amount by which the user can increase the room comfort level setting. (See also section 2.3:Override Comfort Level Setting in the Marshall HE Users Operating Instructions).



Enter the temperature offset upper limit you want from the 'UP' button. :04

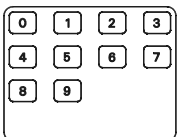
11) Press the ENTER key to enter the new setting and display the 'lower temperature offset' setting screen.



Enter the temperature offset lower limit you want from the 'DOWN' button. :04

12) Use the numerical keypad to set the lower temperature offset limit, in °C. This is the maximum amount by which the user can decrease the room comfort level setting.

Note! If a room sensor is not installed this setting can be ignored.



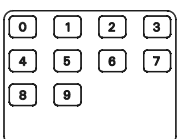
Enter the temperature offset lower limit you want from the 'DOWN' button. :05

13) Press the ENTER key to enter the new setting and display the 'internal/external clock' setting screen.



Enter the Boiler clock source
<00>Internal <01>External :00

14) Use the numerical keypad to select '00' for the Marshall HE internal timeclock, or '01' if an external timeclock is to be used.



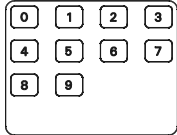
Enter the Boiler clock source
<00>Internal <01>External :00

15) Press the ENTER key to enter the new setting and display the 'number of boilers' setting screen.



```
Please enter the number of BOILERS
On the system ( 2 - 8 )           :08
```

16) Use the numerical keypad to enter the correct number of boilers in the system.



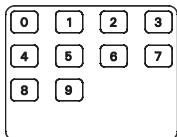
```
Please enter the number of BOILERS
On the system ( 2 - 8 )           :05
```



```
Enter the number of HIGH/LOW BOILERS
on the system ( 0 - 3 )           :00
```

18) Use the numerical keypad to enter the number of high/low control boilers in the system. If the boilers are all on/off set this to zero. If the boilers are all high/low set this to its maximum setting, but note that if more than 4 high/low boilers are to be controlled they cannot all be high/low sequenced. If a combination of on/off and high/low boilers are installed enter the appropriate high/low figure, but note that the high/low boilers must be first in the firing sequence.

Note! The Marshall HE controller will only permit entry of a combination of the 'number of boilers' and 'number of



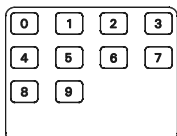
```
Enter the number of HIGH/LOW BOILERS
on the system ( 0 - 3 )           :03
```

19) Press the ENTER key to enter the new setting. The 'fixed or variable flow' setting screen is displayed.



```
Enter the Type of sequencer required
<04>Fixed flow <05>Variable flow:04
```

20) Use the numerical keypad to enter '04' for a fixed water flow temperature control setting or '05' for a variable (compensated) water flow temperature control setting (**Note!** Requires external sensor).



```
Enter the Type of sequencer required
<04>Fixed flow <05>Variable flow:05
```

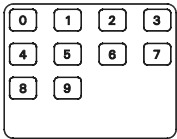
21) Press the ENTER key to enter the new setting and display the 'holiday function' setting screen.



```
HOLIDAY FUNCTION. <03>NONE <02>EXTERNAL
<01>INTERNAL <00>INT. & EXT. :00
```

22) Use the numerical keypad to select '00' to enable both internally generated holiday periods (programmed in User's setup, refer to section 3.5 of the Marshall HE User's Operating Instructions, H.H.L. Pt. No. 50001066) and externally generated holiday periods (via the 'inputs' terminals, refer to section 4.3.5), '01' to enable internal only, '02' to enable external only, or '03' to disable both internal and external.

Note! This setting does not affect the operation of the manual holiday override function, which is described in section ? Of the Marshall HE User's Operating Instructions.



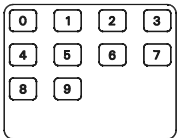
HOLIDAY FUNCTION. <03>NONE <02>EXTERNAL
<01>INTERNAL <00>INT. & EXT. :01

23) Press the ENTER key to enter the new setting and display the 'summer shutdown' setting screen.



Enter the External temperature that
you want the heating off at. :00

24) Use the numerical keypad to enter the outside air temperature in °C at which the heating system is to shut down. A setting of '00' will disable this function.



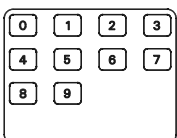
Enter the External temperature that
you want the heating off at. :22

25) Press the ENTER key to enter the new setting and display the 'optimiser' setting screen.



Select <00>Optimizer(Self Learning)
<01>Timer <02>Optimizer(fixed) :00

26) Use the numerical keypad to select '00' to enable the optimiser with self learning function, '01' to disable the optimiser, or '02' to enable the optimiser without the self learning function.



Select <00>Optimizer(Self Learning)
<01>Timer <02>Optimizer(fixed) :00

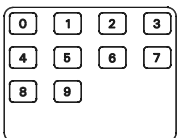
27) Press the ENTER key to enter the new setting and display the 'fixed flow temperature' setting screen.

Note! If variable (compensated) flow temperature control is selected in step 20) this screen is not displayed. See step 29).



Enter the FIXED FLOW temperature for
the BOILER SEQUENCER (e.g. 75) :95

28) Use the numerical keypad to enter the required fixed flow temperature set point in °C.



Enter the FIXED FLOW temperature for
the BOILER SEQUENCER (e.g. 75) :82

29) Press the ENTER key to enter the new setting and display the 'maximum preheat' setting screen.

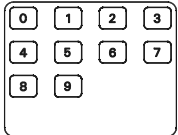
Note! If the 'optimiser' setting is set to '01' (Timer), this screen is not displayed. See step 33).



Enter the MAXIMUM PREHEAT HOURS you want
for the optimiser (e.g. 03 Hours):03

30) Use the numerical keypad to enter the optimiser maximum preheat time, in hours. This setting determines the earliest time at which the heating can start. The maximum setting is 6 hours.

Note! If an external timeclock is used this screen can be ignored.



Enter the MAXIMUM PREHEAT HOURS you want
for the optimiser (e.g. 03 Hours):04

31) Press the ENTER key to enter the new setting and display the 'rate of change' setting screen.

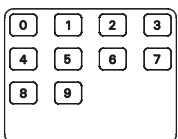
Note! If the 'optimiser' setting is set to '01' (Timer), this screen is not displayed. See step 33).



Enter the RATE OF CHANGE setting for the
optimiser (00 = No Optimizing) :00

32) Use the numerical keypad to enter the optimiser rate of change ratio in minutes/°C. This setting is used to determine the heating start time (see Section 3.3: Optimiser Function Operation). The higher the setting the earlier the heating will start. If the self learning option is utilised a setting of '20' is recommended as the Marshall HE will 'learn' the optimum value. The maximum setting is 46 minutes/°C.

Note! If an external time clock is used this screen can be ignored.



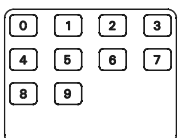
Enter the RATE OF CHANGE setting for the
optimiser (00 = No Optimizing) :20

33) Press the ENTER key to enter the new setting and display the 'flow frost protection' setting screen.



Enter the flow frost protection setting
required. (e.g. 08 C) :04

34) Use the numerical keypad to enter the frost protection temperature, in °C. This is the minimum water temperature to prevent freezing.



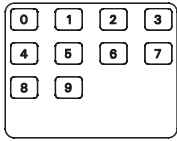
Enter the flow frost protection setting
required. (e.g. 08 C) :08

35) Press the ENTER key to enter the new setting and display the 'two stage frost protection' setting screen.



Enter Temperature for Two Stage Frost
Protection (e.g. 02' C) :00

36) Use the numerical keypad to enter the outside air temperature, in °C, at which the circulation pump is started, in order to prevent remote sections of the system pipework from freezing.



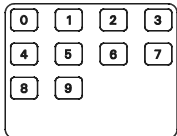
Enter Temperature for Two Stage Frost Protection (e.g. 02° C) :02

37) Press the ENTER key to enter the new setting and display the 'compensation offset' setting screen.
Note! If fixed flow temperature control is selected in step 20) This screen is not displayed. See step 45).



Enter the COMPENSATION OFFSET NUMBER (10 = NORMAL) :00

38) Use the numerical keypad to set the flow temperature compensation slope offset. Figure 11/Page 27 shows the effect of the offset setting on the compensation slope. Each increase of '1' of this setting will reduce the compensated flow temperature by 1°C.



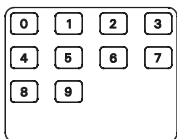
Enter the COMPENSATION OFFSET NUMBER (10 = NORMAL) :10

39) Press the ENTER key to enter the new setting and the 'compensation slope factor' setting screen is displayed.



Enter the COMPENSATION SLOPE FACTOR (03 = NORMAL) :01

40) Use the numerical keypad to set the flow temperature compensation slope. Figure 11/Page 27 shows the relationship between outside air temperature and water flow temperature set point for the different settings. A setting of '01' selects a slope of 1 to 1, a setting of '02' selects a slope of 2 to 1 and so on.



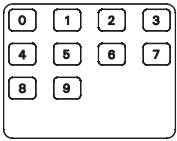
Enter the COMPENSATION SLOPE FACTOR (03 = NORMAL) :03

41) Press the ENTER key to enter the new setting and display the 'minimum flow temperature' setting screen.
Note! If fixed flow temperature control is selected in step 20) This screen is not displayed. See step 45).



Enter the MINIMUM FLOW temperature for the boiler :00

42) Use the numerical keypad to enter the minimum water flow temperature set point, in °C. When non-condensing boilers are installed the return water temperature should not be below 50°C, therefore set the minimum flow water temperature accordingly. However, when condensing boilers are installed this setting can be set lower to allow them to condense.



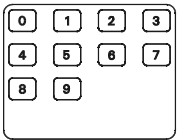
Enter the MINIMUM FLOW temperature
for the boiler :62

43) Press the ENTER key to enter the new setting and display the 'maximum flow temperature' setting screen.
Note! If fixed flow temperature control is selected in step 20) This screen is not displayed. See step 45).



Enter the MAXIMUM FLOW temperature
for the boiler :95

44) Use the numerical keypad to enter the maximum water flow temperature, in °C.



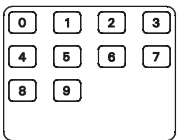
Enter the MAXIMUM FLOW temperature
for the boiler :82

45) Press the ENTER key to enter the new setting and display the 'pump overrun' setting screen.



Enter the PUMP OVERRUN TIME required
:10

46) Use the numerical keypad to enter the circulation pump run on time, in minutes. A minimum of 20 minutes is



Enter the PUMP OVERRUN TIME required
:20

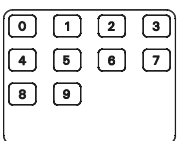
47) Press the ENTER key to enter the new setting and display the 'boiler on delay' setting screen.



Enter the BOILER ON TIME DELAY required
for the boiler sequencer :10

48) Use the numerical keypad to enter the boiler on delay time. (Each 1 of the setting represents 15 seconds, thus a setting of '04' will give a delay of 60 seconds). This setting is the time delay between each step sequencing on. An initial setting of '16' (4 minutes) is recommended.

Note! The setting can be readjusted at a later time when the response of the system has been observed.



Enter the BOILER ON TIME DELAY required
for the boiler sequencer :16

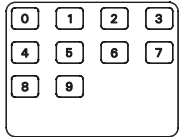
49) Press the ENTER key to enter the new setting and display the 'boiler off delay' setting screen.



Enter the BOILER OFF TIME DELAY required
for the boiler sequencer :10

50) Use the numerical keypad to enter the boiler off delay time. (Each 1 of the setting represents 15 seconds, thus a setting of '04' will give a delay of 60 seconds). This is the time delay between each step sequencing off when the required flow temperature is achieved. An initial setting of '04' (1 minute) is recommended.

Note! The setting can be readjusted at a later time when the response of the system has been observed.



Enter the BOILER OFF TIME DELAY required
for the boiler sequencer :04

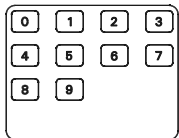
51) Press the ENTER key to enter the new setting and display the 'sequence' setting screen.



Do you want the lead boiler to shift
once a week<01> or be fixed<00> :01

52) Use the numerical keypad to select '01' for the weekly lead boiler shift, or '00' for the fixed boiler sequence.

Note! If a combination of high/low and on/off boilers are installed, it is desirable that the high/low boilers are always first in the sequence, therefore select '00' for the fixed sequence.



Do you want the lead boiler to shift
once a week<01> or be fixed<00> :00

53) Press the ENTER key to enter the new setting and return to the Engineer's Setup Menu screen.



1) SETUP 2) CODE
Press <1-2> for required option.

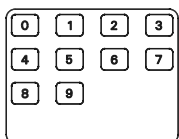
5.2.4 Code Option

1) To change the User setup code press the '2' key from the Engineer's Setup Menu screen. The 'user code' setting



The old 'USER' security code was :0000
PLEASE ENTER A NEW CODE (4 digits):

2) Enter the new user code, using the numerical keypad. The code entered is not displayed - an asterisk is used to represent each of the four digits as it is entered.



The old 'USER' security code was :0000
PLEASE ENTER A NEW CODE (4 digits):****

3) Press the ENTER key to enter the new code and return to the Engineer's Setup Menu screen.

ENTER



1) SETUP 2) CODE
Press <1-2> for required option.

5.2.5 End Programming

Press the RUN key from the Engineer's Setup Menu screen to return to Run mode, the Marshall HE unit will implement the setting changes and commence normal operation.

RUN



1 HEATING SYSTEM (20):21 STATUS ACTIVE
BLRS _____ FLOW (62):16 PUMP ON 20

5.3 Marshall HE Operation Checks

5.3.1 Switch on the electrical supplies to the boilers. Dependent on the system temperatures the boilers will fire and sequence off when the required flow temperature is achieved.

5.3.2 Observe the system as the boilers sequence on and off. If necessary adjust the 'boiler on delay' and 'boiler off delay settings as described in section 5.2.3 steps 47) to 50) to improve the response time and reduce flow temperature overshoot.

5.3.3 When the boilers are firing, check the operation of the safety interlock circuit (if utilised). When a fault condition is simulated, the boilers will be shut down and the legend 'LOCKED' will be displayed on the 'system information' screen (refer to Section 1.0: Run Mode Screens, of the Marshall HE Users Instructions). When the fault condition is removed the system will reset and the boilers will fire.

5.3.4 If an external time clock or remote override switch is utilised, check that the Marshall HE system responds correctly when it is switched on and off.

5.3.5 If a remote holiday override switch is utilised, check that the Marshall HE system responds correctly when it is switched on and off.

5.3.6 When these checks have been carried out, enter the settings into the Marshall HE Control Settings table in Figure 12/Page 28.

5.3.7 The Marshall HE system should now be demonstrated to the owner or their representative. The Marshall HE Users Operating Instructions should be presented and the setting procedure detailed therein should be carried out.

This Installers Guide and the Users Operating Instructions should then be handed over and be kept in a safe place for easy reference.

6.0 FAULT FINDING

General fault finding is shown in Figure 13/Pages 29/30. If the Marshall HE system still cannot be operated satisfactorily after following the chart, consult your local office of Hamworthy Heating for assistance.

Note! Before carrying out any work ensure that the boiler is electrically isolated.

IF IN ANY DOUBT CONSULT A QUALIFIED ELECTRICIAN.

7.0 SERVICING

7.1 The Marshall HE system requires no regular servicing. However, an annual check of the systems operation can be useful to highlight any possible problems.

7.2 To allow servicing of the boilers, use should be made of the Marshall HE service function.

Put the controller into service mode by pressing the 'PROG' key, the legend 'A SECURITY CODE IS REQUIRED TO PROGRAM THIS UNIT. Please enter the code : ' will be displayed. Press the 'OVERRIDE' key four times, four asterisks will appear on the display, then press the 'ENTER' key. All of the boiler steps and the circulation pump will switch on and the 'system information screen' will display the legend 'SERVICE MODE'.

When servicing is finished repeat the above procedure to return the Marshall HE controller to run mode.

Note! The boiler thermostats must be reset to a suitable temperature set point to prevent boiler overheating during this operation.

Figure 2—Overall Dimensions

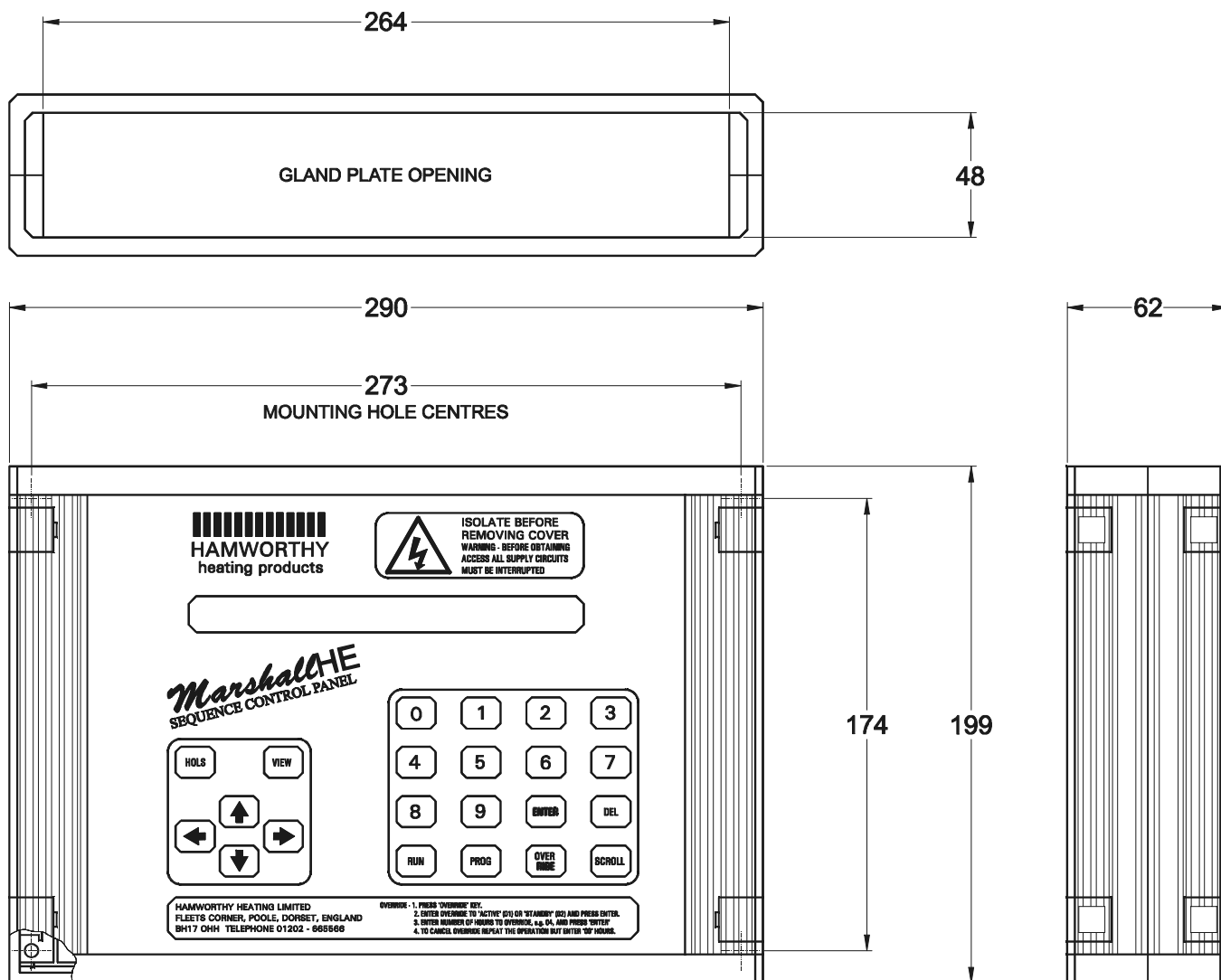


Figure 4 - Marshall HE System Schematic

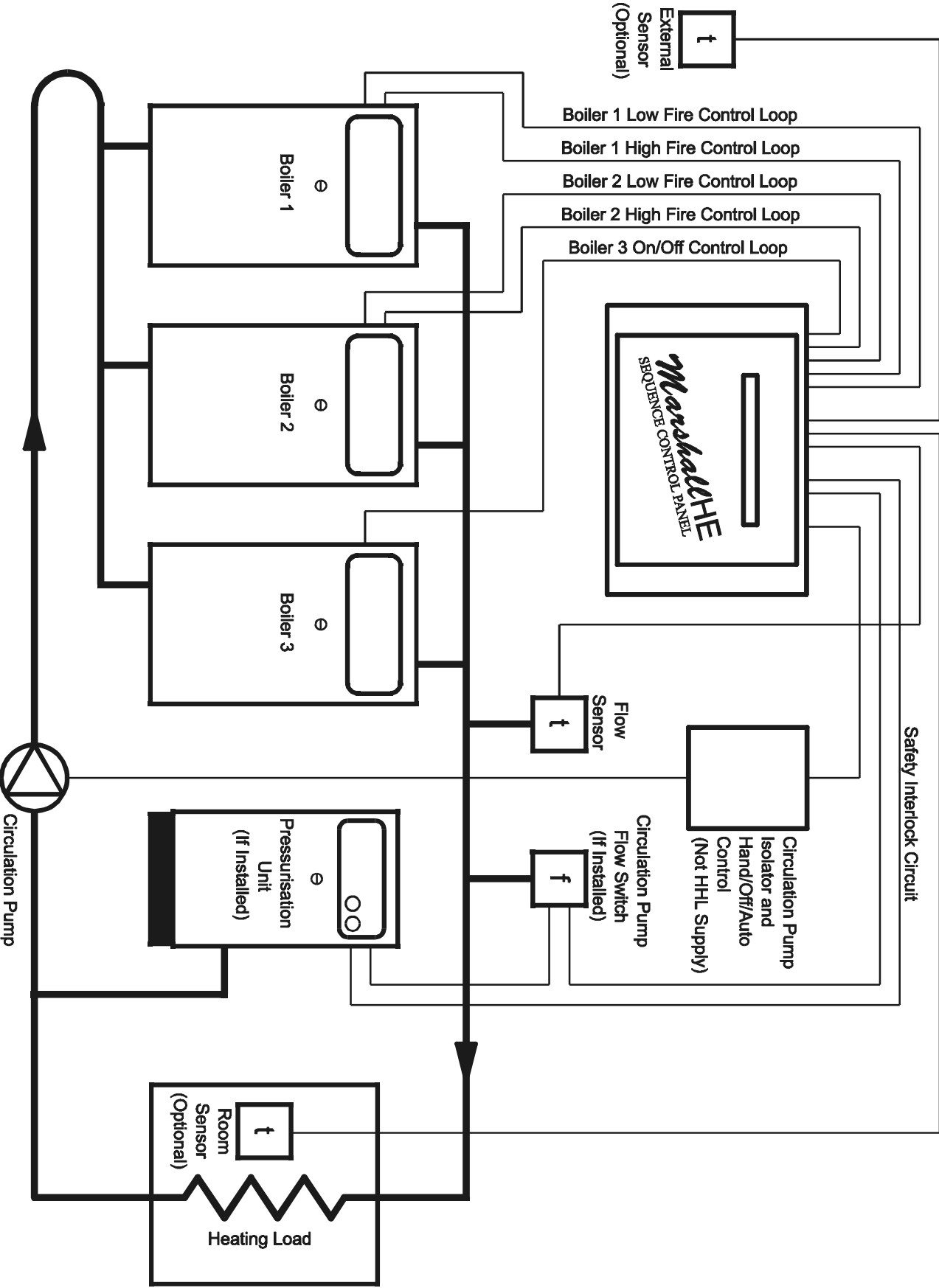


Figure 5 - Site Wiring Connection Details

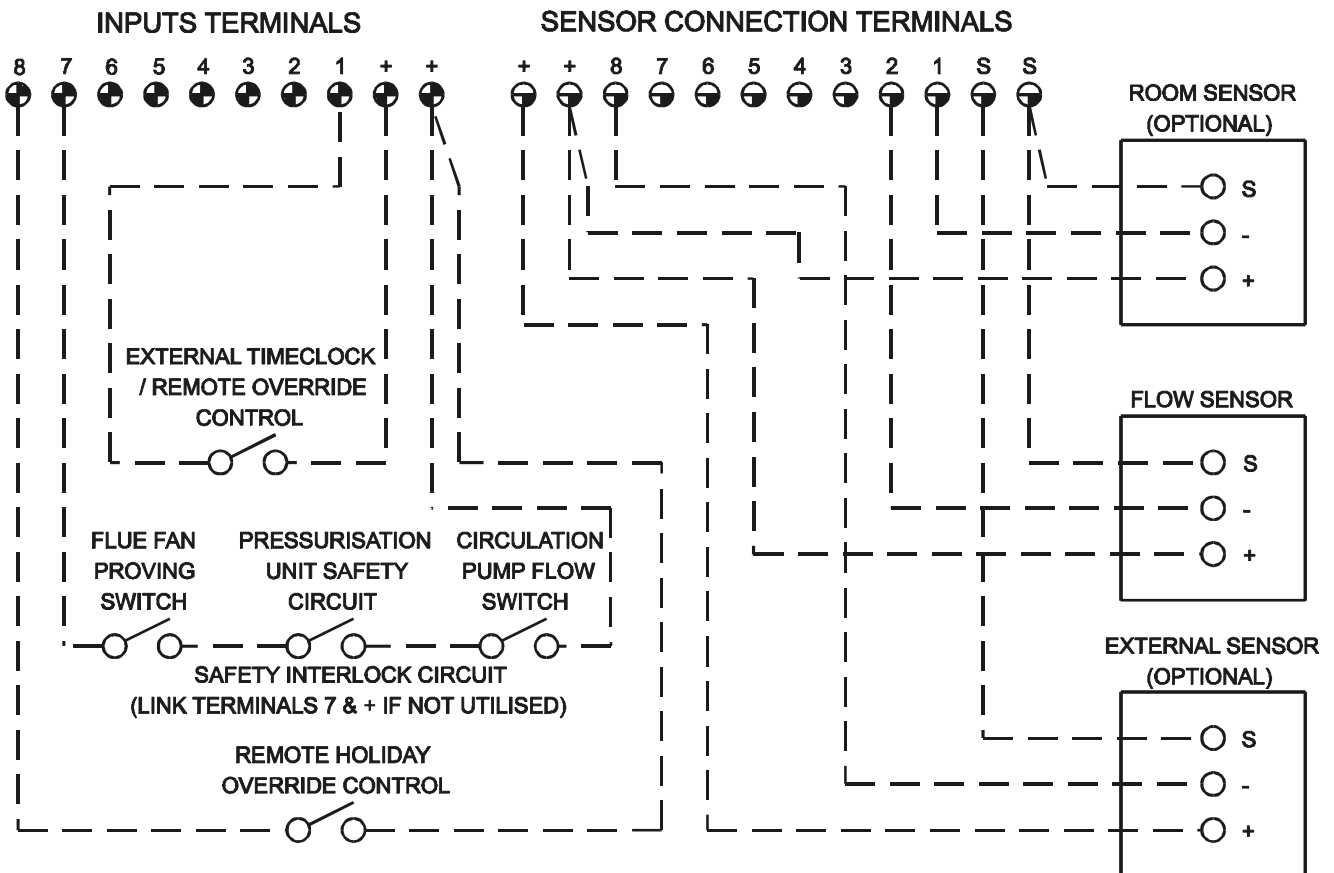
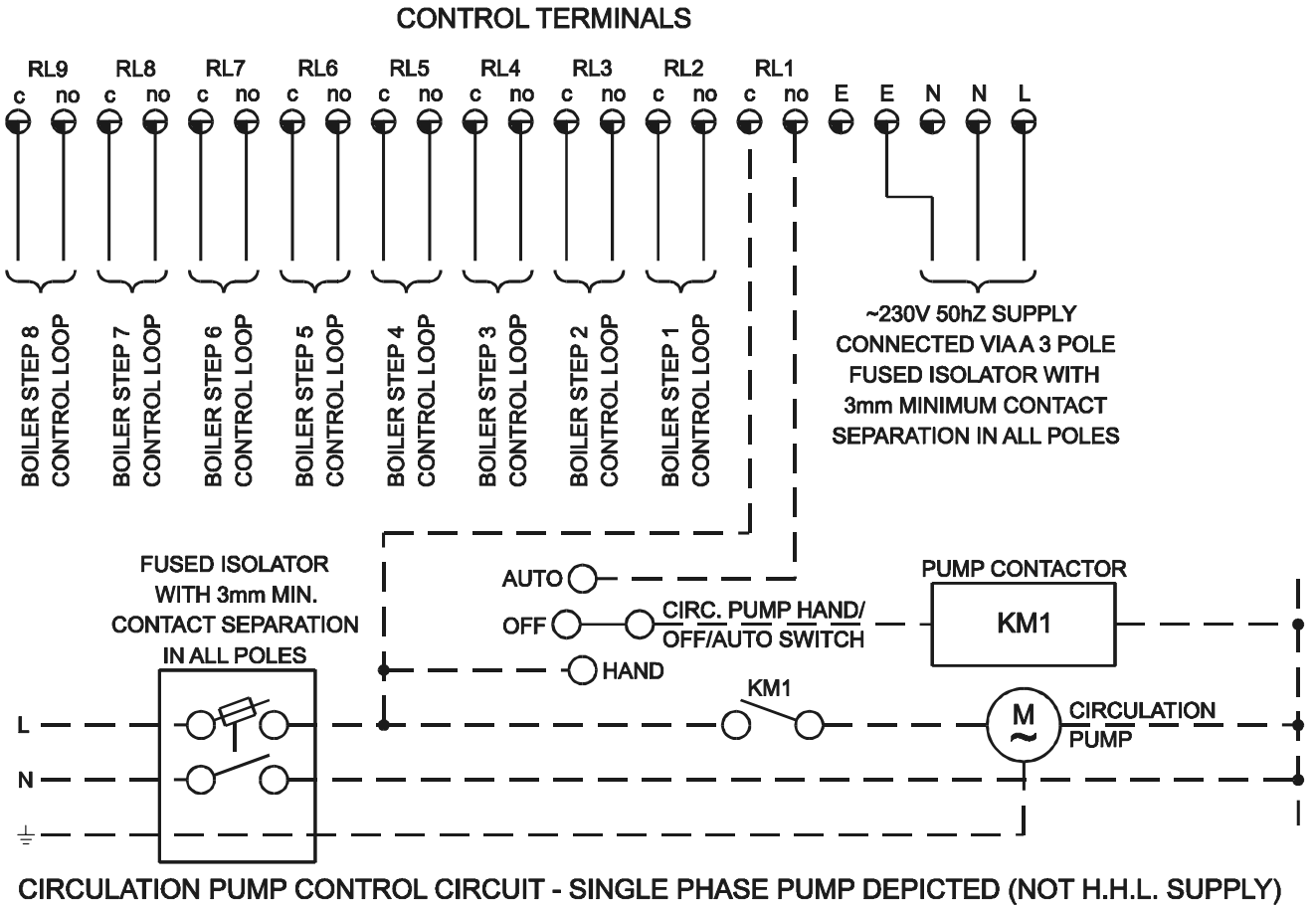
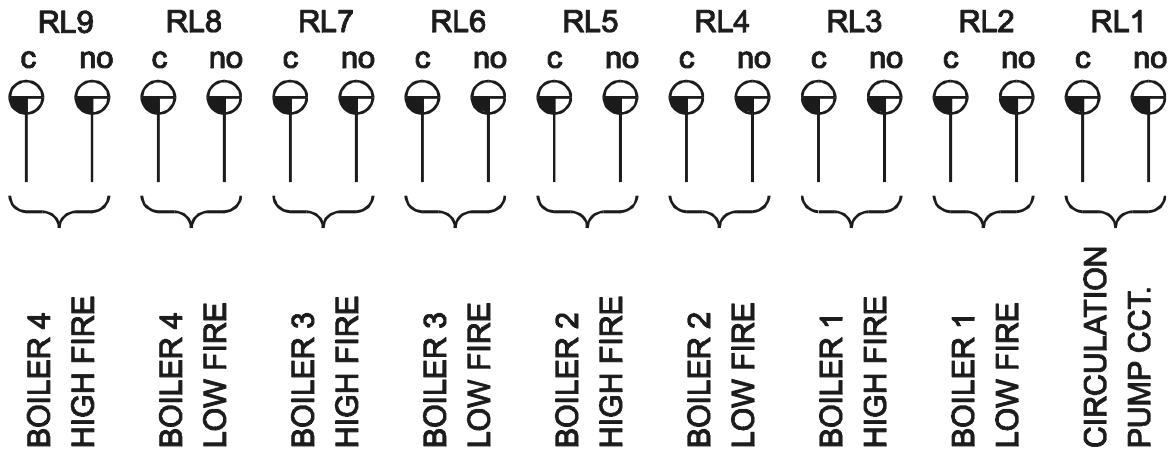
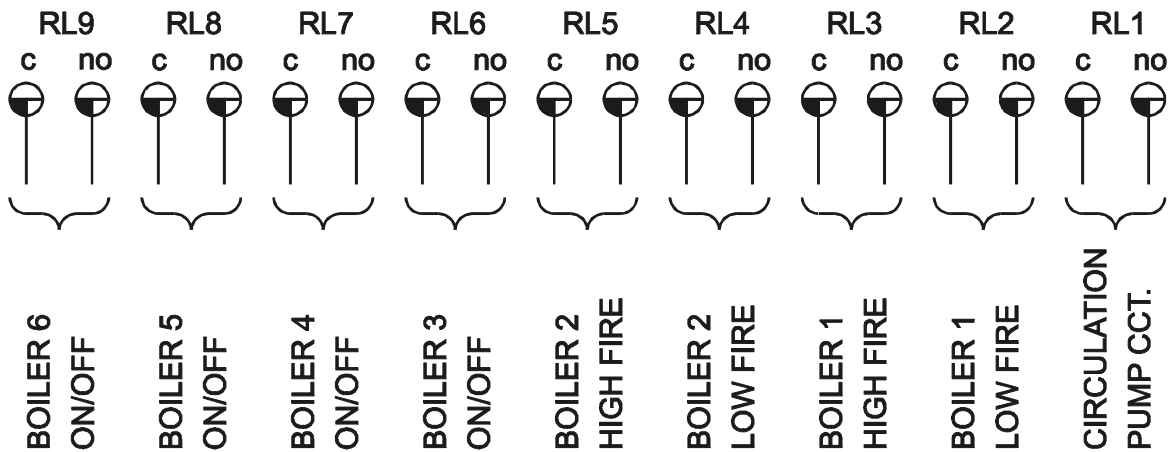


Figure 6 - Example Boiler Connection Schemes

1) 4 OFF HIGH/LOW CONTROL BOILERS



2) 6 OFF HIGH/LOW CONTROL BOILERS



NOTE! IN THIS EXAMPLE BOILERS 3 - 6 CAN ONLY BE CONTROLLED ON/OFF.

3) 1 OFF HIGH/LOW & 3 OFF ON/OFF CONTROL BOILERS

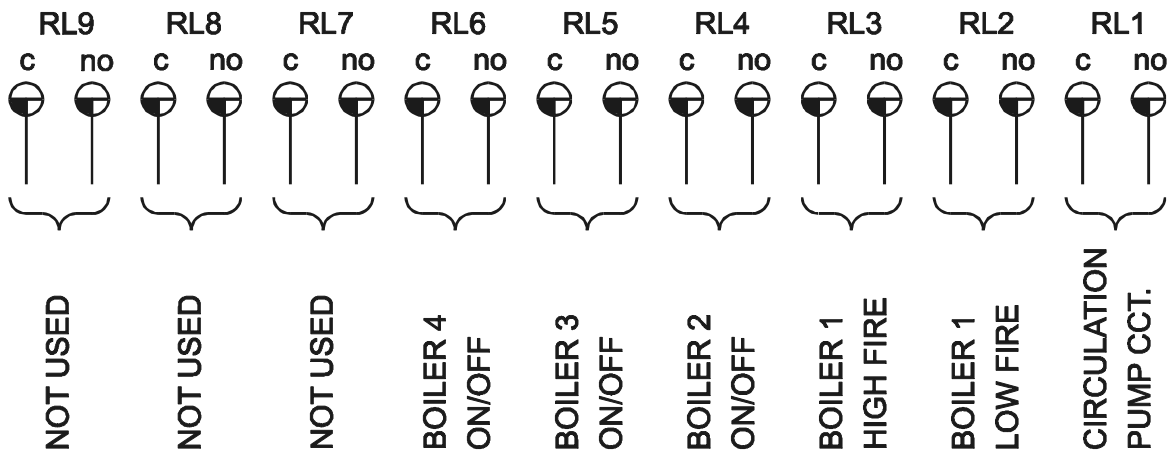


Figure 7 - Insertion Flow Sensor

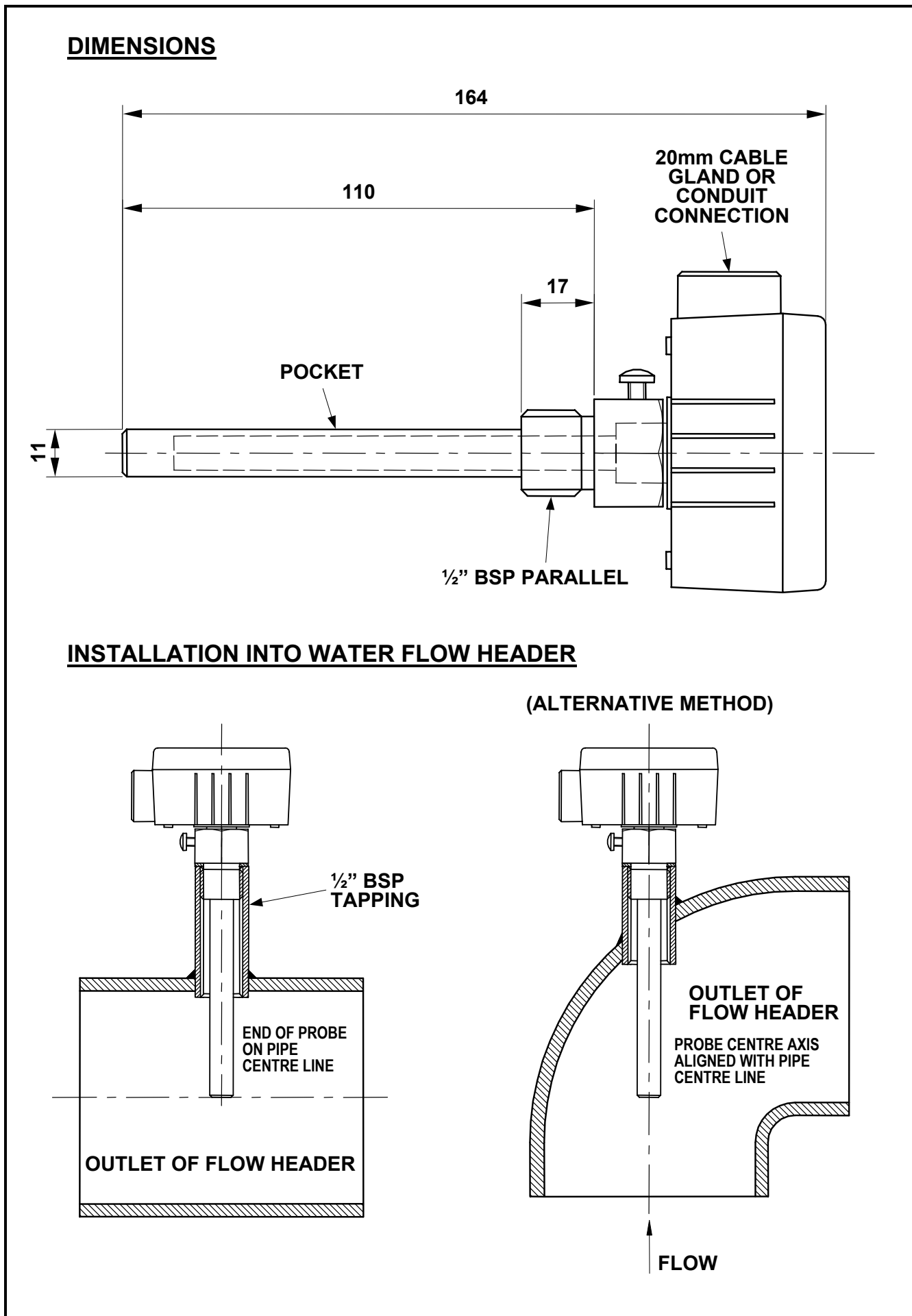
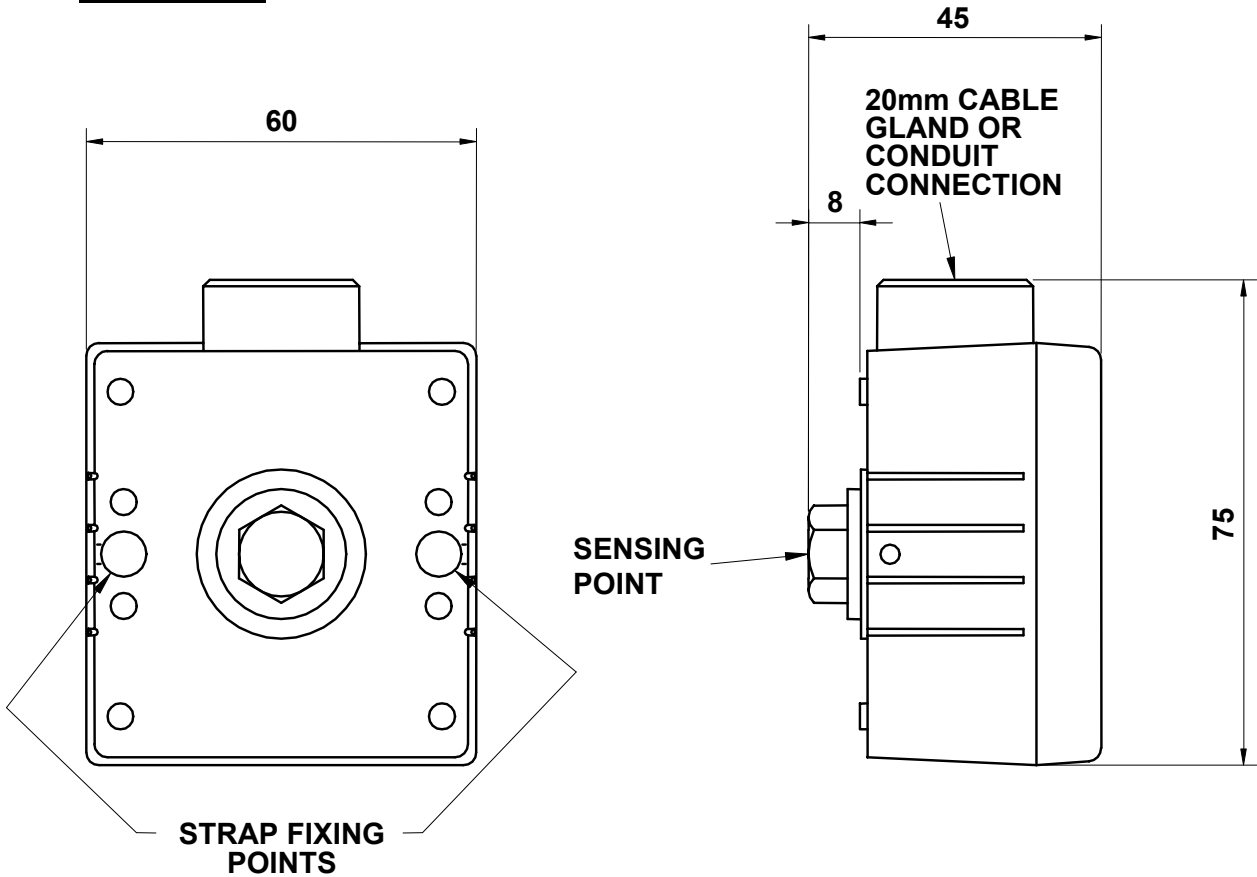
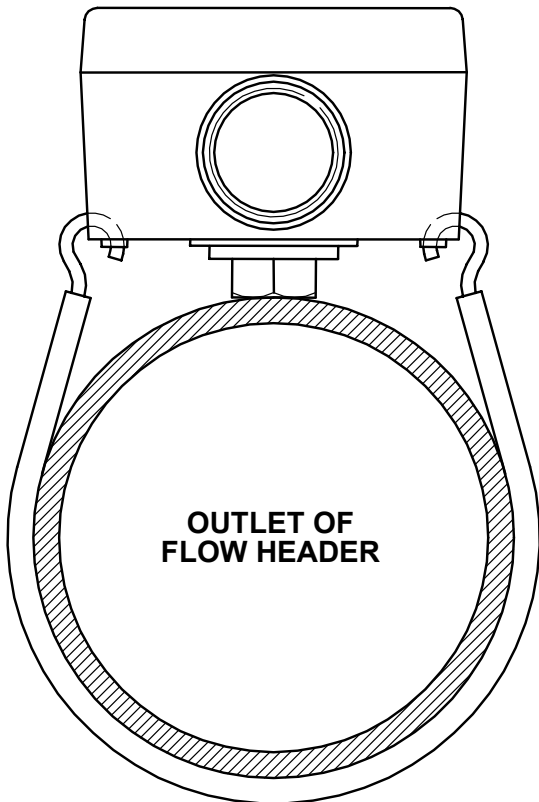


Figure 8 - Strap-on Flow Sensor

DIMENSIONS



INSTALLATION TO WATER FLOW HEADER



CUT STRAP TO CORRECT LENGTH AND SCREW IN FASTENING HOOKS. ENSURE A FIRM AND CLEAN CONTACT BETWEEN THE SENSOR AND THE SURFACE OF THE FLOW HEADER.

NOTE: MEASURE REQUIRED UNSTRETCHED STRAP LENGTH, THEN REDUCE BY 20mm TO PRODUCE A TIGHT FIT TO THE PIPE.

Figure 9 - External Sensor

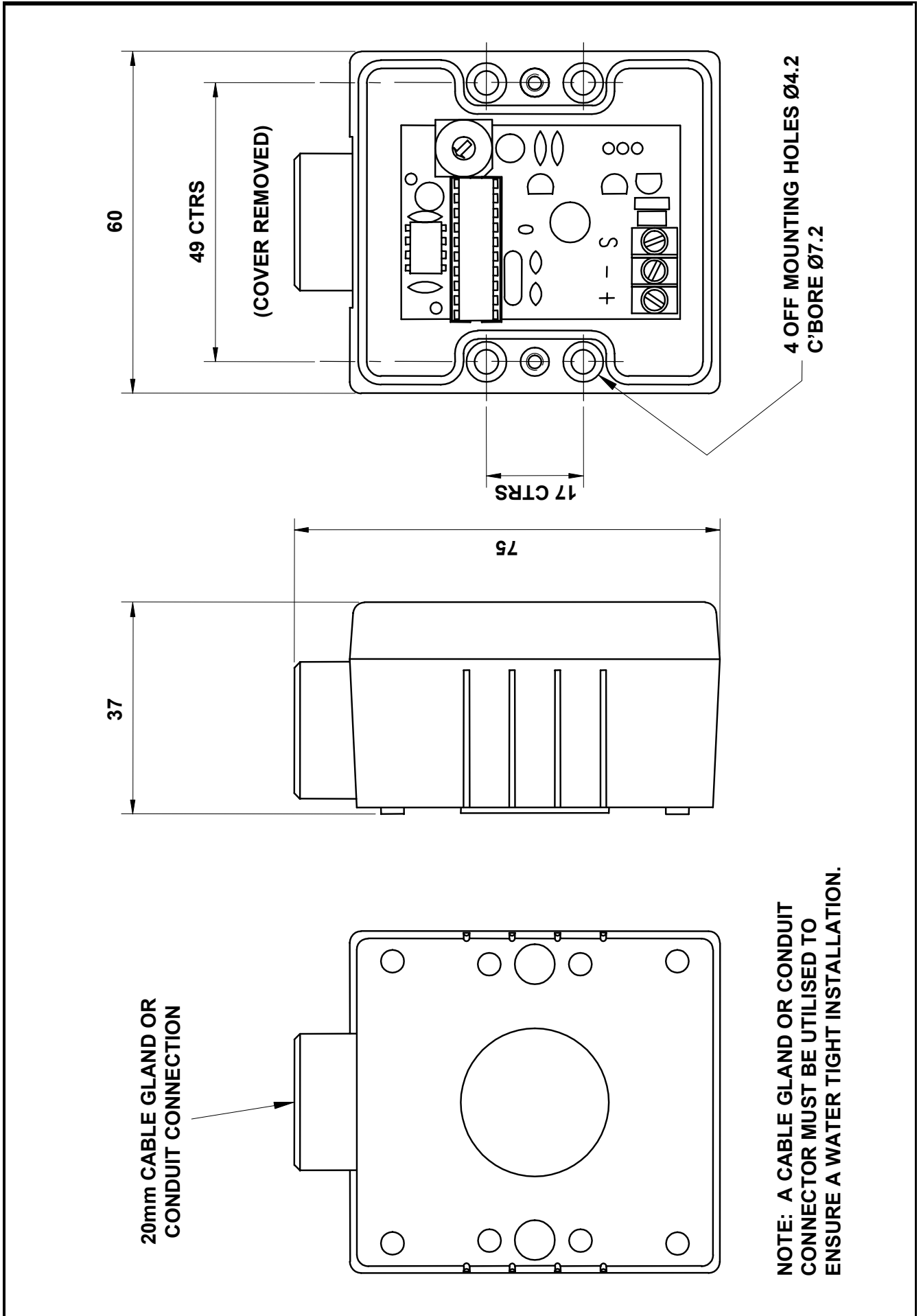


Figure 10 - Room Sensor

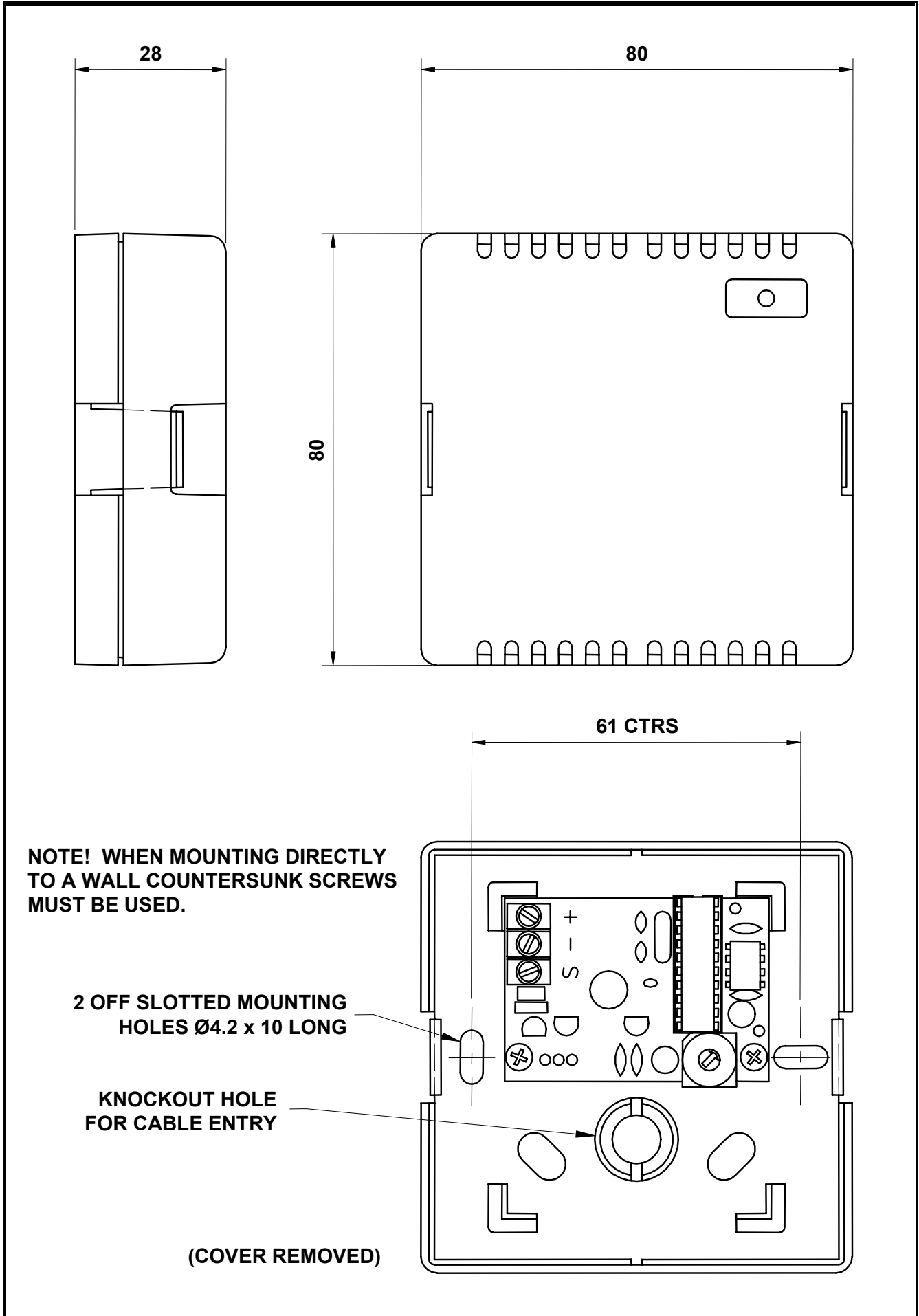


Figure 11 - Marshall Compensation Function Characteristic Graph

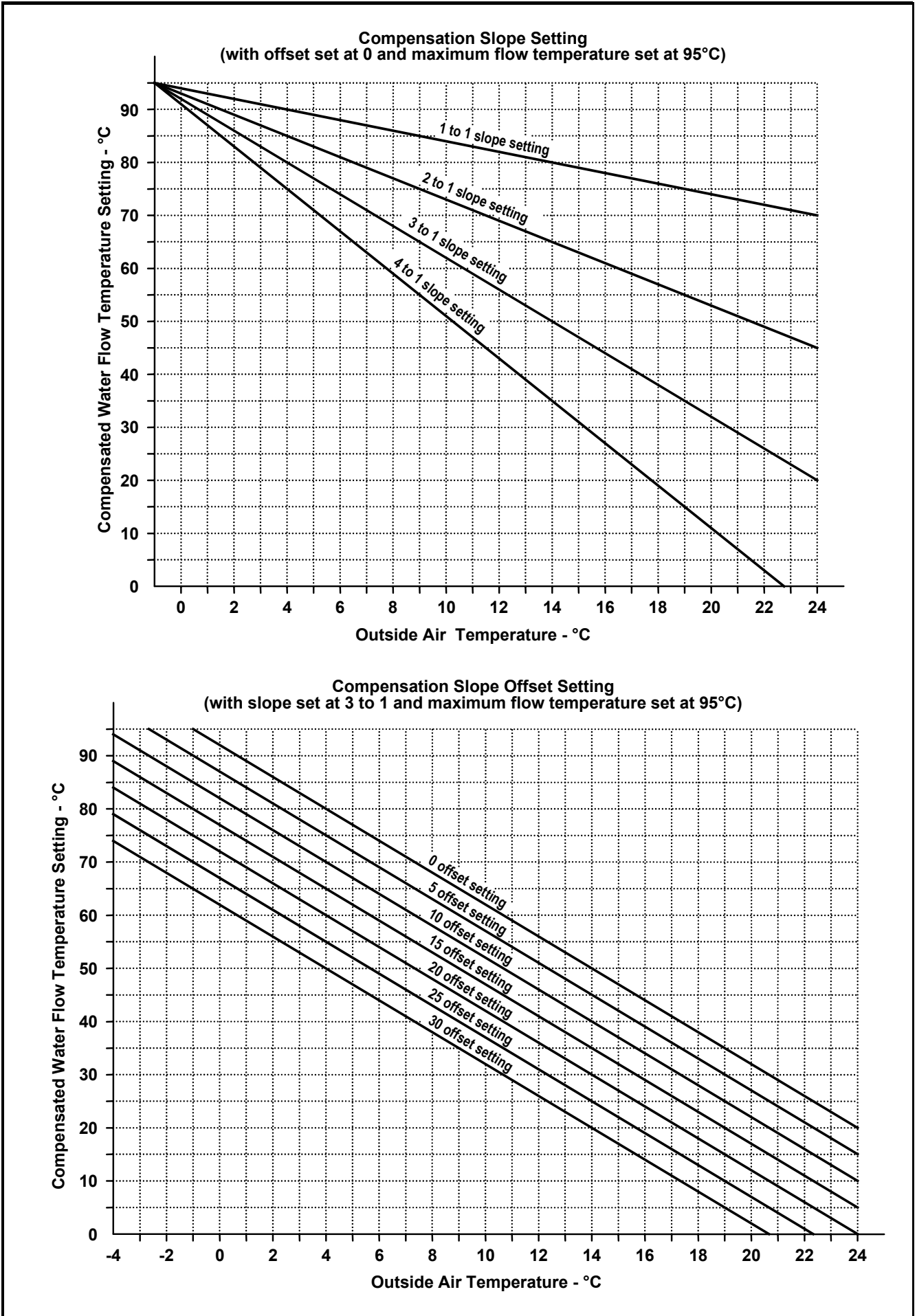


Fig 12 - Marshall Settings

SETUP	
Room Sensor Calibration Setting	
Flow Sensor Calibration Setting	
External Sensor Calibration Setting	
Maximum Override Setting	hours
Upper Temperature Offset Limit	°C
Lower Temperature Offset Limit	°C
Timeclock Setting - Internal (00) or External (01)	
Number of Boilers	
Number of High/Low Boilers	
Compensation Function Setting - Fixed Flow (04) or Variable Flow (05)	
Holiday Function Setting - Internal & External (00), Internal Only (01), External Only (02) or None (03)	
Summer Shutdown Setting	°C
Optimiser Setting - Optimiser (00), Timer (01) or Fixed Optimiser (02)	
Fixed Flow Temperature	°C
Maximum Preheat Time	hours
Rate of Change Setting (Fixed Optimiser only)	min/°C
Flow Frost Protection Setting	°C
2 Stage Frost Protection Setting	°C
Flow Temperature Slope Offset Setting	
Flow Temperature Slope Setting	
Minimum Flow Temperature	°C
Maximum Flow Temperature	°C
Circulation Pump Overrun Time	min
Boiler On Delay Setting	
Boiler Off Delay Setting	
Sequence Setting - Fixed (00) or Weekly Shift (01)	
CODE	
User's Code	

Fig 13 - Fault Finding (page 1 of 2)

Fault	Cause	Remedy
The heating system does not operate	Mains power is not supplied to the Marshall HE	Check mains supply fuses and isolators
	Marshall HE controller internal fuse is blown	Replace fuse
	Safety interlock circuit interrupted (the system information screen displays a 'LOCKED' legend)	Check the connected safety devices and remedy the fault
	Flow temperature sensor fault (sensor reads '??' and the system information screen displays a 'FAULT' legend)	Check the flow sensor wiring connections at the sensor and within the Marshall HE controller
	'Active' room comfort level setting overridden to a lower value.	Reset to correct value (refer to section 2.3 of the Marshall HE User's Instructions)
	Timeclock overridden to 'Standby'.	Reset override time (refer to section 2.4 of the Marshall HE User's Instructions)
	A programmed holiday override period is in force	Delete the holiday period (refer to section 3.5 of the Marshall HE User's Instructions)
	The Marshall HE has been manually overridden to holiday mode	Reset the manual holiday override function (refer to section 2.6 of the Marshall HE User's Instructions)
	The Marshall HE has been remotely overridden to holiday mode	Reset the remote holiday override control
Individual boilers will not fire		Refer to the boiler's Installation , Commissioning and Maintenance Manuals
The boilers' temperature limiters repeatedly operate	The 'boiler off delay' setting is too high - the boilers take too long to sequence off	Reduce the 'boiler off delay' setting (refer to section 5.2.3 step 49)
	The circulation pump is not running	Check the circulation pump and control circuit
	If a 'strap-on' type flow sensor is fitted, poor sensor contact with the water flow header is causing a high lag in sensor response	Remount the sensor ensuring a good contact with the flow header (HHL recommend a suitable heat sink compound be used e.g. R. S.554-311)
Replace the strap-on sensor with an insertion sensor (HHL part no. 533901265)		

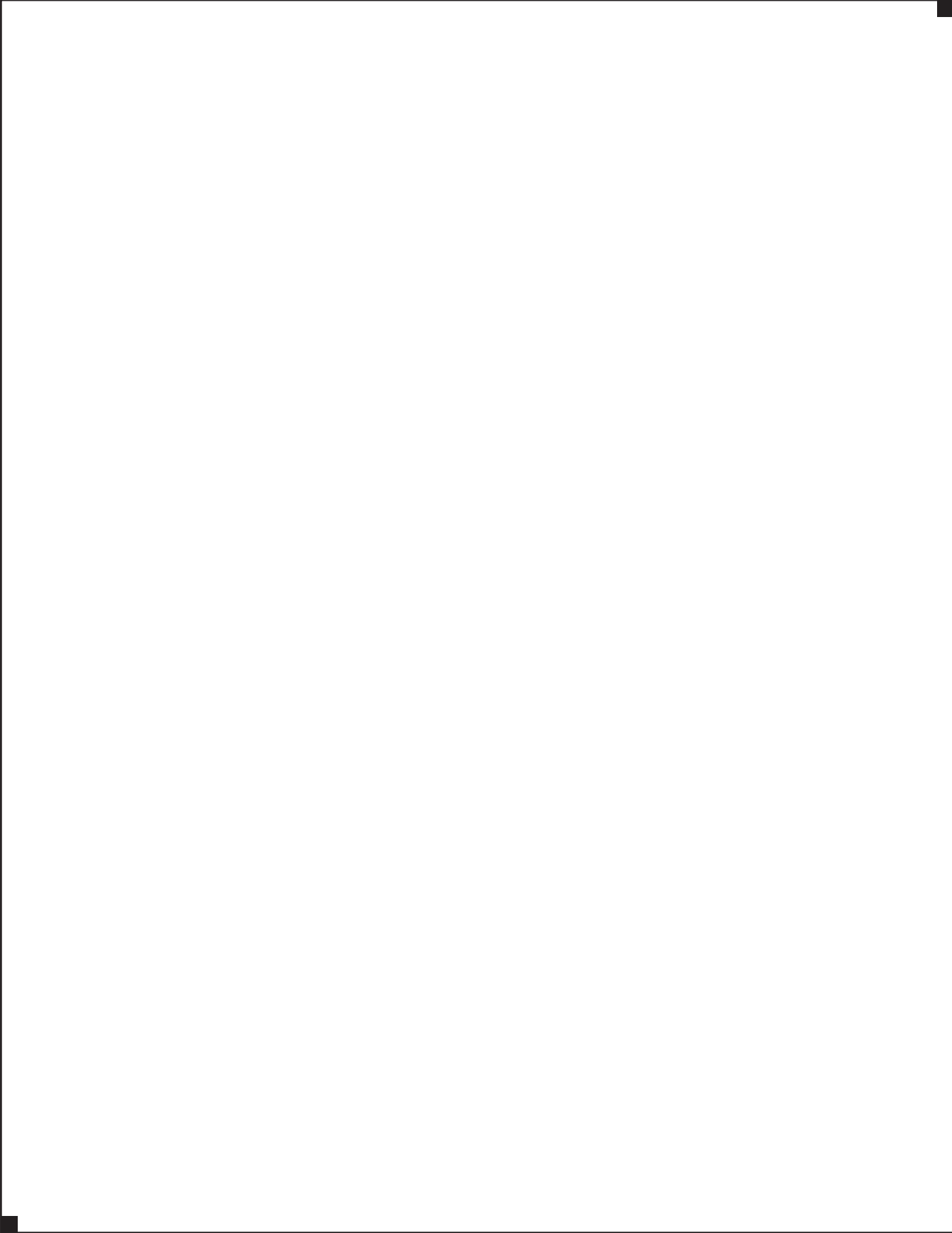
Fig 13 – Fault Finding (page 2 of 2)

Fault	Cause	Remedy
The heating system is unable to achieve the desired room comfort level	If the outside temperature compensation function is utilised, the 'slope' and 'offset' settings are incorrect.	Use a lower slope or reduce the slope offset setting (refer to section 5.2.3 steps 37 to 40)
	The maximum flow temperature or fixed flow temperature set point setting is set too low	Increase the setting (refer to section 5.2.3 step 27 or 43)
The room temperature is too high	'Active' room comfort level setting overridden to a higher value.	Reset to correct value (refer to section 2.3 of the Marshall HE User's Instructions)
	Room temperature sensor fault (if fitted) - sensor reads '??'	Check the room sensor wiring connections at the sensor and within the Marshall HE controller
	If the outside temperature compensation function is utilised, the 'slope' and 'offset' settings are incorrect.	Use a higher slope or increase the slope offset setting (refer to section 5.2.3 step 20)
	The maximum flow temperature or fixed flow temperature set point setting is too high	Reduce the setting (refer to section 5.2.3 step 27 or 43)
	External temperature sensor fault (if fitted) - external sensor reads '??' and flow temperature set point remains constantly at the maxi-	Check the external sensor wiring connections at the sensor and within the Marshall HE controller

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Direct Dial Telephone and Fax Numbers



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- controllers
- water heaters
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Poole Office

Hamworthy Heating Limited
Fleets Corner, Poole, Dorset BH17 0HH England
Main switchboard tel: **01202 662500**

Technical enquiries	 01202 662527/662528	 01202 665111
Spare parts	 01202 662525	 01202 665111
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Birmingham Office

Hamworthy Heating Limited
Shady Lane, Great Barr, Birmingham B44 9ER
Main switchboard tel: **0121 360 7000** fax: **0121 325 2309**

General enquiries  **0121 360 7000**

Direct Email Addresses

Customer Services spares@hamworthy-heating.com
service@hamworthy-heating.com
technical@hamworthy-heating.com
sales.flues@hamworthy-heating.com

Hamworthy Heating Accredited Agents

North West England

Gillies Modular Services
210-218 New Chester Road, Birkenhead, Merseyside L41 9BG
tel: **0151 666 1030** fax: **0151 647 8101**

Southern Ireland

HEVAC Limited
Naas Road, Dublin 12, Ireland
tel: **00 3531 141 91919** fax: **00 3531 145 84806**

Northern Ireland

HVAC Supplies Limited
Unit 2, Antrim Line Business Park, Sentry Lane, Newtownabbey BT36 8XX
tel: **02890 849826** fax: **02890 847443**

Scotland

McDowall Modular Services
14-46 Lomond Street, Glasgow, Scotland G22 6JD
tel: **0141 336 8795** fax: **0141 336 8954**

North East England

Allison Heating Products
17 Beech Road, South Shields, Tyne & Wear NE33 2QH
tel: **0191 455 7898** fax: **0191 455 7899**

Website

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