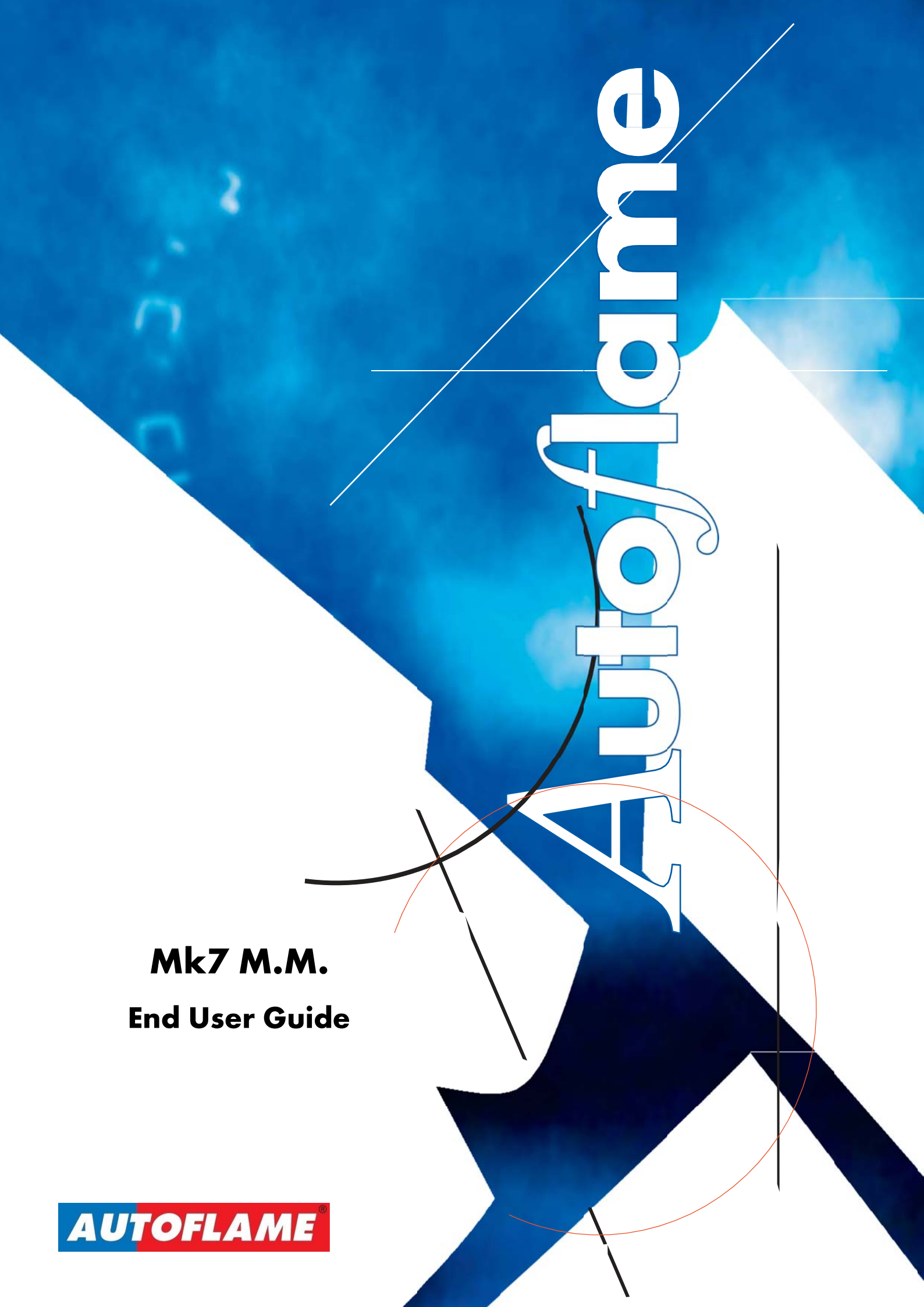

Mk7 M.M.

End User Guide

AUTOFLAME®

Mk7 M.M.

End User Guide

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2007

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Important Notes

A knowledge of combustion related procedures and commissioning is essential before embarking work on any of the M.M./E.G.A. systems. This is for safety reasons and effective use of the M.M./ E.G.A. system. Hands on training is required. For details on schedules and fees relating to group training courses and individual instruction, please contact the Autoflame Engineering Ltd. offices at the address listed on the front.

Short Form - General Terms and Conditions

A full statement of our business terms and conditions are printed on the reverse of all invoices. A copy of these can be issued upon application, if requested in writing.

The System equipment and control concepts referred to in this Manual MUST be installed, commissioned and applied by personnel skilled in the various technical disciplines that are inherent to the Autoflame product range, i.e. combustion, electrical and control.

The sale of Autoflame's systems and equipment referred to in this Manual assume that the dealer, purchaser and installer has the necessary skills at his disposal. i.e. A high degree of combustion engineering experience, and a thorough understanding of the local electrical codes of practice concerning boilers, burners and their ancillary systems and equipment.

Autoflame's warranty from point of sale is two years on all electronic systems and components.
One year on all mechanical systems, components and sensors.

The warranty assumes that all equipment supplied will be used for the purpose that it was intended and in strict compliance with our technical recommendations. Autoflame's warranty and guarantee is limited strictly to product build quality, and design. Excluded absolutely are any claims arising from misapplication, incorrect installation and/or incorrect commissioning.

Contents

1 OVERVIEW AND BENEFITS

1.1 Features and Benefits

Micro-Modulation (M.M.) / Flame Safeguard

- Fuel/Air ratio control
- 10.4" Full colour touch screen
- 110V or 230V Standard operation 50/60Hz
- Control up to 5 servomotors and 2 variable speed drives (VSD/VFD)
- 4 independent fuel programmes
- Fully adjustable PID load control for temperature and pressure
- Internal flame safeguard – full flame supervision with UV and IR self-check
- Gas valve train leak supervision and high/low gas pressure monitoring
- Air pressure proving and monitoring
- Oil pressure high/low limits supervision
- Last 16 lockouts/errors stored with date, time, phase and reset
- Single point change function for adjusting commission curve
- User definable optimum ignition position – golden start
- User definable flue gas recirculation ignition position
- Variable servomotor travel speed
- Burner control safety times user selectable
- External voltage/current load control and setpoint adjustment
- Outside temperature compensation of boiler setpoint
- Second setpoint with run times
- Hand/auto/ low flame hold
- Various boiler load detectors available
- Twin burner capability
- Fully compatible with control frequency drives
- Fuel flow metering capability – instantaneous and totalised
- 4-20mA (0-20mA)/ 0-10V (2-10V) Input for external modulation
- 4-20mA (0-20mA)/ 0-10V (2-10V) Output confirming firing rate
- Password protection of all safety related functions
- Infra-red port for upload/download of commissioning data

Exhaust Gas Analyser (E.G.A.)

- 3 Parameter Trim of O_2, CO_2, and CO
- Analysis of O_2, CO_2, CO, NO, exhaust gas temperature, efficiency and delta T
- Optional analysis of NO_2 and SO_2
- Local display for re-calibration, changing cells, user configuration and stand-alone operation
- Upper/lower/absolute limits for O_2, CO_2, CO, NO and exhaust temperature
- Six 4-20mA output signals for interface with other controls/chart recorders

Intelligent Boiler Sequencing

- System will sequence hot water boilers and steam boilers via lead/lag distribution
- Fully adjustable user options within the system to tailor sequencing operation to the application
- System control for isolation of valves or pumps
- Phantom setpoint and standby warming for lag boilers via a timing sequence and pressure offset or aqua-stat

Data Transfer Interface

- System will collect operational data for up to 10 M.M. modules, 10 E.G.A. modules, and 10 Universal I/O modules on one site. Information transmitted via RS422 or Ethernet link to a local PC/network for running Autoflame CEMS Audit Software
- Modbus communications compatible with Building Management Systems (BMS)

Expansion Board

- Additional 7th channel in system for stack damper angle and stack pressure for draft control
- Automatic bottom blowdown with time reduction for blowdown savings
- Fully modulating water level control including all safeties, 2nd low, 1st low and high water with optional pre-alarms
- Surface blowdown management – continuous modulating TDS (total dissolved solids)
- 2nd low conductivity probe for additional safety
- 15 First out Annunciation inputs
- Steam/heat flow metering

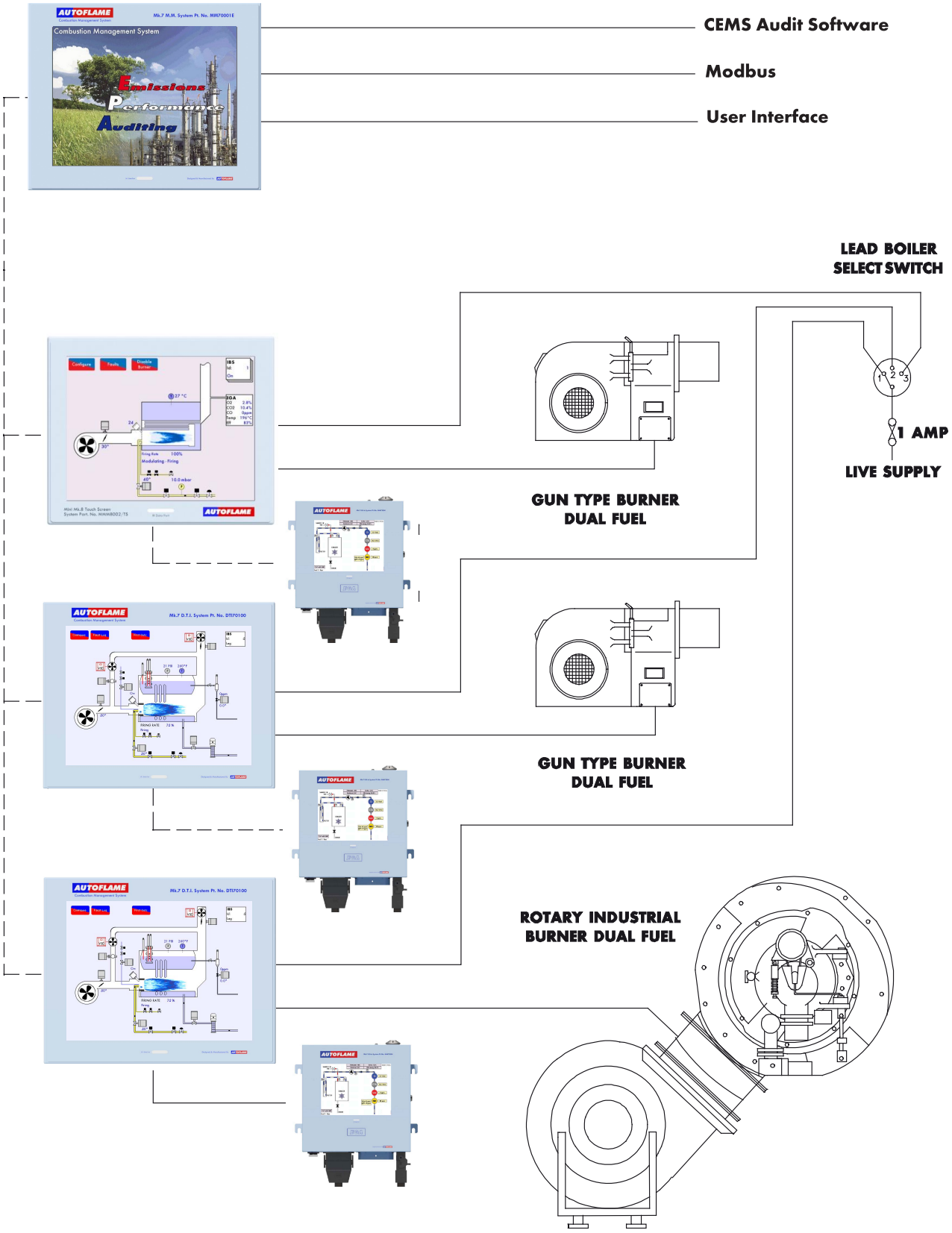
PC Compatible

- Download all commissioning data from M.M. module to a PC
- Upload commissioning data to from a PC to M.M. module

Universal Digital & Analogue Input/ Output Module

- Detailed logging inputs and outputs when coupled with the Mk7 D.T.I.
- 16 Line inputs (110V/230V)
- 6 Analogue inputs and 6 analogue outputs (0-10V, 0-20mA & 4-20mA)
- 8 Volt free contacts
- Configurable alarms through Mk7 D.T.I.

1.1.1 System Possibilities



1.2 Micro-Modulation (M.M.)

To ensure maximum efficiency and reliability of the boiler plant operation, two requirements are of paramount importance, the air to fuel ratio and the target temperature or pressure:

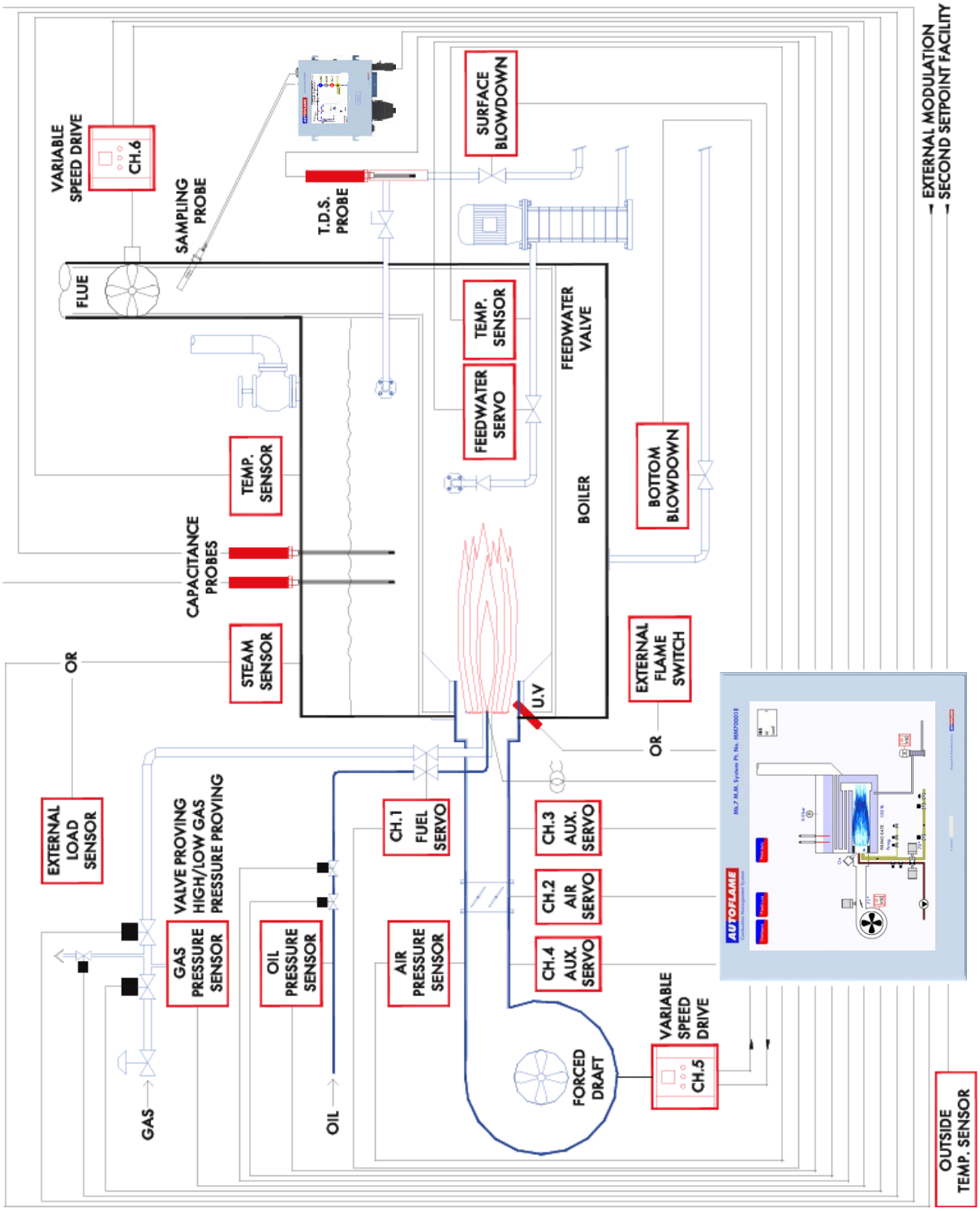
- The air to fuel ratio must be kept to the minimum to ensure complete combustion within the limitations of the combustion head design. A very high air to fuel ratio will be indication of high excess air, which decreases the overall efficiency of the boiler. The fuel valve and air damper positions set for this minimum air to fuel ratio along the whole commission curve must be infinitely repeatable to an incredibly high degree of accuracy.
- The target temperature or pressure of the boiler should be monitored by the combustion system and at all times, with exactly the right amount of fuel and air fired to achieve this target value. Irrespective of load changes, the burner/boiler system should be able to meet the target temperature or pressure.

The burners' fuel to air ratios were traditionally governed by mechanical systems which involved multiple cams, shafts and linkages controlled by one motor. The inherent hysteresis that occurred from the system design allowing components to be loose, made the level of accuracy required impossible. With this poor accuracy, the response of the fuel input to the monitored temperature/ pressure of the boiler meant that the set target value at most times would overshoot or fall short.

The Micro-Modulation module is the basic building block of the Autoflame System. The Autoflame M.M. module provides an easily programmable and flexible means of optimising combustion quality throughout the load requirement range of the burner/boiler unit whilst ensuring the temperature is accurate to within 1°C (°F) and pressure to within 1 PSI (0.1Bar). Using direct drive motors to individually control the air damper and fuel valve(s), gives the optimum combustion of the burner at every point along the firing range. The maximum error in angular degrees of rotation between the two servomotors at any position in the load range is 0.1°.

This automated system of burner control achieves 'locked on' near stoichiometric air to fuel mixing throughout the fuel input range of the boiler while maintaining exact temperature or pressure target values. The load control incorporates user-variable Proportional Integral Derivative control. The PID control is infinitely adjustable to match any boiler room requirements.

1.2.1 M.M. System Example



2 ELECTRICAL SPECIFICATIONS

2.1 Classifications

Classification according to EN298 – F B L L J B

Mains Supply:	230V, +10%/-15%} 110V, +10%/-15%}	47-63 Hz, unit max. consumption 62W
Max Leakage:	3.5mA	
Climate:	Temperature	0 to +40°C (32 to 104°F)
	Humidity	0 to 90% non-condensing
Storage:	Temperature	-20 to 85°C (-4 to 185°F)
Protection Rating:	The unit is designed to be panel mounted in any orientation and the front facia is IP65, NEMA4. The back of the unit is IP20, NEMA1.	

2.1 Inputs and Outputs

230V Unit:

Outputs	Terminal	57	250mA	Must be connected through contactor	
		58	250mA	Must be connected through contactor	
		59	1A	0.6 power factor	
		60	1A	0.6 power factor	
		61	1A	0.6 power factor	Max Load 6A
		62	1A	0.6 power factor	
		63	1A	0.6 power factor	
		78	100mA	To drive relay only – switched neutral	
		79	100mA	To drive relay/lamp only – switched neutral	

Analogue I/Os 240Ω or less

110V Unit:

Outputs	Terminal	57	250mA	Must be connected through contactor	
		58	250mA	Must be connected through contactor	
		59	2A	0.6 power factor	
		60	2A	0.6 power factor	
		61	2A	0.6 power factor	Max Load 6A
		62	2A	0.6 power factor	
		63	2A	0.6 power factor	
		78	100mA	To drive relay only – switched neutral	
		79	100mA	To drive relay/lamp only – switched neutral	

Analogue I/Os 240Ω or less

Max Load 2A on Expansion Board terminal PF

Note:

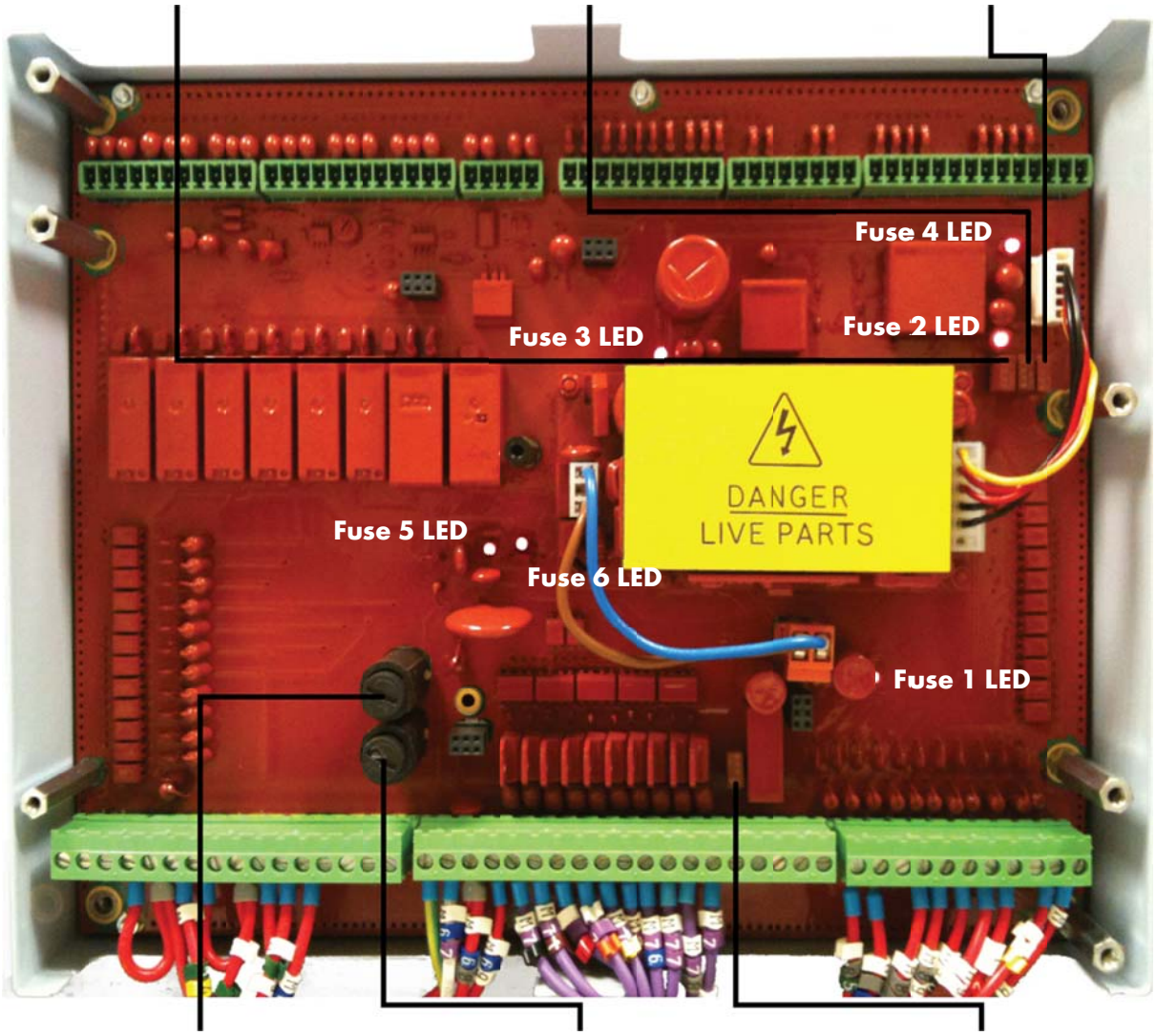
1. The high and low voltage connections are not safe to touch. Protection against electric shock is provided by correct installation. **CAUTION – ELECTRIC SHOCK HAZARD.**
2. Cabling should be maximum 25m.
3. Use screened cable as specified in section 2.4.
4. The burner 'High Limit Stat' must be of the manual reset type.

2.3 Fuse Ratings

Fuse 6 - 500mA(T) Time lag
Part No. FU10040
(IR Sensor failure/ Terminals 37 – 39 Failure)

Fuse 1 - 2.5A(T) Time lag
Part No. FU10042
(Short Circuit on 12V)

Fuse 2 - 2.5A(T) Time lag
Part No. FU10042
(Internal 5V)



Fuse 3 - 2A(T) Time lag
Part No. FU10034
(Servo Short Circuit)

Fuse 4 - 6.3A(T) Time lag
Part No. FU10026
(Terminals 50 to 64)

Fuse 5 - 1A(T) Time lag
Part No. FU10041
(Servo AC Switching failure)

Text in brackets indicates possible causes of fuse blowing.

All fuses should be time lag type (T).

If a fuse LED is extinguished, then this indicates that the fuse has blown.

2.4 Cable Specifications

Screened Cable

The screened cable used from the M.M. to the servomotors and detectors must conform to the following specification:

16/0.2mm PVC insulated overall braid, screened, PVC sheathed.

- Sixteen wires per core
- Diameter of wires in each core 0.2mm
- Rated at 440V AC rms at 1600Hz
- DEF 61-12 current rating per core 2.5A
- Maximum operating temperature 70°C (158°F)
- Nominal conductor area 0.5sq mm per core
- Nominal insulation radial thickness on core 0.45mm
- Nominal conductor diameter per core 0.93mm
- Nominal core resistance at 20°C. 40.1Ω/1000m
- Nominal overall diameter per core 1.83mm
- Fill factor of braid screen 0.7
- Equivalent imperial conductor sizes 14/0.0076

Use the number of cores suitable for the application. A universal part numbering system appears to have been adopted for this type of cable as follows:

16-2-2C 2 Core
16-2-3C 3 Core
16-2-4C 4 Core
16-2-6C 6 Core

(5 Core not readily available)

Note: If using 4 Core cable and interference is detected, use 2 sets of 2 Core.

Data Cable

Data cable must be used for connections between M.M.s for twin burner/sequencing applications and between M.M.s and E.G.A.s and for connection between M.M.s and D.T.I.

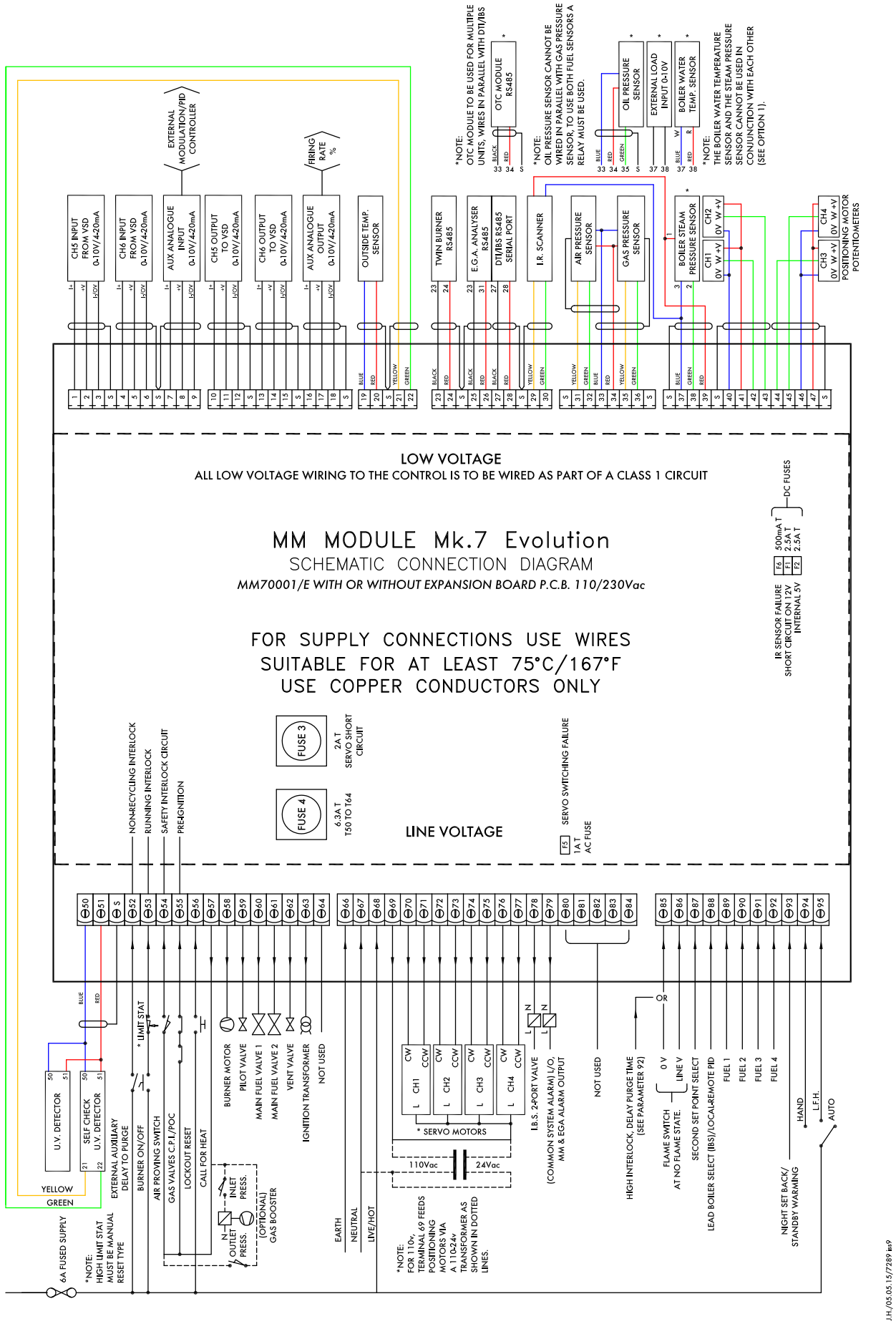
Types of data cable that can be used:

1 Beldon 9501 for 2-core shielded cable (1 twisted pair)
2 Beldon 9502 for 4-core shielded cable (2 twisted pairs)
3 STC OS1P24

Samples are available upon request.

Cables can be ordered directly from Autoflame Engineering, please contact Autoflame Sales.

2.5 Wiring Schematic



2.6 Terminals Description

S	All terminals marked S are internally connected. They are provided for connections to the various screened cables. Refer to the schematic connection diagrams, section 1.3, 1.4, and 1.5.
1	Current Input, 4-20mA. For channel 5 VSD use only. Can be connected to the current output of a VSD or tachometer system as appropriate
2	Voltage Input, 0-10V. For channel 5 VSD use only. Can be connected to the voltage output of a VSD or tachometer system as appropriate
3	Common for Terminals 1 or 2
4	Current Input, 4-20mA. For channel 6 VSD use only. Can be connected to the current output of a VSD or tachometer system as appropriate
5	Voltage Input, 0-10V. For channel 6 VSD use only. Can be connected to the voltage output of a VSD or tachometer system as appropriate
6	Common for Terminals 4 or 5
7	Current Input, 4-20mA. Used for external modulation or external required setpoint
8	Voltage Input, 2-10V. Used for external modulation or external required setpoint
9	Common for Terminals 7 or 8
10	Current Output, 4-20mA. For channel 5 VSD use only. Can be connected to the current input of a VSD
11	Voltage Output, 0-10V. For channel 5 VSD use only. Can be connected to the voltage input of a VSD
12	Common for Terminals 10 or 11
13	Current Output, 4-20mA. For channel 6 VSD use only. Can be connected to the current input of a VSD
14	Voltage Output, 0-10V. For channel 6 VSD use only. Can be connected to the voltage input of a VSD
15	Common for Terminals 13 or 14
16	Current Output, 4-20mA. Varies in accordance with firing rate
17	Voltage Output, 0-10V. Varies in accordance with firing rate
18	0V common for Terminals 16 or 17

Note that all the common Terminals (3, 6, 9, 12, 15, 18) are connected to each other internally. All of the circuitry, associated with the analogue inputs and outputs detailed above, are isolated from earth/ground potential, i.e. floating.

19, 20	Connections to an Autoflame outside temperature sensor (options 80-85)
21, 22	Connections to an Autoflame self-check UV sensor
23, 24	Communications port connections for twin burner operation
25, 26	Communications port connections to an Exhaust Gas Analyser (E.G.A.)
27, 28	Communications port connections for Data Transfer Interface (D.T.I.) and/or Intelligent Boiler Sequencing operation
29, 30	Connections to an Autoflame Self check IR sensor (M10017)
31, 32	Signal inputs from Autoflame air pressure sensor
33	0V supply to Autoflame air/gas/(oil) pressure sensors
34	+12V supply to Autoflame air/gas/(oil) pressure sensors
35, 36 (35)	Signal inputs from Autoflame gas pressure sensor (oil)
37, 38 (39)	Connections to an Autoflame boiler temperature detector (pressure)
40	0V supply to channel 1 and channel 2 servomotors
41	+12V supply to channel 1 and channel 2 servomotors
42	Signal from channel 1 servomotor, indicating position
43	Signal from channel 2 servomotor, indicating position
44	Signal from channel 3 servomotor, indicating position
45	Signal from channel 4 servomotor, indicating position
46	0V Supply to channel 3 and channel 4 servomotors
47	+12V Supply to channel 3 and channel 4 servomotors
48, 49	No terminals allocated
50,51	Connections to an Autoflame UV sensor
52	Mains voltage input- external auxiliary delay to purge
53	Mains voltage input- burner on/off signal, running interlock circuit
54	Mains voltage input- safety circuits, e.g. air proving
55	Mains voltage input- proving circuits, e.g. gas valve proof of closure
56	Mains voltage input- lockout reset
57	Mains voltage output- call for heat

58	Mains voltage output- burner motor
59	Mains voltage output- start/pilot valve
60	Mains voltage output- main fuel valve 1
61	Mains voltage output- main fuel valve 2
62	Mains voltage output- vent valve
63	Mains voltage output- ignition transformer
64	Unused – do not connect
65	No terminal allocated
66	Mains supply- earth
67	Main supply- neutral
68	Mains supply- live/hot
69	Mains voltage output, power to servomotors
70	Switched neutral- drives channel 1 servomotor clockwise
71	Switched neutral- drives channel 1 servomotor counter clockwise
72	Switched neutral- drives channel 2 servomotor clockwise
73	Switched neutral- drives channel 2 servomotor counter clockwise
74	Switched neutral- drives channel 3 servomotor clockwise
75	Switched neutral- drives channel 3 servomotor counter clockwise
76	Switched neutral- drives channel 4 servomotor clockwise
77	Switched neutral- drives channel 4 servomotor counter clockwise
78	Switched neutral-to drive 2-port valve for IBS/lead-lag operation
79	Switched neutral- alarm output for M.M. lockout/M.M. error/E.G.A. error.
80	Unused- do not connect
81	Unused- do not connect
82	Unused- do not connect
83	Unused- do not connect
84	Unused- do not connect

85	Mains voltage input. For use when using an external flame switch- 0V when at no flame state, or when using boiler differential proving (parameter 92)
86	Mains voltage input. For use when using an external flame switch- line voltage when at no flame state
87	Mains voltage input. Select second required setpoint- second set-point facility
88	Mains voltage input. Can be used to select this M.M. as lead boiler when Intelligent Boiler Sequencing is implemented. If this terminal is used to select the lead boiler, it will take priority over a lead boiler set via the D.T.I. Also used as an input to select between internal and external modulation using external PID loop (or option 55)
89	Mains voltage input- selects fuel 1 curve
90	Mains voltage input- selects fuel 2 curve
91	Mains voltage input- selects fuel 3 curve
92	Mains voltage input- selects fuel 4 curve
93	Mains voltage input- if low pressure steam operation is optioned, this input is used to detect low boiler temperature (by means of an appropriate temperature switch/aquastat). If outside temperature compensation is optioned, this input is used to activate the night setback
94	Mains voltage input- selects hand operation
95	Mains voltage input- selects low flame hold operation

3 INTERACTING WITH THE MK7 M.M.

3.1 End User Screens

3.1.1 System Configuration

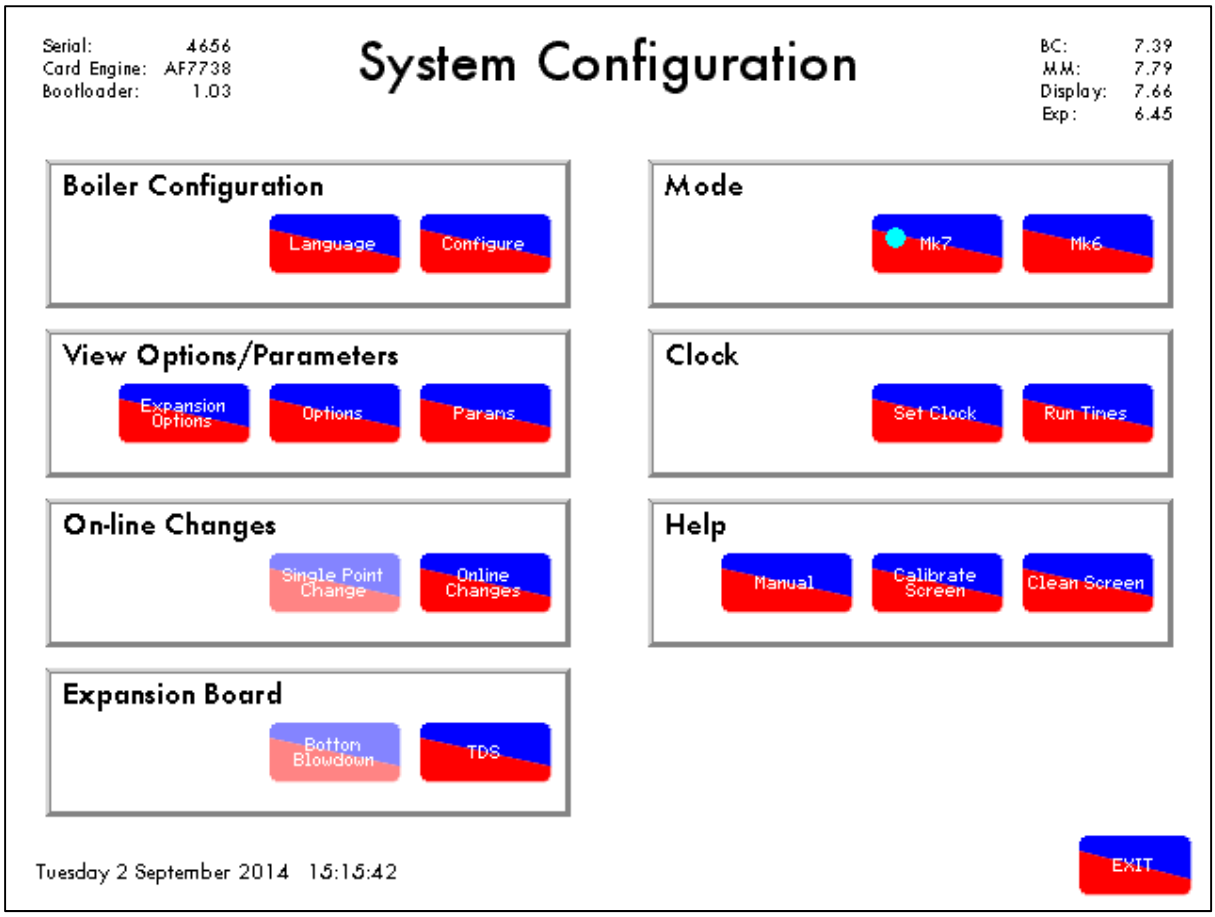


Figure 3.1.1.i System Configuration Screen

This is the main configuration screen of the Mk7 M.M, divided into the following sections:

System Information

- The serial number, software versions (BC, MM, DI and Exp), card engine, and bootloader.
- The current date and time.

Boiler Configuration – To configure the boiler home screen and change the language.

View Options/Parameters – To view all Options, Parameters and Expansion Options as well as their current values. No password is required as their settings cannot be changed via this screen.

Expansion Board – To configure the bottom blowdown timings, and calibrate the TDS probe.

Mode – To select the Operational Mode: Mk6 or Mk7. The light blue dot indicates the current mode.

Clock – To set the clock and run times, see sections 3.1.7 and 3.1.8.

Help – To read the manual on the Mk7 M.M, calibrate the screen and disable the screen for cleaning.

3.1.2 Home Screen – Mk6 Mode

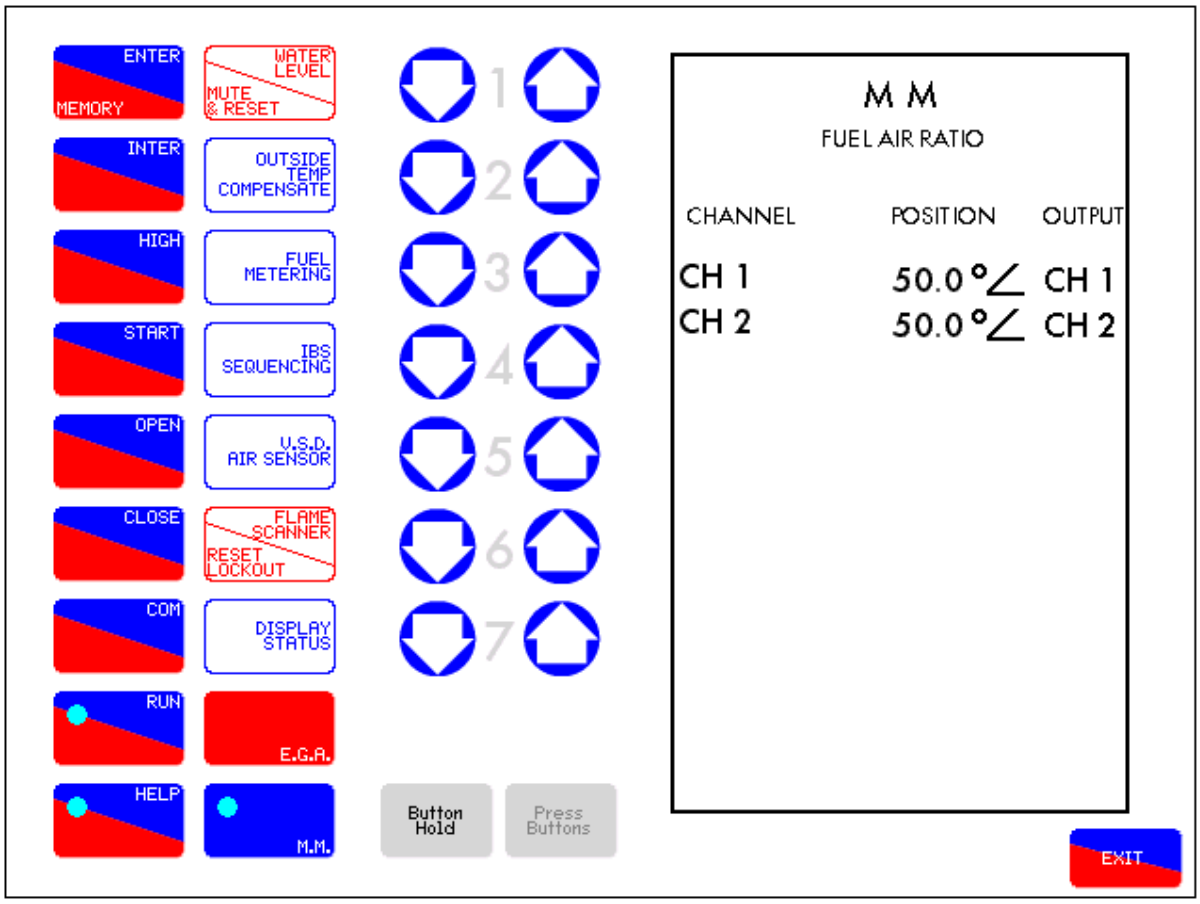


Figure 3.1.2.i Home Screen - Mk6 Mode

The mode of operation is selectable on the system configuration screen and allows easy transition between Mk6 and Mk7 mode. The Mk6 mode matches the user experience of the Mk6 M.M. units. Whilst in this mode, all features and screens are the same as those on standard Mk6 M.M. units, apart from the button hold facility replacing the old style of pressing two button simultaneously.

- Button Hold: This button toggles multiple button press on/off.

- Press Buttons: This button is used to press currently selected buttons.

Button Hold instructions:

1. Press 

button. The on-screen LED will appear confirming that the button is active.
2. Select the buttons you wish to press simultaneously. Highlighted yellow selected buttons (e.g. )
3. Press the 

button to press the selected simultaneously.

3.1.3 Home Screen – Mk7 Mode

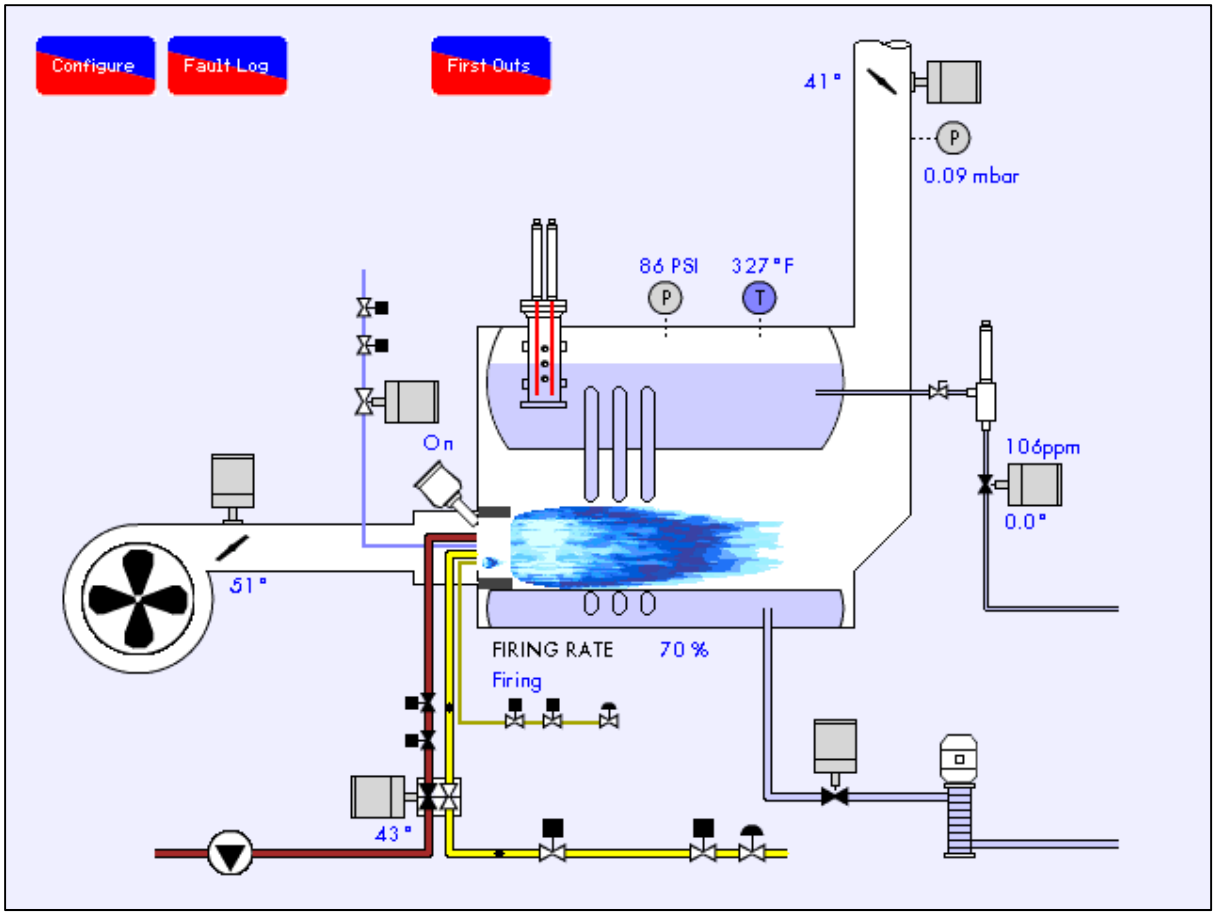
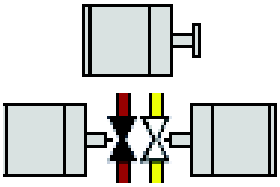
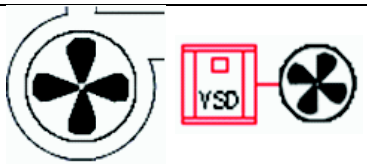
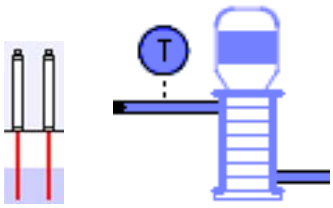
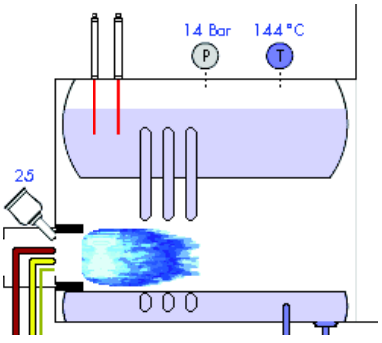


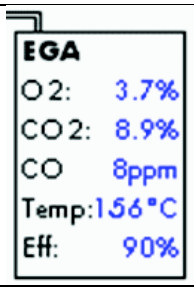
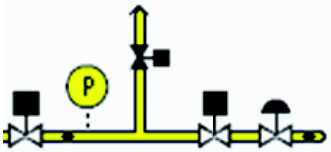
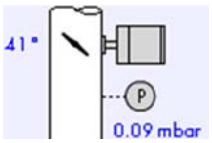
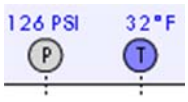
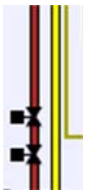
Figure 3.1.3.i Home Screen – Mk7 Mode

Selecting Mk7 mode by pressing on the System Configuration screen will show a similar screen to the above. This Home Screen displays the current boiler room setup. It provides operating information about each component of the boiler in real time. Pressing on a component will display further information about it. e.g. pressing on the servomotor image will show the servomotor position history.

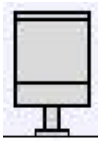
3.1.4 Home Screen Buttons

The Home Screen comprises of various buttons that can be selected to navigate through the screens of the Mk7 M.M. unit. The buttons that appear on screen depend upon the boiler room configuration.

Button	Button Name	Notes
	Servomotor Button	Action: This button will open the M.M. Servo Channels screen (Section 3.1.11). This button is animated to display real time information corresponding to the servo movement. This button may appear in several places.
	VSD Button	Action: This button will open the M.M. Servo Channels Screen (Section 3.1.11) The fan will rotate when the fan motor/ VSD is active
	Flame Safeguard Button	Action: This button will display the flame safeguard screen (Section 3.1.12). The number of counts will be displayed above this button if a UV/IR sensor is used. If a flame switch is used, the current state of the flame (on/off) is displayed.
	Flame Safeguard Button	Action: This button will display the flame safeguard screen (Section 3.1.12). It will animate during the burner's sequence showing when valves are open or closed.
	Water Level Buttons	Action: These buttons will display the water level screen (Section 3.1.18). The Temperature icon will display the current water inlet temperature in real time. (This button will only appear if an expansion board is connected and set-up for water level control.
	Boiler Status Button	Action: Pressing this button will display the status screen (Section 3.1.9). The exact display of this button will vary greatly to match the current boiler room setup (eg: existence of feedwater management, current fuel being used, boiler type, etc.) The flame colour will correspond to the current fuel being used (blue for gas and yellow for oil). The flame length will correspond to the current firing rate. Fuel flow metering must be completed for this function to be accurately displayed (Section 3.1.14).

Button	Button Name	Notes
	E.G.A. Button	Action: This button will open the E.G.A. Screen (Section 3.1.16). It will display in real time, the values of O_2, CO_2, CO, exhaust gas temperature and current combustion efficiency. (This button will only appear if an E.G.A. has been optioned).
	I.B.S. Button	Action: This button will open the IBS Screen (Section 3.1.13). This button will display in real time the ID number of the current boiler and the current IBS status. (This button only appears if IBS is optioned).
	Fuel Pressure Sensor History Button	Action: This button will open the VPS Screen (Section 3.1.15). This button will animate to show each stage of the VPS sequence in real time. This button is available in 2 and 3 valve configurations (Option 130).
	Outside Temperature Compensation Button	Action: This button will open the OTC Screen (Section 3.1.20). This button will actively display the current outside temperature. (This button will only display if a OTC sensor is optioned). Note: Not to be confused with water temperature sensors which are displayed in blue.
	Draft Control Servomotor and Pressure Sensor button	Action: This button will open the draft control history screen showing the air pressure and the servomotor position for up to 24hours.
	Steam/ Heat Flow Metering buttons	Action: These buttons will open the steam/heat flow metering screens.
	Fuel Flow Metering button	Action: This button will open the fuel flow screen, showing the fuel and air positions for the combustion curve as well as the current fuel valve and air damper angles.

3.1.5 Home Screen Components



Servomotor

Variable Speed Drive

Gas Pipe (No Flow)

Gas Pipe (Gas Flowing)

Oil Pipe (No Flow)

Oil Pipe (Oil Flowing)

Water Pipe (No Flow)

Water Pipe (Water Flowing)

Feed Water Valve

Flue Gas Recirculation Valve

Damper

Piping (Gas is currently flowing)

Gas Valve (Solenoid Closed)

Gas Valve (Solenoid Open)

Fuel Valve (Closed)

Fuel Valve (Open)

Regulator

Flame Detector

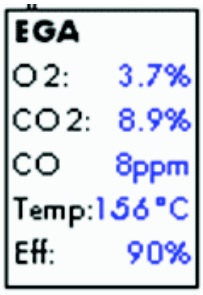
Temperature Sensor (Water)

Temperature Sensor (Outside)

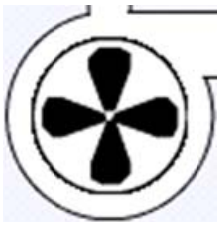
Pressure Sensor (Air/Steam)

Pressure Sensor (Fuel)

Intelligent Boiler Sequencing information

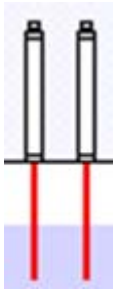


Exhaust Gas Analyser information

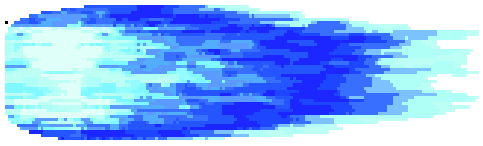


Fan

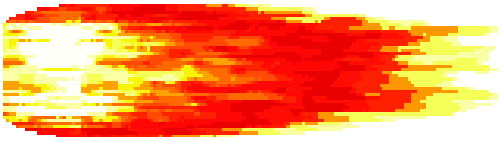
Water Level



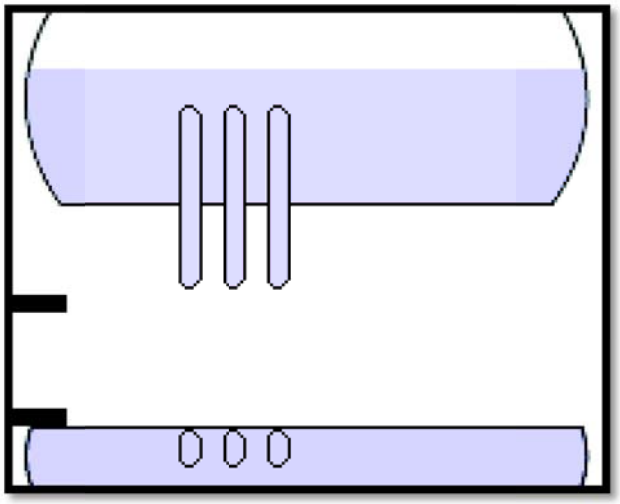
Water Level Probes



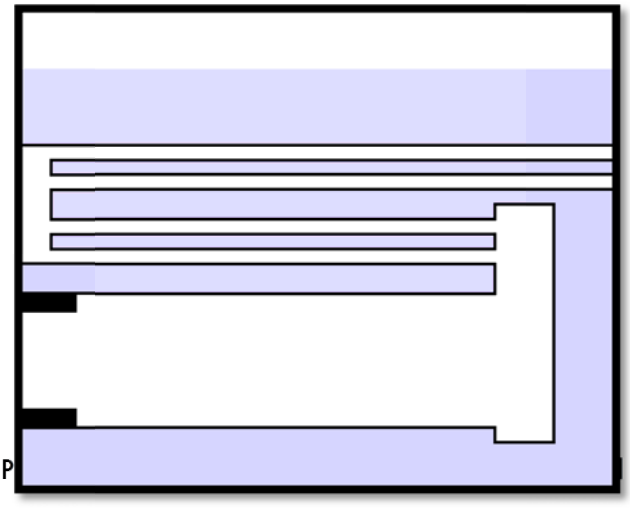
Gas Flame



Oil Flame



Watertube Boiler



Fire Tube Boiler

3.1.6 View Options/ Parameters

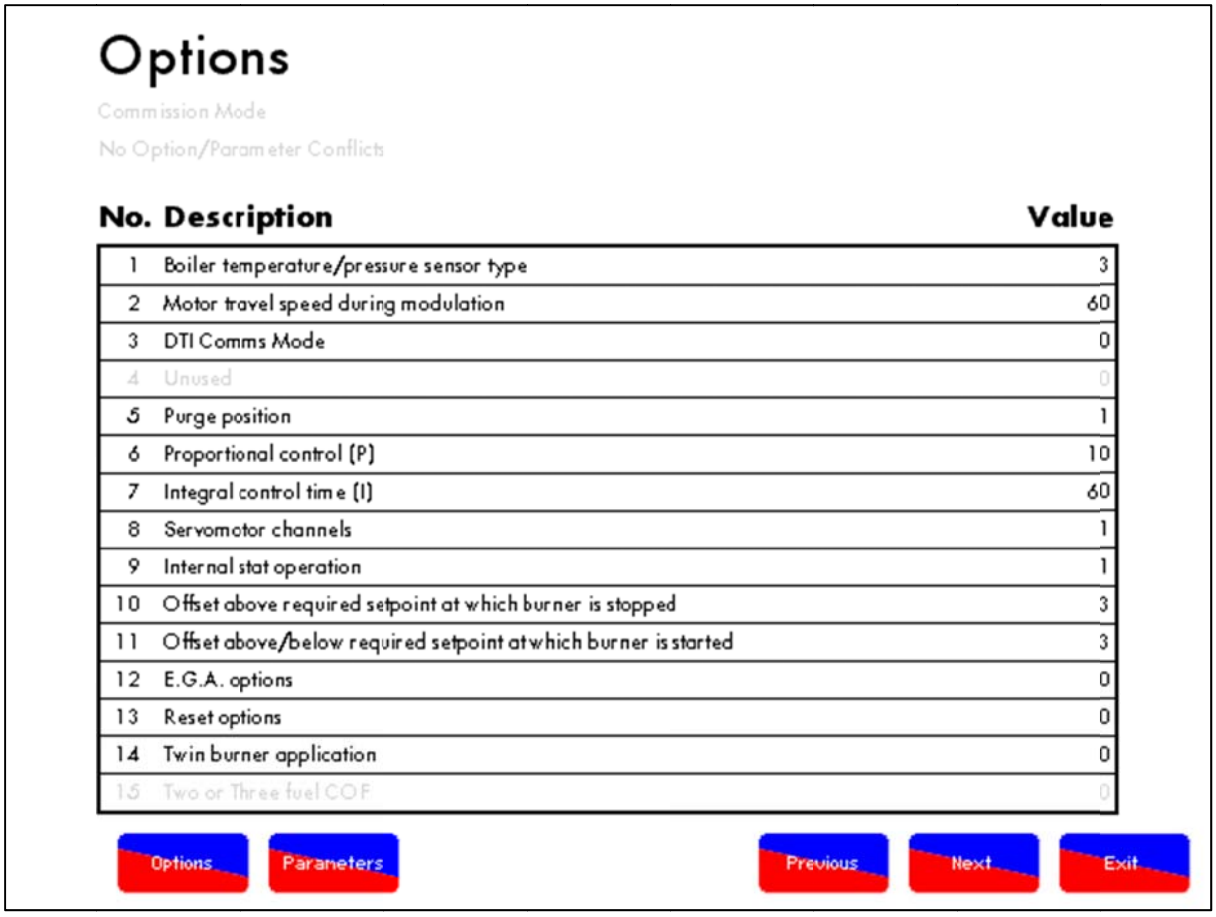


Figure 3.1.6.i Options

By accessing View Options/Parameeers in the System Configuration screen, all of the options, parameters and expansion options and can be viewed while the burner is firing. These settings cannot be changed in these screens. The currently selected value for each option is listed on the right end of that option/ parameter/ expansion option row. Pressing on an option/ parameter/ expansion option will display further information.

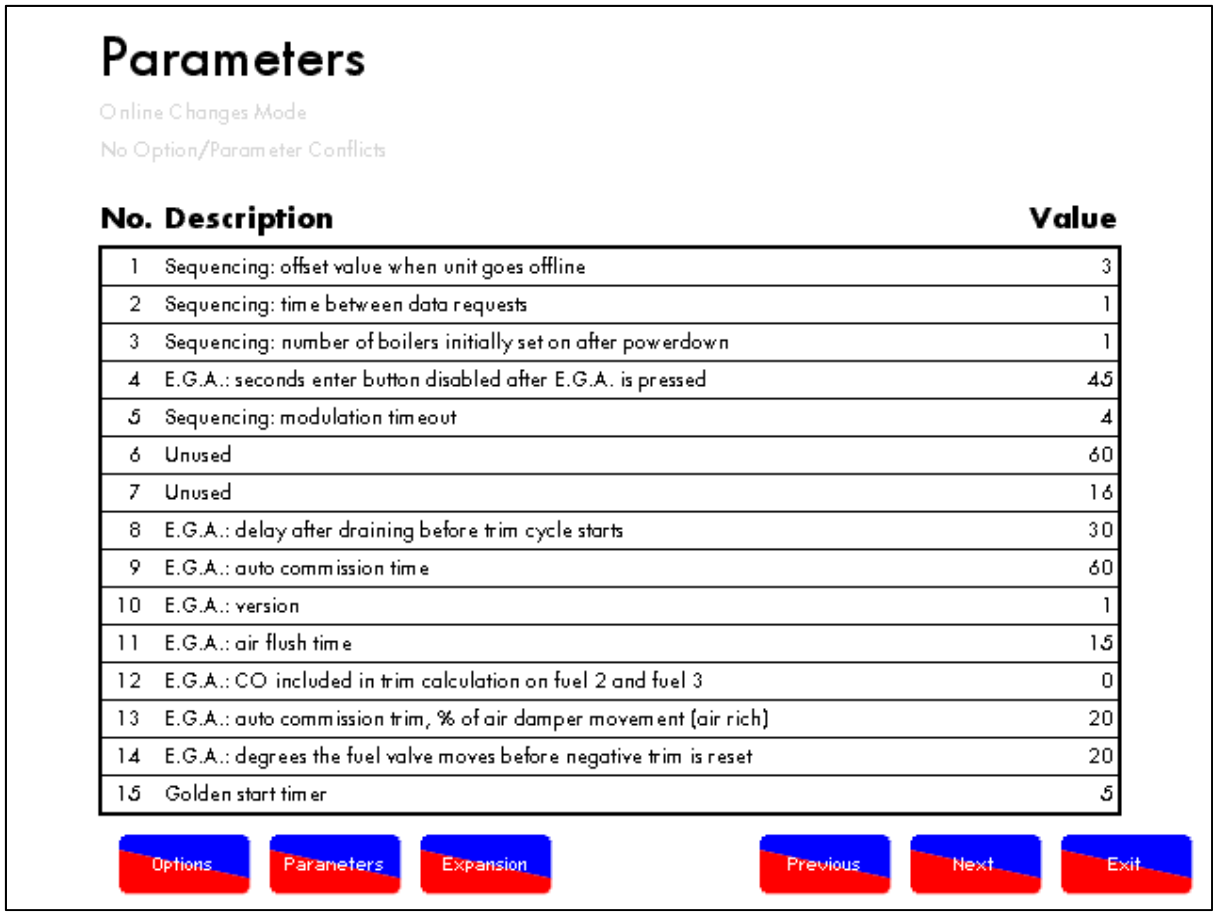


Figure 3.1.6.ii Parameters

Figure 3.1.6.ii shows the Parameters screen.

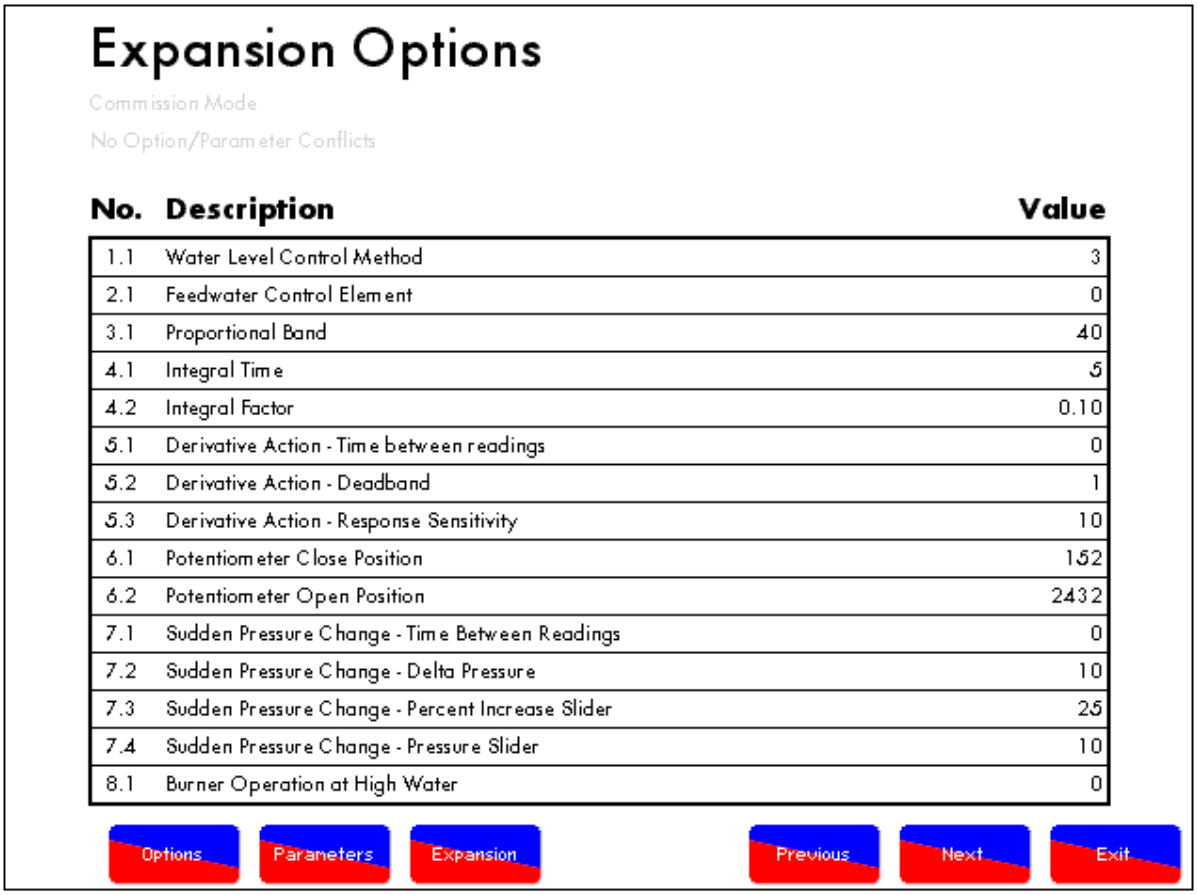


Figure 3.1.6.iii Expansion Options

Figure 3.1.6.iii shows the Expansion Options screen.

3.1.7 Setting the Time

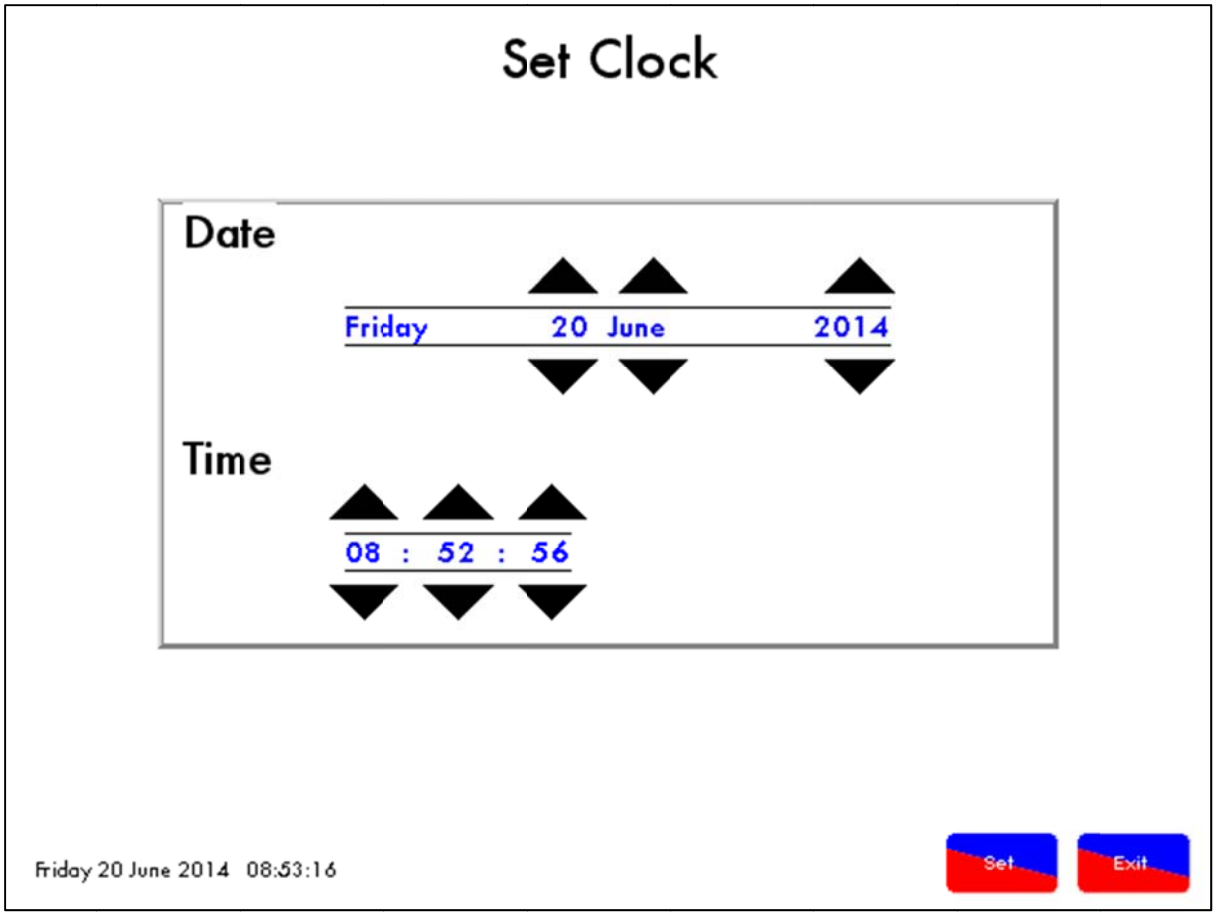


Figure 3.1.7.i Set Clock Screen

The set clock screen is used to set the time used for all functions within the Mk7 M.M. It is particularly important for logging functions such as lockout, errors and alarms.

1. Press the 

button to access the Set Clock screen.
2. Enter the Set Clock password (10, 10) using the keypad and press 

.
3. Use the  buttons to change the date and time.
4. Once complete press the 

button to save any changes or the 

button to leave the Set Clock screen without making any changes.

3.1.8 Setting Run Times

Figure 3.1.8.i Run Times Screen

The Run Times screen allows the user to set the times at which the burner will run and be switched off. The reduced setpoint is set on the status screen (3.1.9).

1. Press the Run Times button to access the Run Times screen.
2. Using the keypad enter the Run Times password (11, 11) and press Continue.
3. Directly beneath the Run Times heading is the current boiler status and if Run Times is enabled or disabled. By default this facility is disabled. To enable/disable press on the text to change.
4. Enabling the Run Time facility will enable the Run Times editing. Press on the day you wish to set the Run Times for.

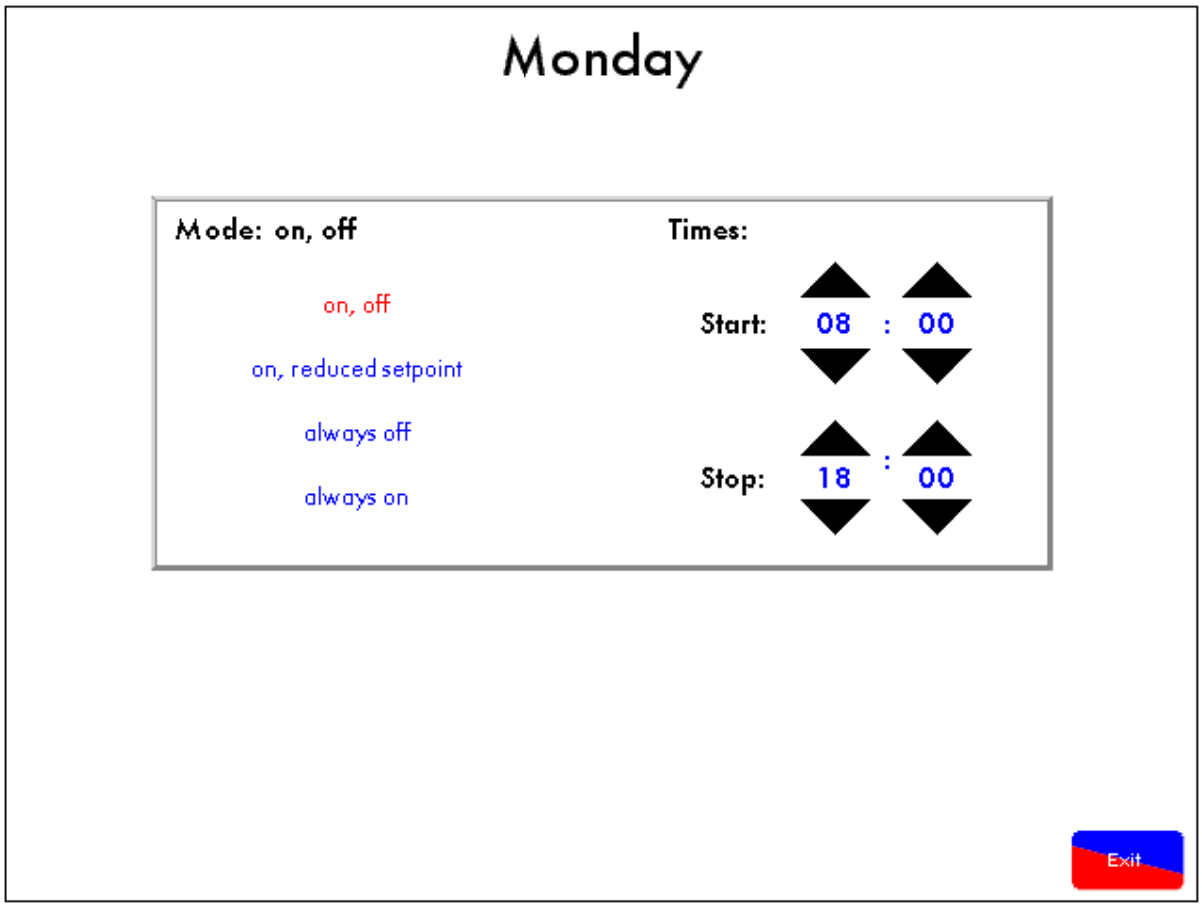


Figure 3.1.8.ii Run Times Editing Screen

5. Using the  buttons, select the time at which the burner starts (Start:) and the time the burner stops (Stop:). The mode of operation can also be selected by pressing the text applicable. Once the desired settings have been changed for the current day press the  button to return to the main Run Times screen.

   Note: The time range between the start and stop time refers to the ON times. All times outside of this range will be either off or in a reduced setpoint, depending upon which option is selected. For modes "always off" and "always on" the times section is disabled as this is no longer applicable.

6. Repeat steps 4 and 5 until each day has been set up as desired. Once complete, press the  button to record the changes or the  button to discard any changes made.

3.1.9 Status Screen

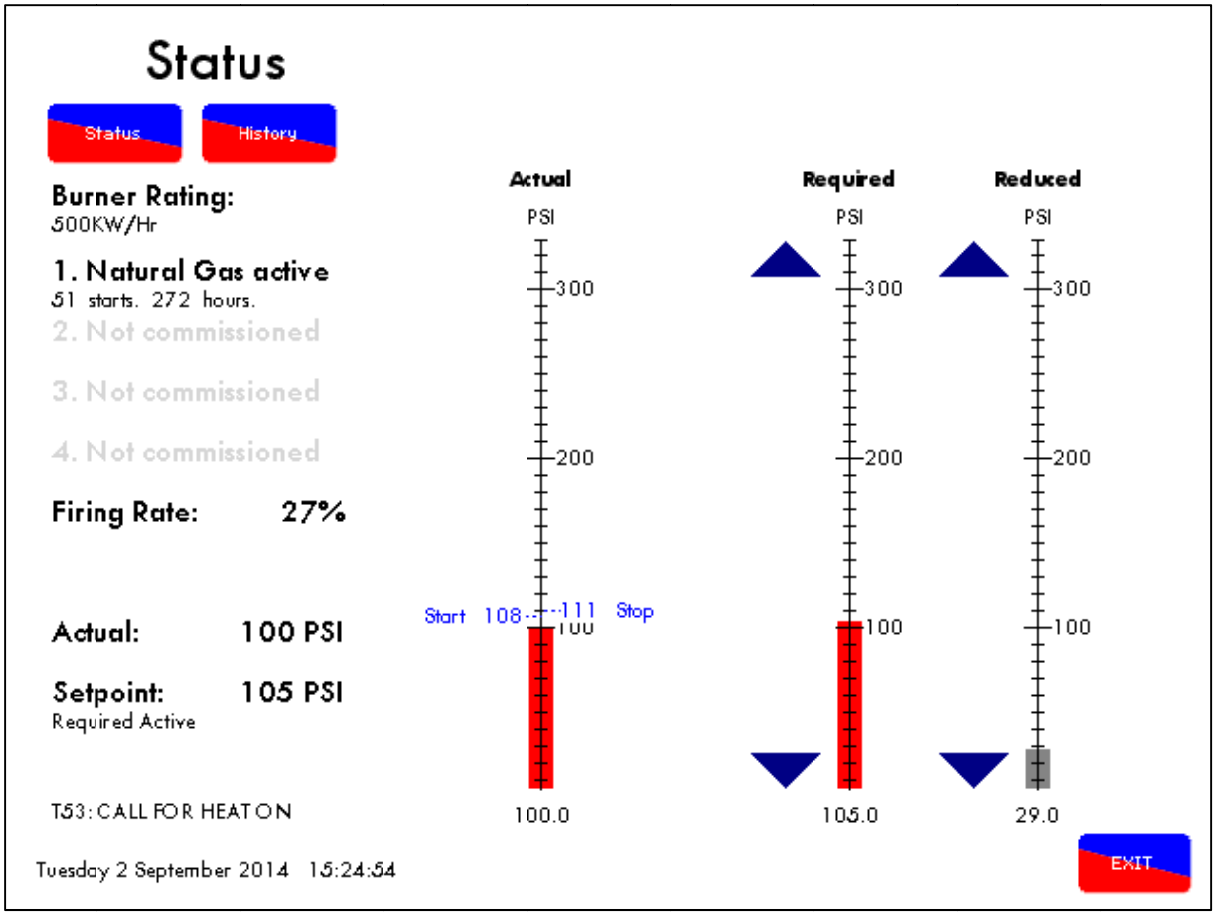


Figure 3.1.9.i Boiler Status Screen

The status screen allows the adjustment of the required and reduced setpoints using the arrows. It also displays the following information:

- The burner rating
- The current fuel being fired and the other available fuels along with how many times each fuel has been started and has run.
- The current firing rate along with the actual pressure/temperature and the setpoint pressure/temperature.
- The current T53 status (call for heat ON/OFF) and the current date and time.
- Burner start (Option 11) and burner stop (Option 10) pressure/temperature.
- Required setpoint. Note: If the required value has been locked the arrows shown in Figure 3.1.9.i will not appear.
- Reduced setpoint (Relates to Run Times Section 3.1.8)

Note: The colour of the bars on for the required and reduced setpoints indicate which is active/ inactive. Red = active, Grey = inactive.

To calibrate the actual value, go to Mk6 mode and press Display. Using the Button Hold function, press RUN and CH3 UP or DOWN to calibrate the actual readings.

3.1.10 Setpoint History Screen

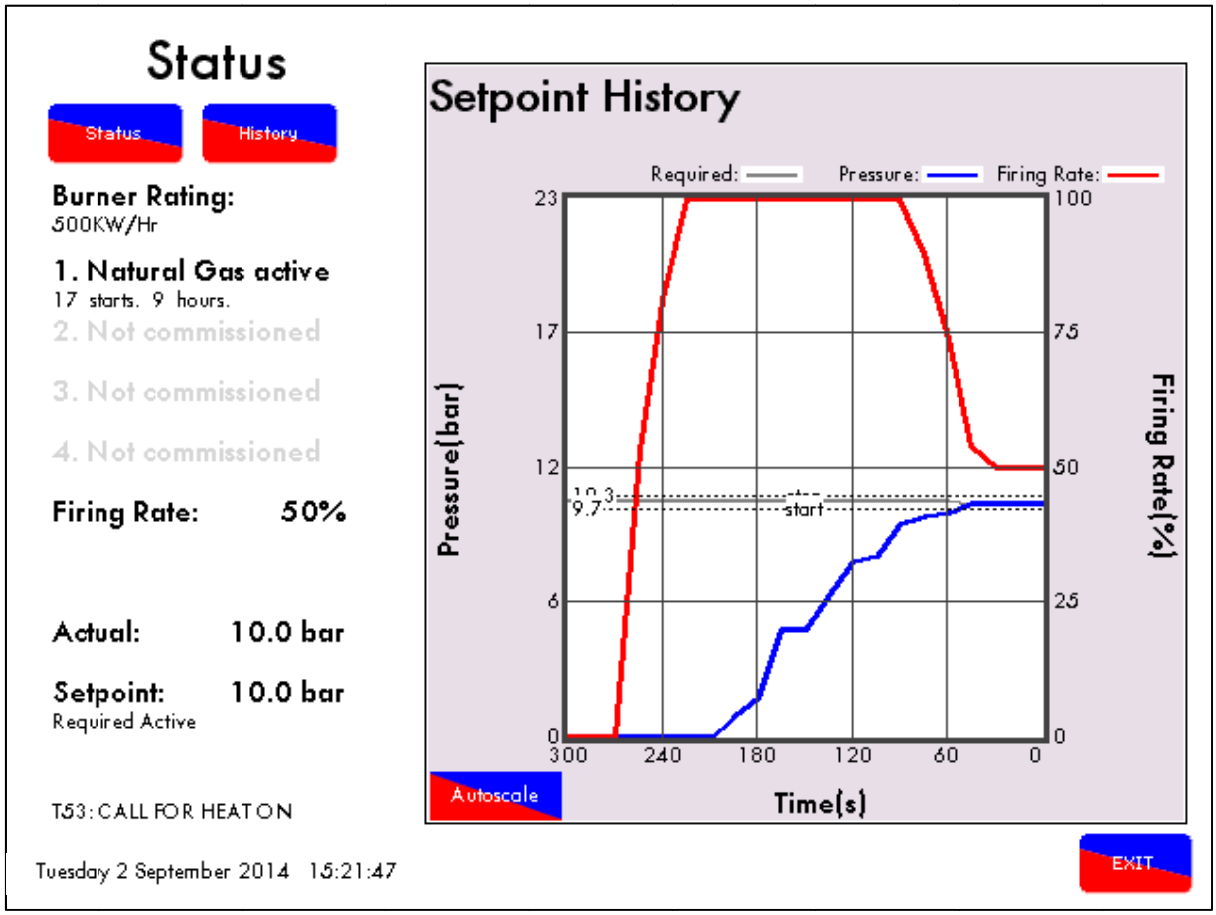


Figure 3.1.10.i Setpoint History Screen

Pressing the History button shows the setpoint history graph where values for required setpoint, actual pressure/temperature and firing rate for the past 24 hours are displayed.

Note: The drag buttons for scaling shown in Figure 3.1.10.i cannot be used if Autoscale is enabled.

Some important information from the previous screen still remains:

- The burner rating
- The current fuel being fired (highlighted) and the other available fuels along with how many times each fuel has been started and has run.
- The current firing rate along with the actual pressure/temperature and the setpoint pressure/temperature.
- The current T53 status (call for heat ON/OFF) and the current date and time.

3.1.11 M.M. Servomotor Channels Screen

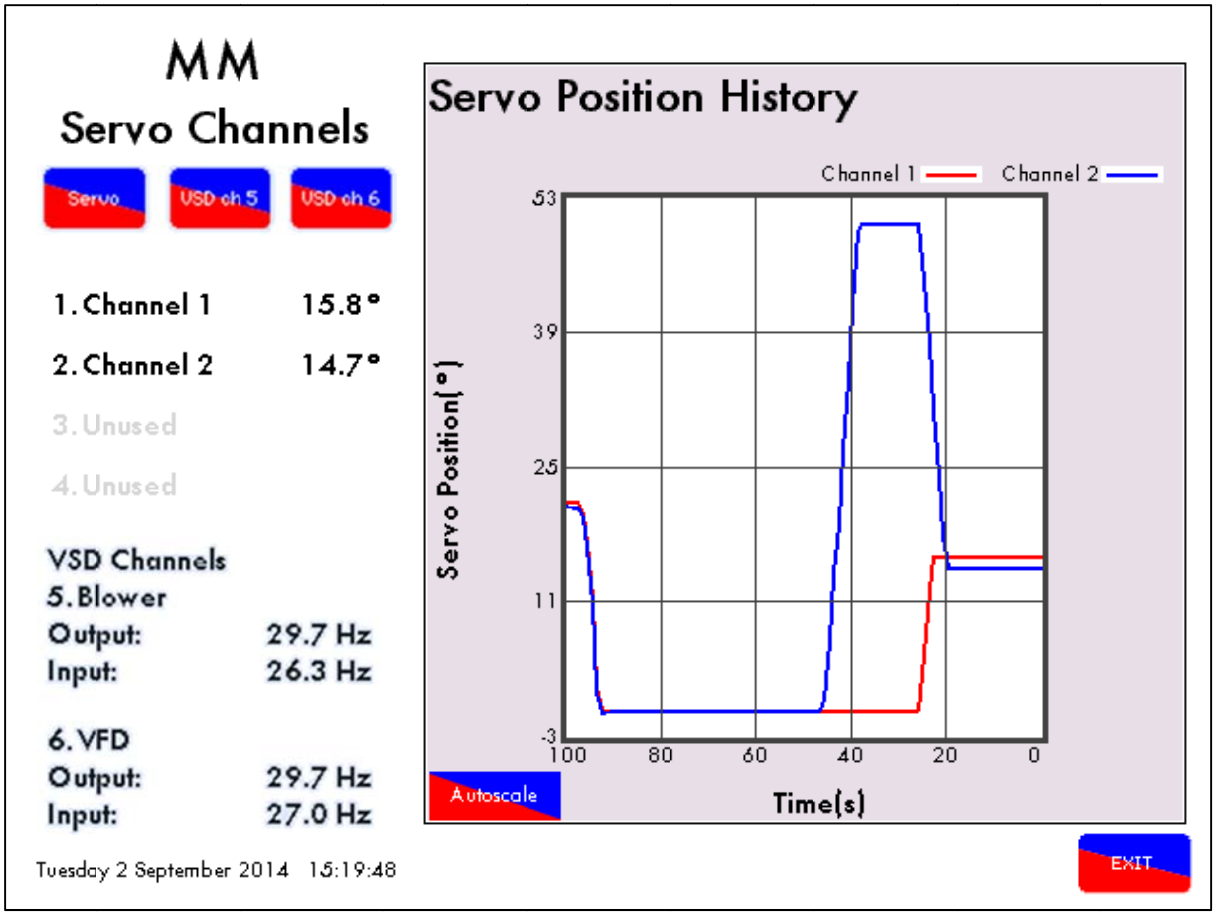


Figure 3.1.11.i M.M. Servomotor Position History

The M.M. servomotor channel screen displays current and historical servomotor positioning information as well as VSD information for every second, up to 96 minutes.

1. Current servomotor position
2. Current input and output values for the two VSD channels

If VSD channels are used, then the following buttons will show:

Displays VSD Channel 5 History.

Displays VSD Channel 6 History.

3.1.12 Flame Safeguard Screen

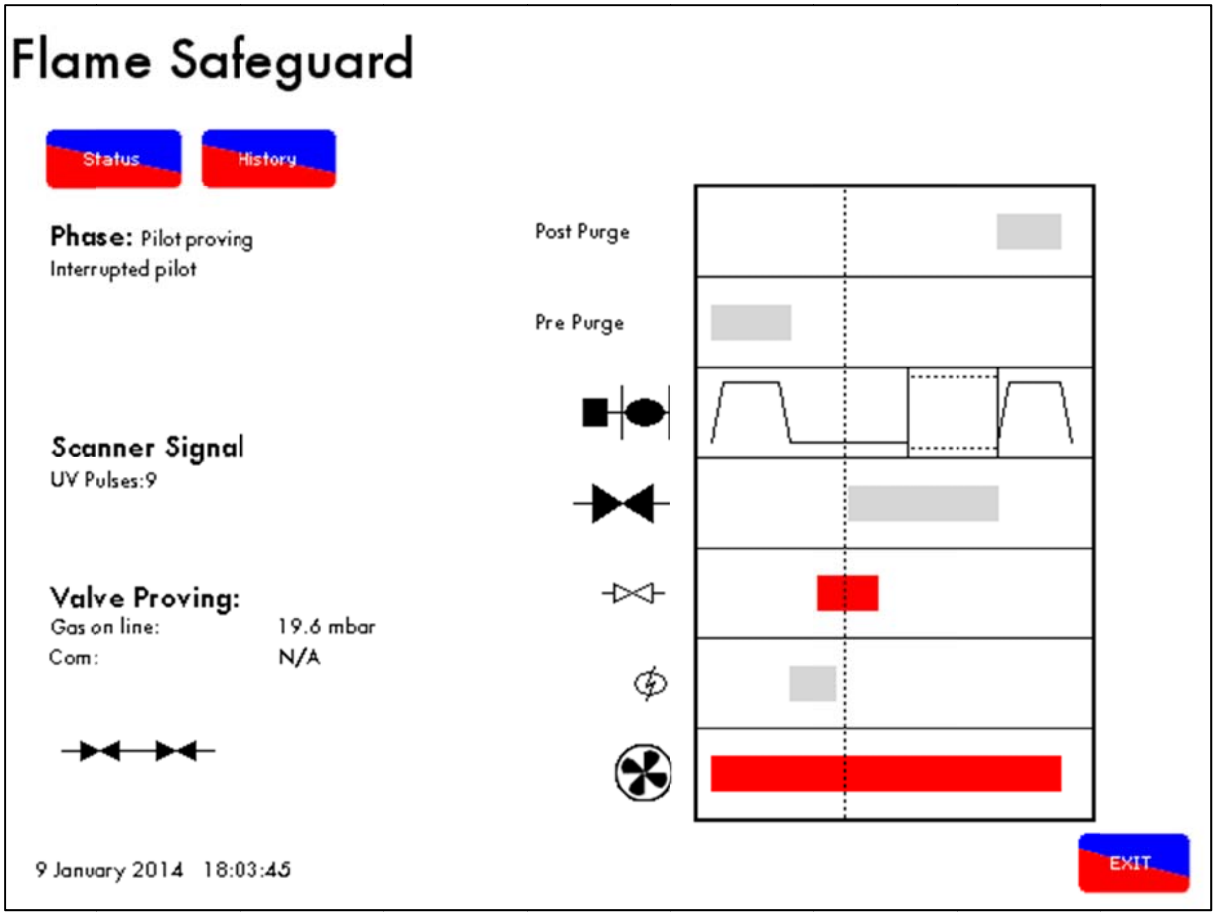


Figure 3.1.12.i Flame Safeguard Screen

The Flame Safeguard screen displays the current status of the system and associated valves.

- The current phase of the M.M. will update to display the current checks in real time.
- If a flame scanner is optioned, the current signal strength will be shown here. This section only appears in the presence of a compatible scanner.
- When VPS is optioned, this section displays the valve arrangement and the current status of each valve during the Valve Proving Sequence. If an Autoflame gas sensor is used for the proving, the current gas concentration will be displayed from start-up to shut down.

Throughout the entire firing sequence, the vertical dotted line will move horizontally showing the currently active components. The inactive components are shown in grey and active in red.

- The Pre and Post Purge times
- Blower motor position
- Main Gas Valve
- Start Gas Valve
- (Pre-) Ignition
- Air motor/VSD

Please refer to section 3.2 for the burner start-up sequence.

3.1.13 Intelligent Boiler Sequencing

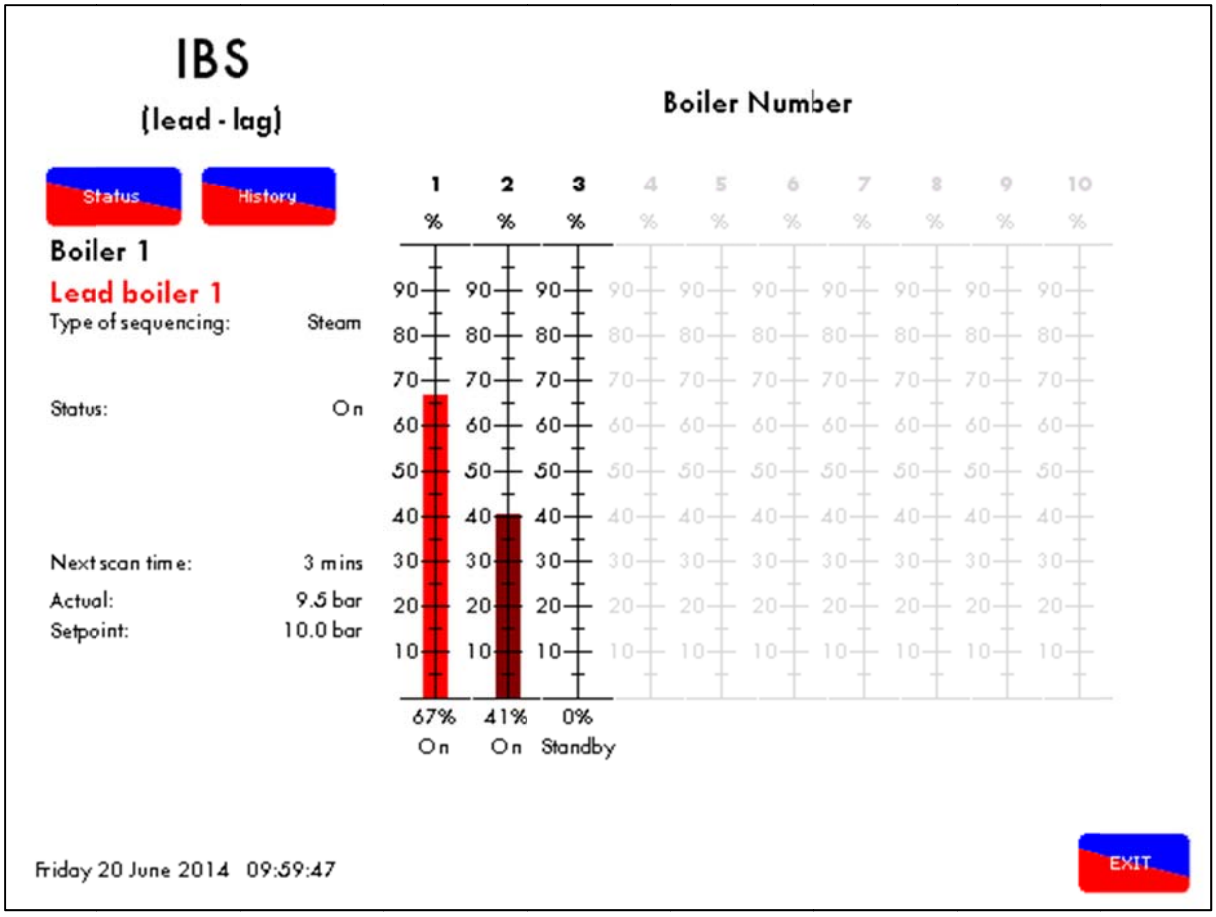


Figure 3.1.13.i IBS Screen

The IBS screen shows the current status of all the boilers that are setup for IBS. It displays which boiler is the lead boiler (red bar) and current status of the boiler.

- The current M.M./Boiler ID and the selected lead boiler
- IBS information for the current boiler
- Required setpoint, actual pressure and phantom setpoint information. It also displays the type of sequencing for the current boiler.
- Boiler Number
- Firing Rate for each boiler
- Current Burner status (On/Off/Standby)

Pressing this button will display the firing rate for each IBS boiler over the past 24 hours (Figure 3.1.13.iii).

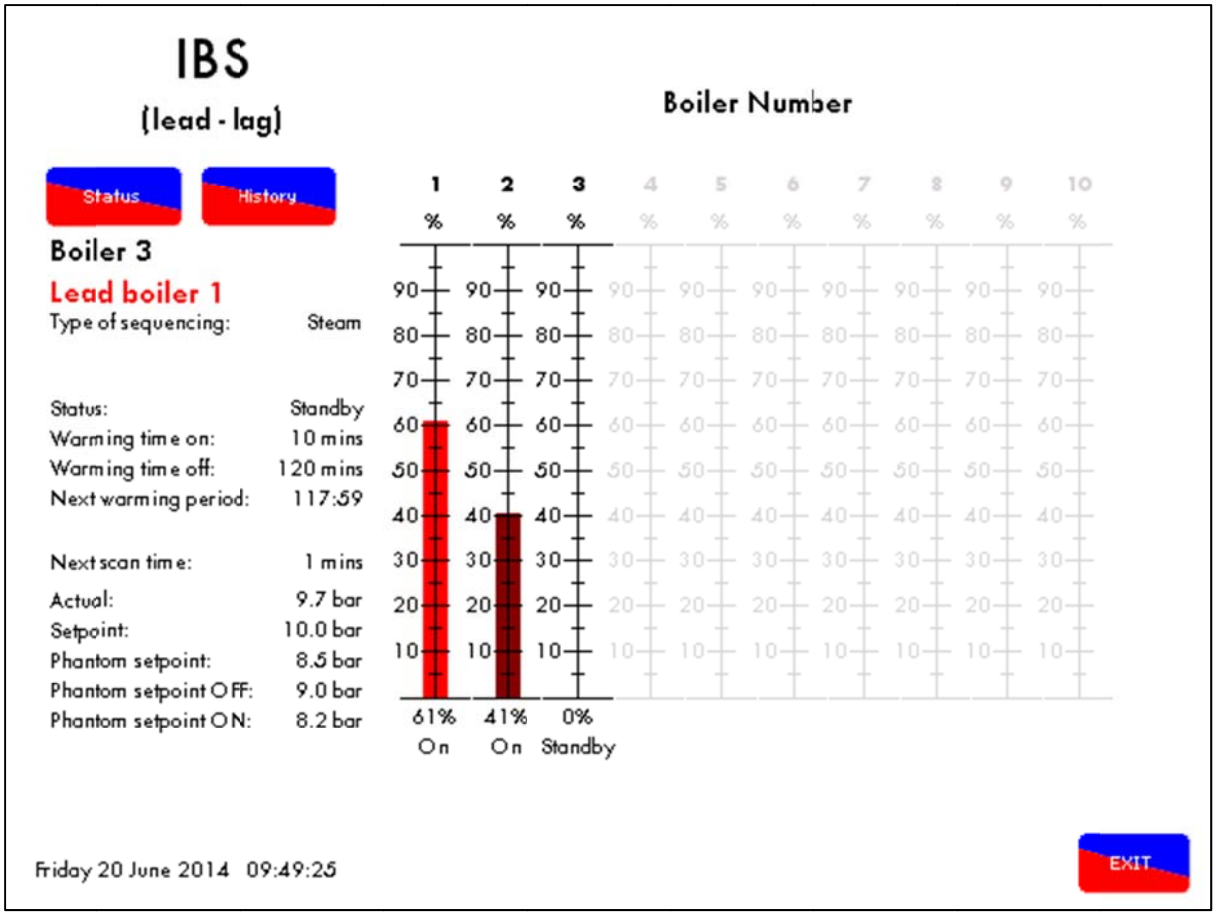


Figure 3.1.13.ii Standby Boiler Screen

The IBS status screen on the lag boiler shows the information on the warming phase for steam boilers:

- Status
- Warming on and off times
- Time until next warming period
- Next scan time
- Phantom setpoint
- Phantom setpoint above and below offset

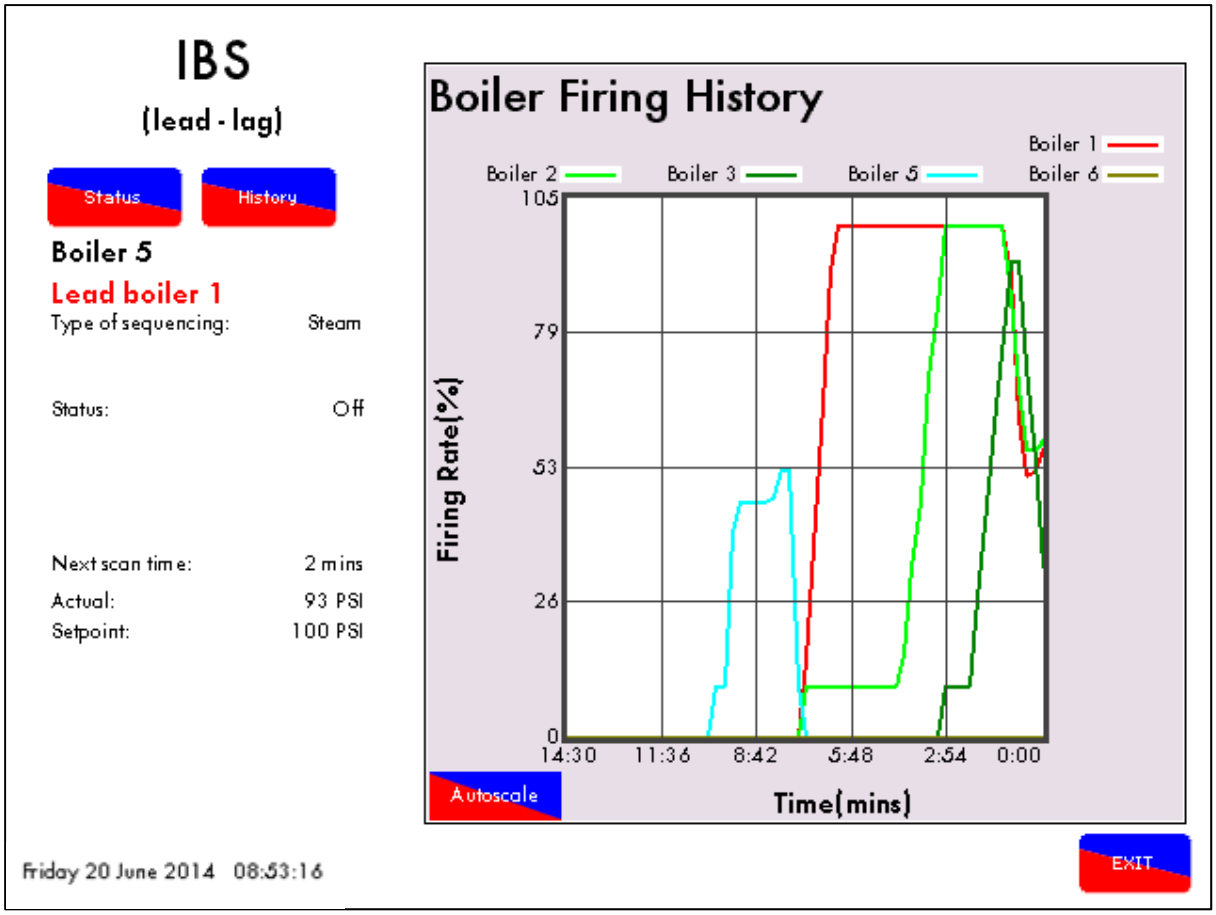


Figure 3.1.13.iii IBS History Screen

Press History on the IBS status screen to get the firing rate history for all the boilers in that sequence loop. Pressing the boiler number will select/deselect that boiler history from the graph. The graph can also be scaled by dragging 2 points on the axis in Figure 3.1.13.iii or by pressing the Autoscale button.

3.1.14 Fuel Flow Screen

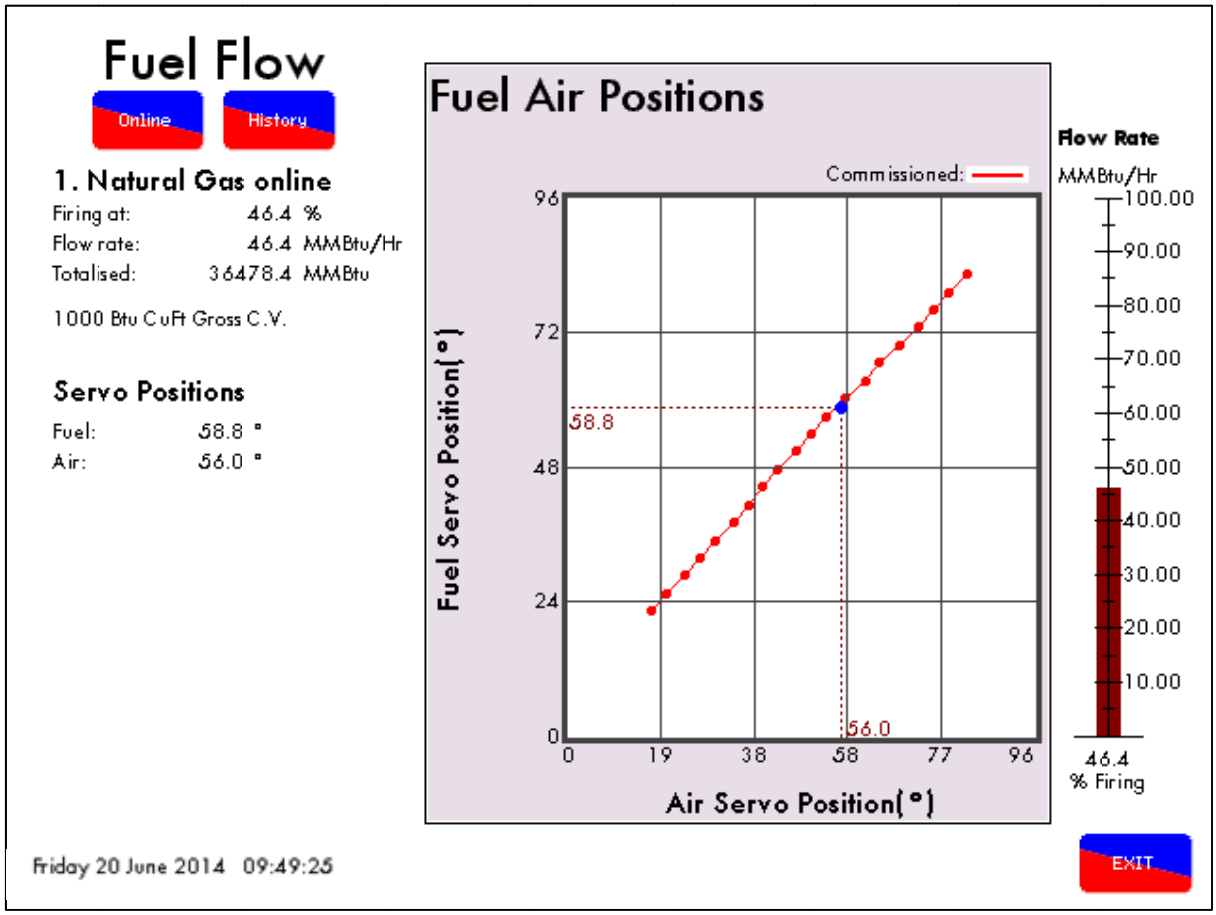
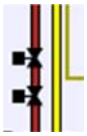


Figure 3.1.14.i Fuel Flow Screen



Press the fuel lines on the Home Screen to access the Fuel Flow screen. This screen shows the commissioned fuel curve for both fuel and air servomotor positions. It also displays the current rate of fuel flow at the current positions and the following:

- Firing rate, flow rate and totalised consumption of all fuels fired
- Current positions of the fuel and air servomotors
- Current flow rate at current servomotor positions

Note: Shown on the above screen are commissioned fuel-air values making up the fuel curve. Each red dot is an Inter point on the commission curve. Pressing on a point inside the commissioned line will display the corresponding fuel and air servo positions.

3.1.15 Valve Proving System

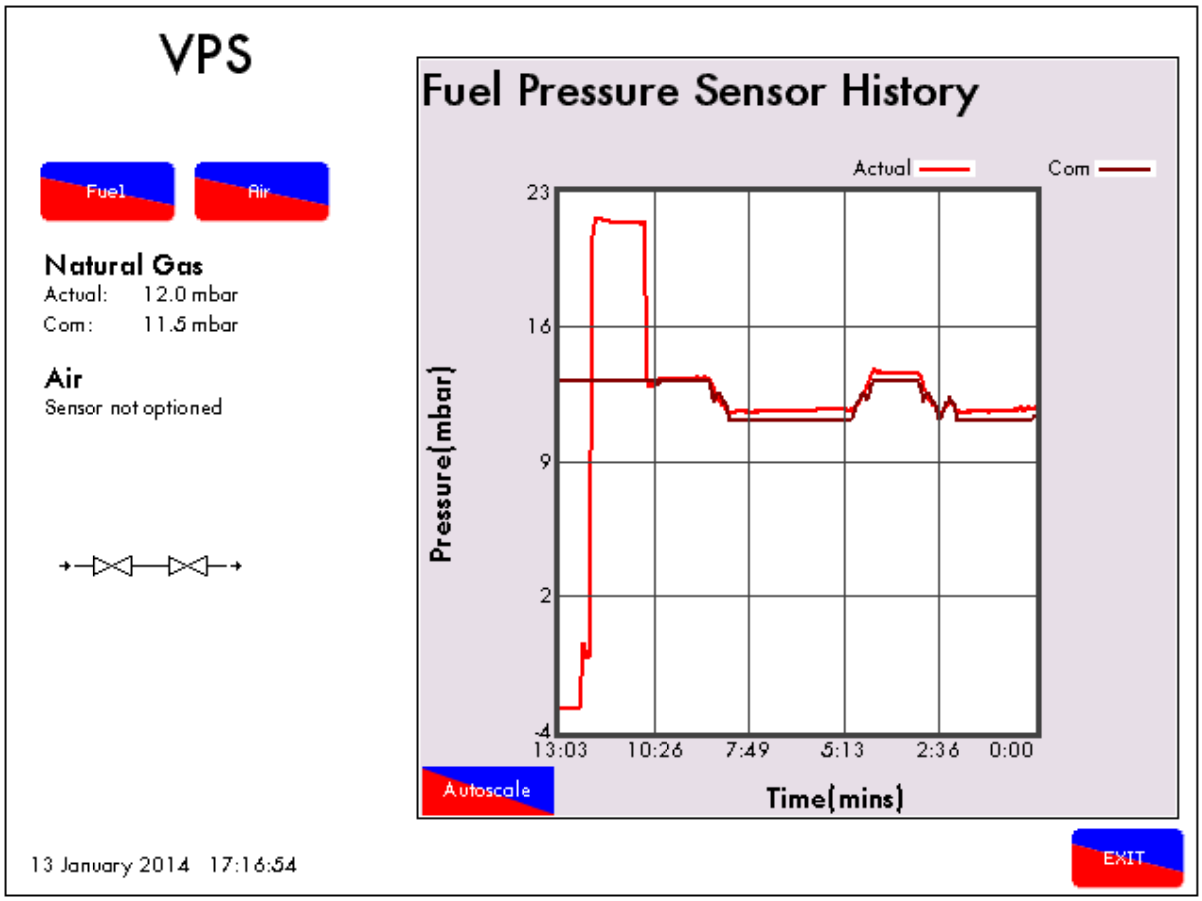


Figure 3.1.15.i Valve Proving System Screen

Press  or  on the Home Screen to access the fuel pressure sensor history. The VPS screen in Figure 3.1.15.i delivers the fuel and air pressure readings from burner start up to a maximum of 24 hours showing the following:

- Commissioned and current fuel pressure
- Commissioned and current air pressure

Pressing this button will give the air pressure history graph.

Pressing this button will give the fuel pressure history graph.

3.1.16 E.G.A. Screen

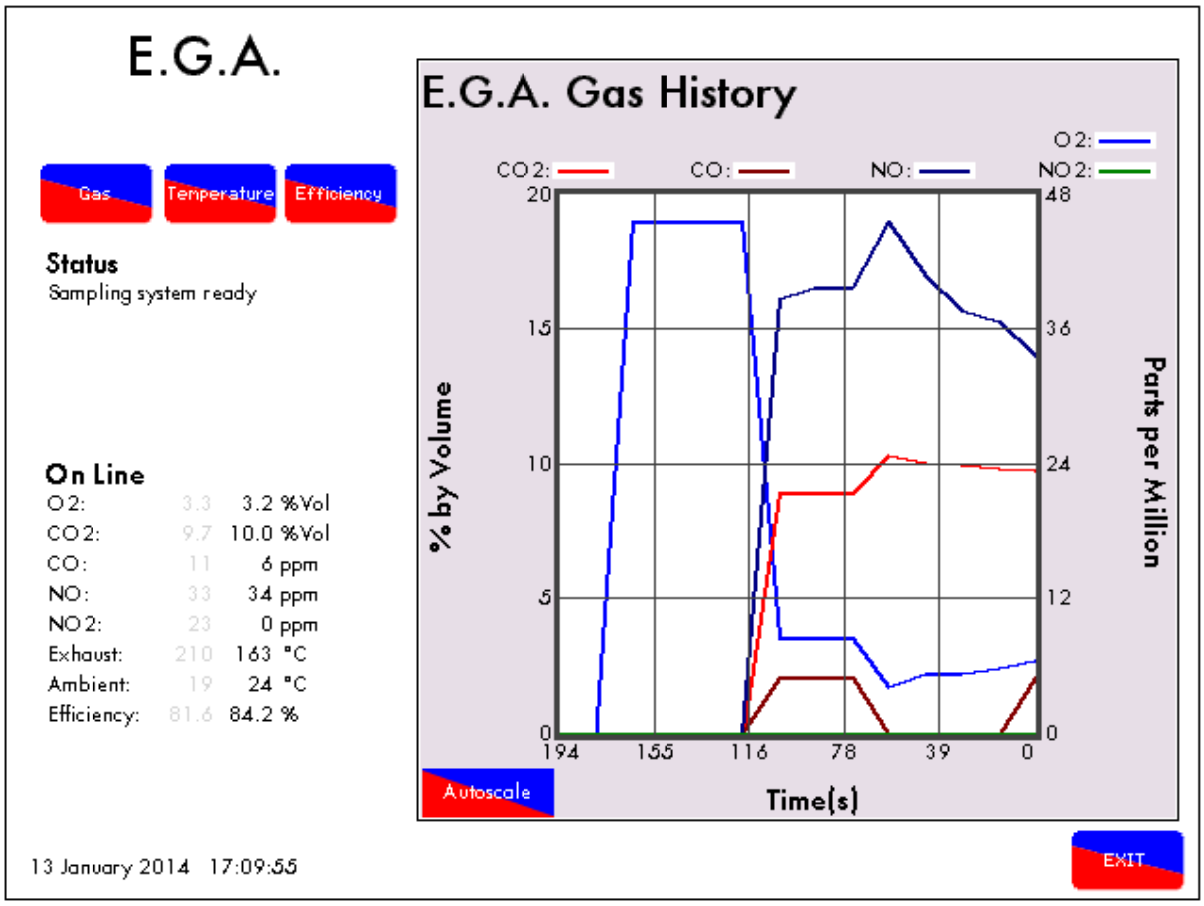


Figure 3.1.16.i E.G.A. Screen

Press the E.G.A. box on the Home Screen to access the E.G.A. history. Upon entering the E.G.A. screen the display shows:

- The current E.G.A. status (e.g. calibrating, sampling, etc.)
- The gas values at time of commissioning
- The current values for each cell, the current temperatures and combustion efficiency

Pressing this button will display the gas history graph. This graph shows the measured gas history for the past 24 hours.

Pressing this button will display the temperature history screen, both the ambient and exhaust gas temperature is displayed for the past 24 hours.

Pressing this button will display the efficiency history graph showing the combustion efficiency over the past 24 hours.

3.1.17 Combustion Map Screen

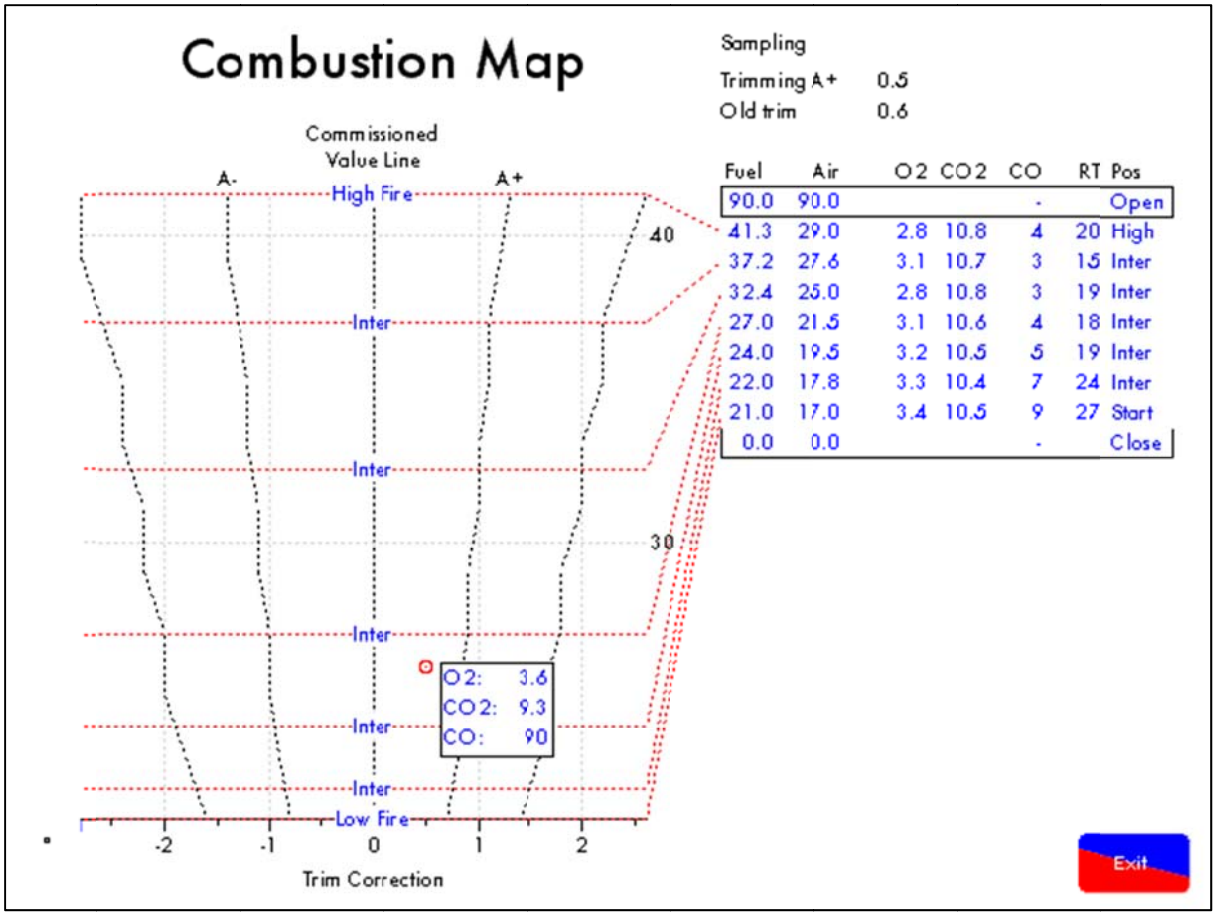


Figure 3.1.17.i Combustion Map Screen

If the E.G.A. is functioning in trim mode, the combustion map gives a real time visual indication of the 3 parameter trim function working to keep the combustion levels as near as possible to the commissioned combustion levels.

Press the Combustion Map button on the Home Screen to access the combustion map, which clearly shows the fuel curve positions on the right along with the commissioned E.G.A. values for O_2, CO_2 and CO. The graphic on the left of the screen shows the amount of trim being added or subtracted by the Mk7 M.M. to control the emissions values. The red circle indicates the current position of the trim and the current combustion values.

3.1.18 Water Level Screen

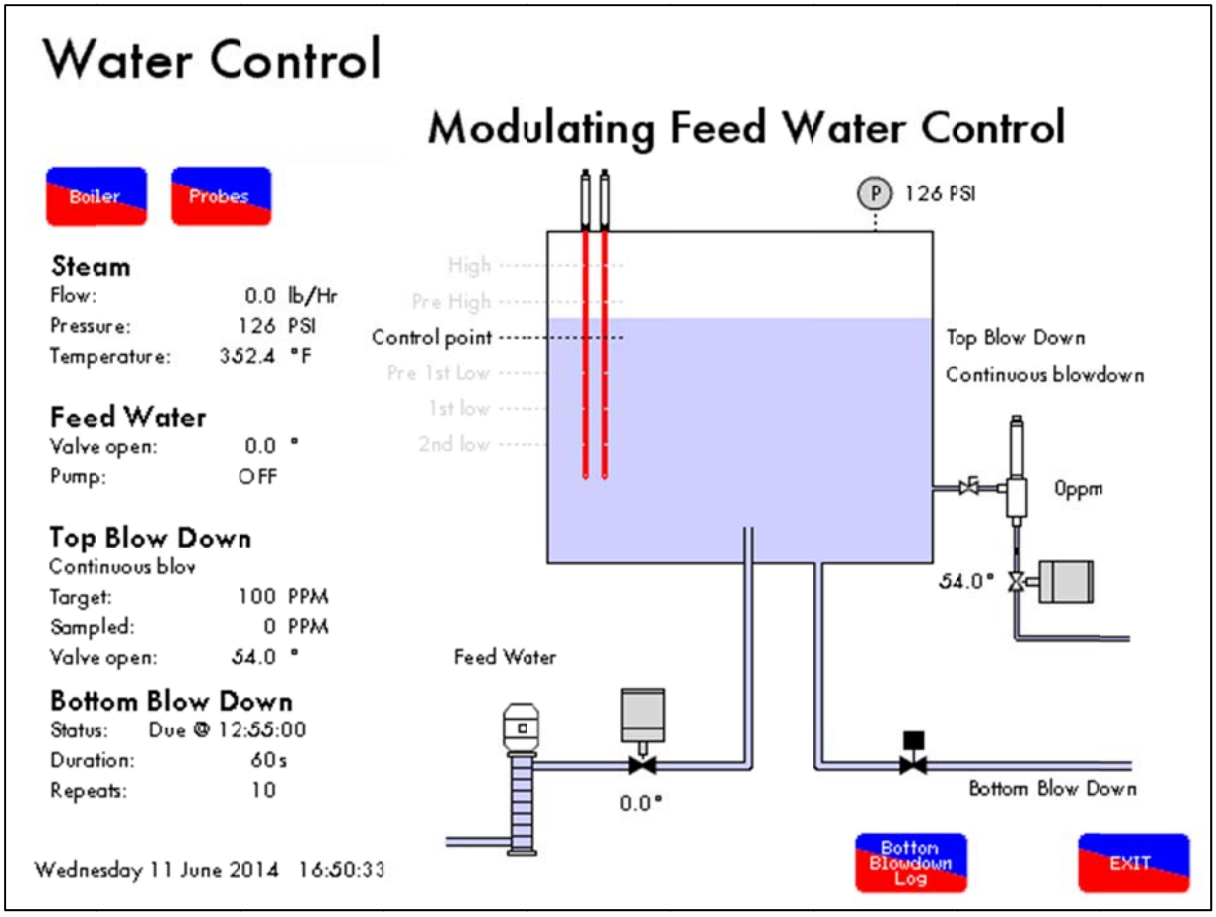


Figure 3.1.18.i Water Level Home Screen

Press the Water Level button on the Home Screen to access water level screen. This will show the following information for water level control functions optioned:

- Steam Information: the current rate of flow of steam, current pressure of steam and the temperature of the steam.
- Feed Water information: temperature of the feed water, current angular degrees of the feed water valve and pump status (on/off).
- Top Blow Down information: Interval between samples, target solute concentration and sampled solute concentration.
- Bottom Blow Down information: current status (on/off), duration of each bottom blow down and number of repeats.
- Feed Water pump.
- Feed Water temperature sensor and currently sampled temperature.
- Feed Water valve and current angular position.
- Capacitance Probes.
- Current Operating point (Level of water measured)
- Current steam pressure.
- Current Top Blow Down status and currently sampled solute density.
- Bottom Blow Down valve (on/off).

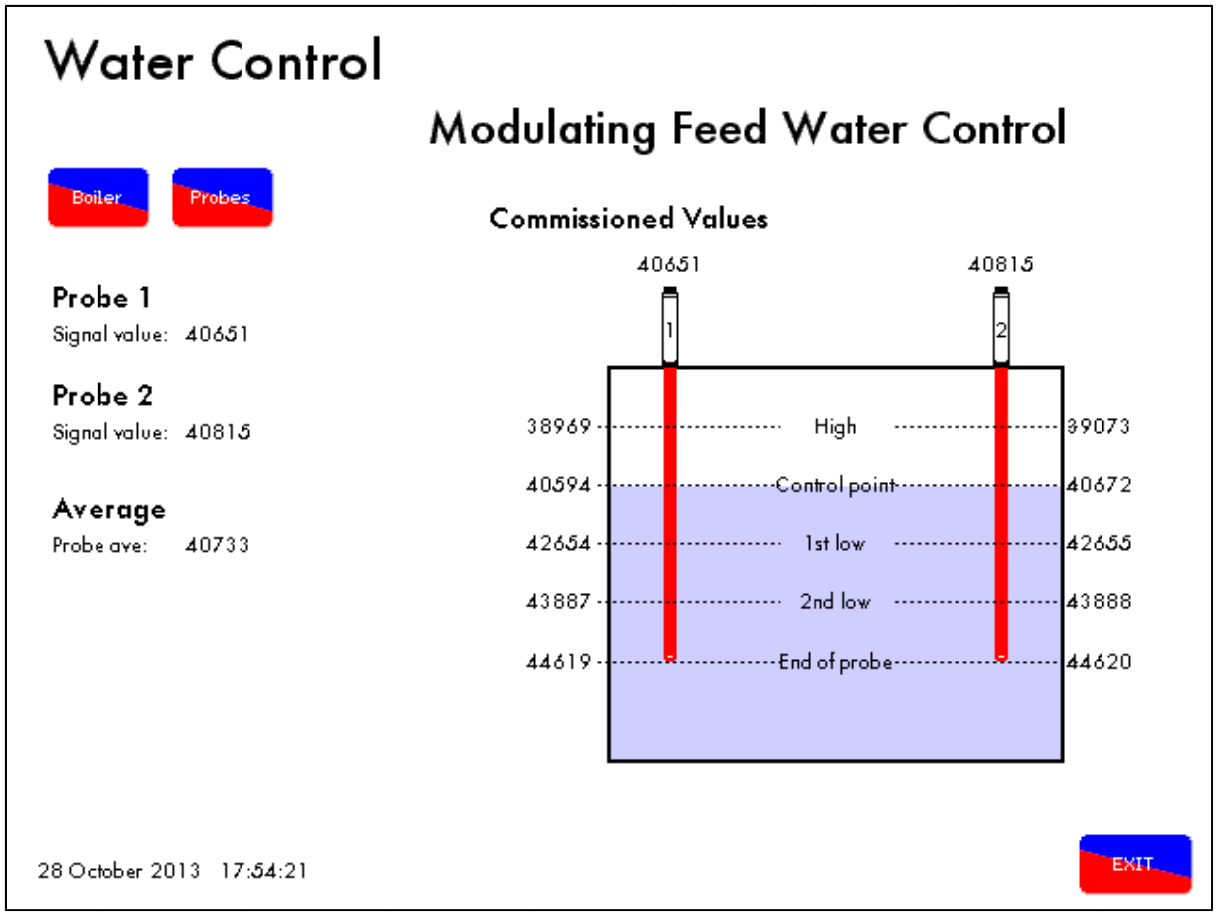


Figure 3.1.18.ii Water Level Capacitance Probes Screen

Press 

on the Water Level screen or the probes on the Home screen to view information on the probe readings and the control levels:

- Current capacitance values for probes 1 and 2.
- The average of the two probe values.
- Commissioned capacitance values for each control point.

3.1.19 Steam Flow Metering Screen

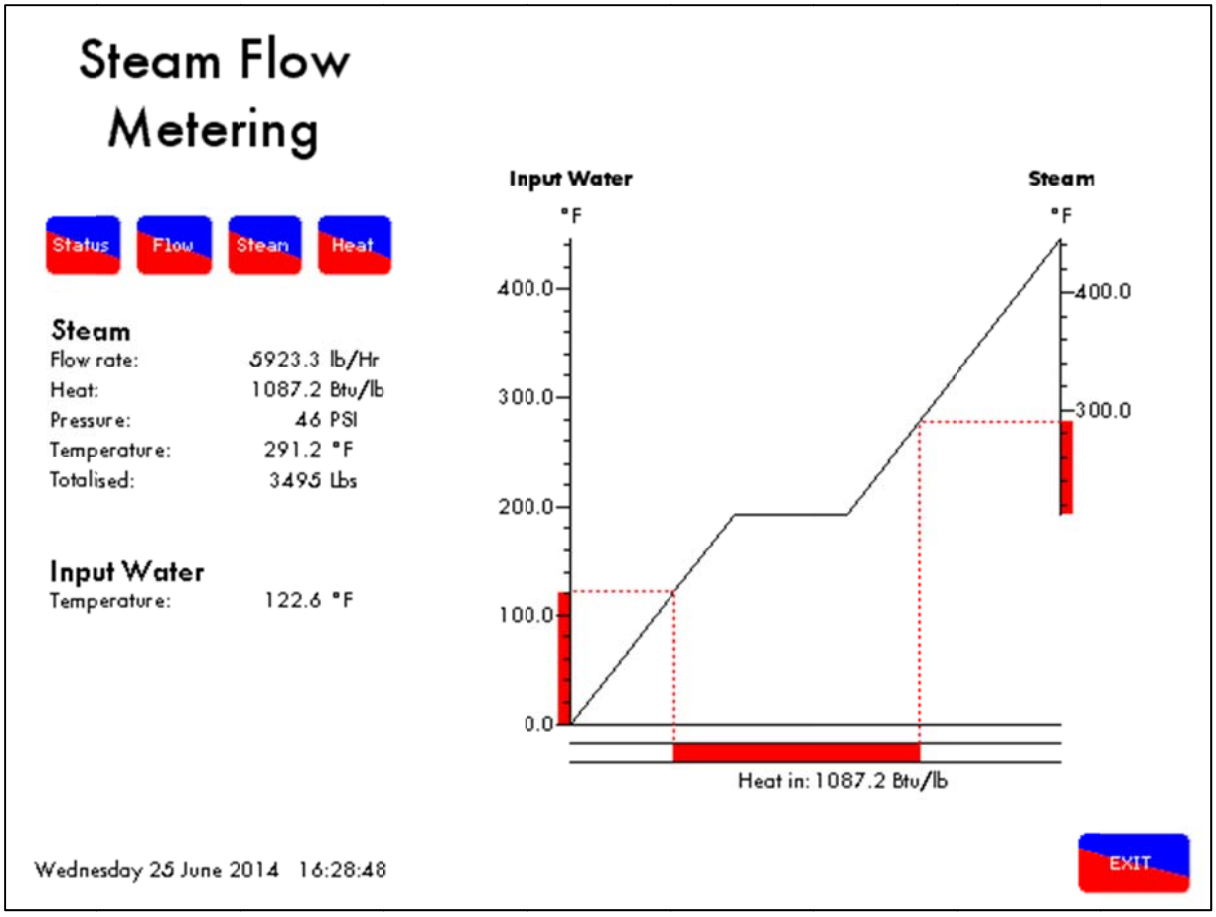


Figure 3.1.19.i Steam Flow Metering Screen

Press the steam temperature sensor  on the Home Screen to access the steam flow metering screens. This screen gives the following information:

- Steam flow rate (steam output rate)
- Heat input to produce said steam
- Current steam pressure
- Current steam temperature calculated based on current steam pressure
- Totalised steam
- Current feed water temperature

For more information on water level control and steam flow metering, please refer to the Mk7 Manual: Expansion Board End User Guide.

3.1.20 Outside Temperature Compensation Screen

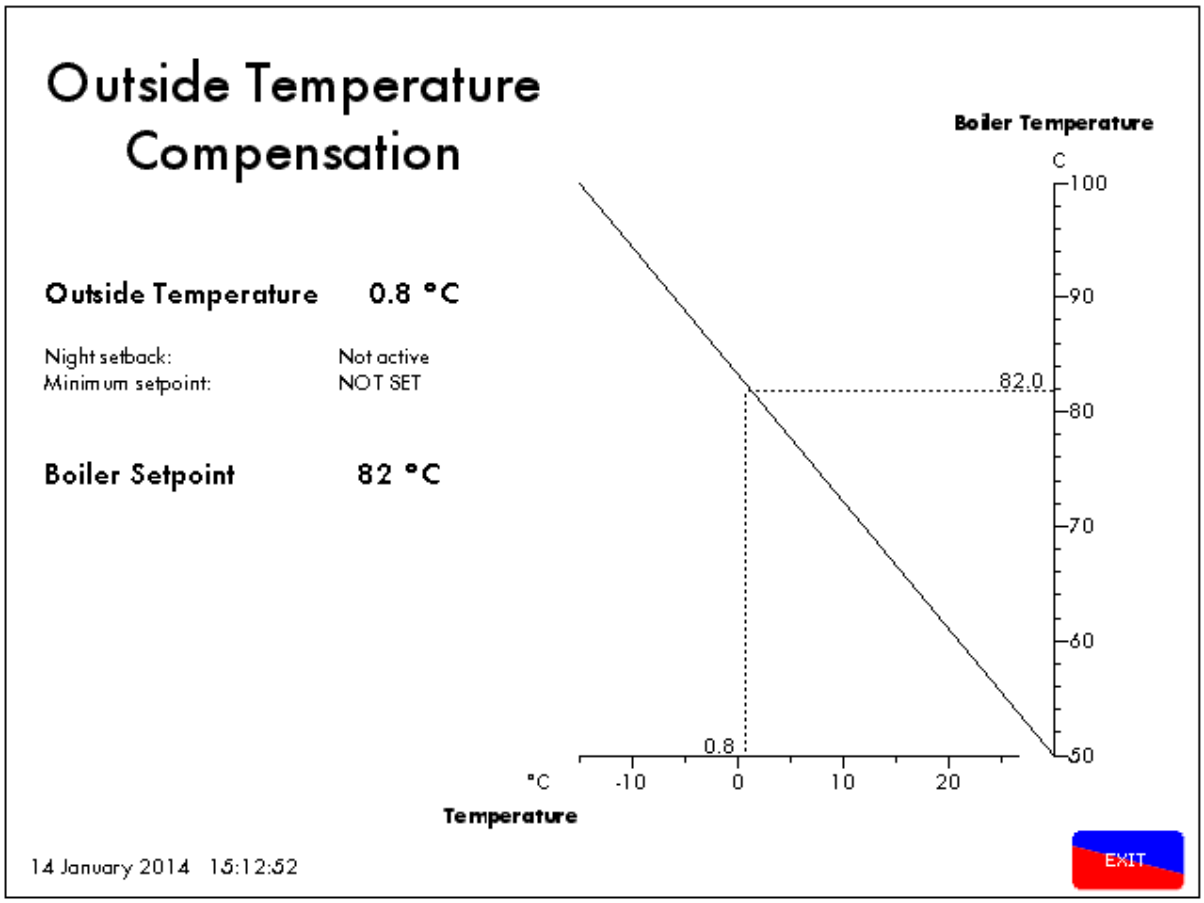


Figure 3.1.20.i Outside Temperature Compensation Screen

Press  on the home screen to access the Outside Temperature Compensation screen, enabled by setting option 80. The following information is shown:

- Maximum boiler required setpoint at minimum outside temperature (Option 81).
- Minimum outside temperature (Option 82).
- Current outside temperature and calculated required setpoint.
- Maximum outside temperature (Option 84).
- Minimum boiler required setpoint at maximum outside temperature (Option 83).

Note: If the actual outside temperature exceeds the boundaries set by Options 82 and 84, the boiler setpoint will remain at the maximum or minimum setpoints specified by Options 81 and 83.

3.1.21 Lockout Record Screen

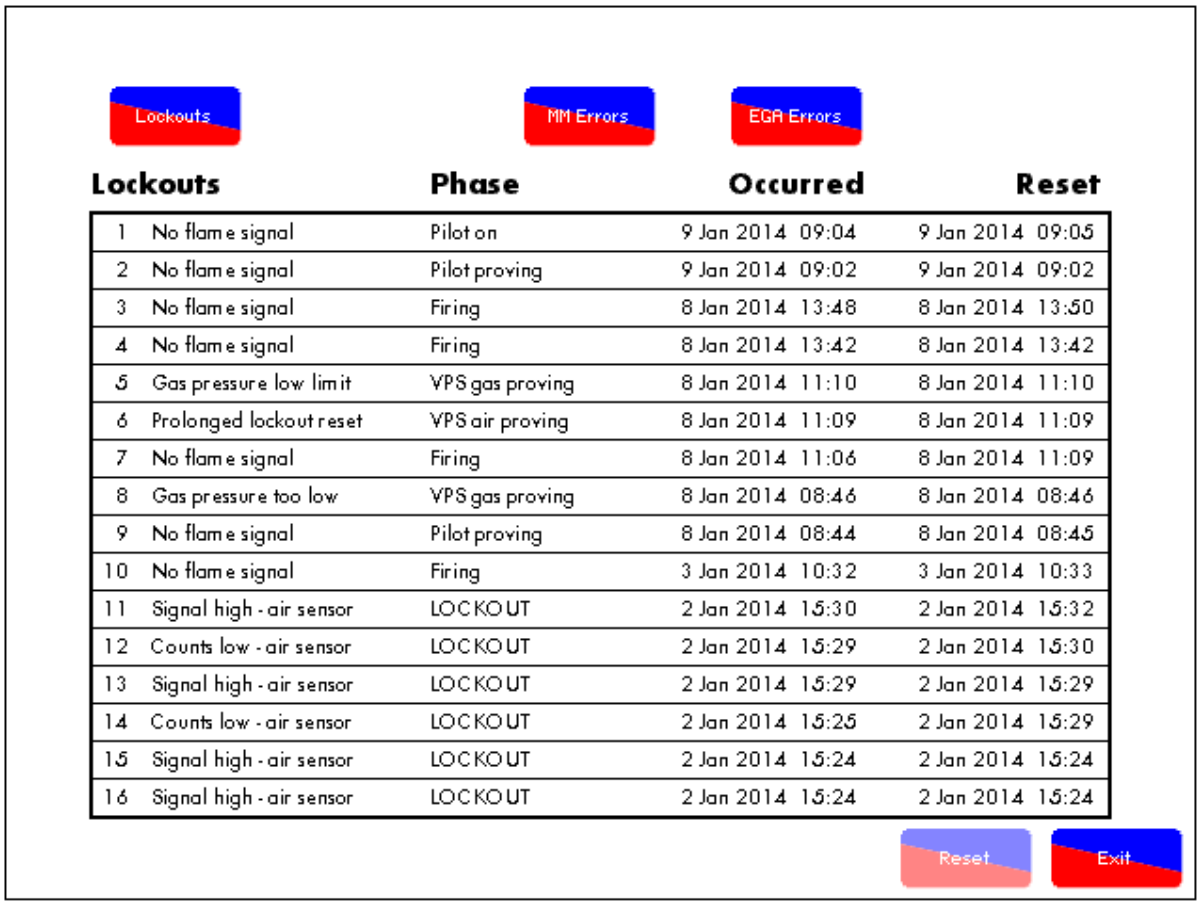


Figure 3.1.21.i Lockout Record Screen

Press the 

on the Home Screen, and then 

to view the fault log up to 16 burner lockouts. For each burner lockout, the following information is displayed:

- Lockout description
- Phase of the firing sequence at which lockout occurred
- Date and time of the lockout.
- Date and time when the lockout was reset.

To reset a lockout press Reset or input to terminal 56.

Note: The time used is the global time which is set in Section 3.1.7.

3.1.22 M.M. Errors Screen

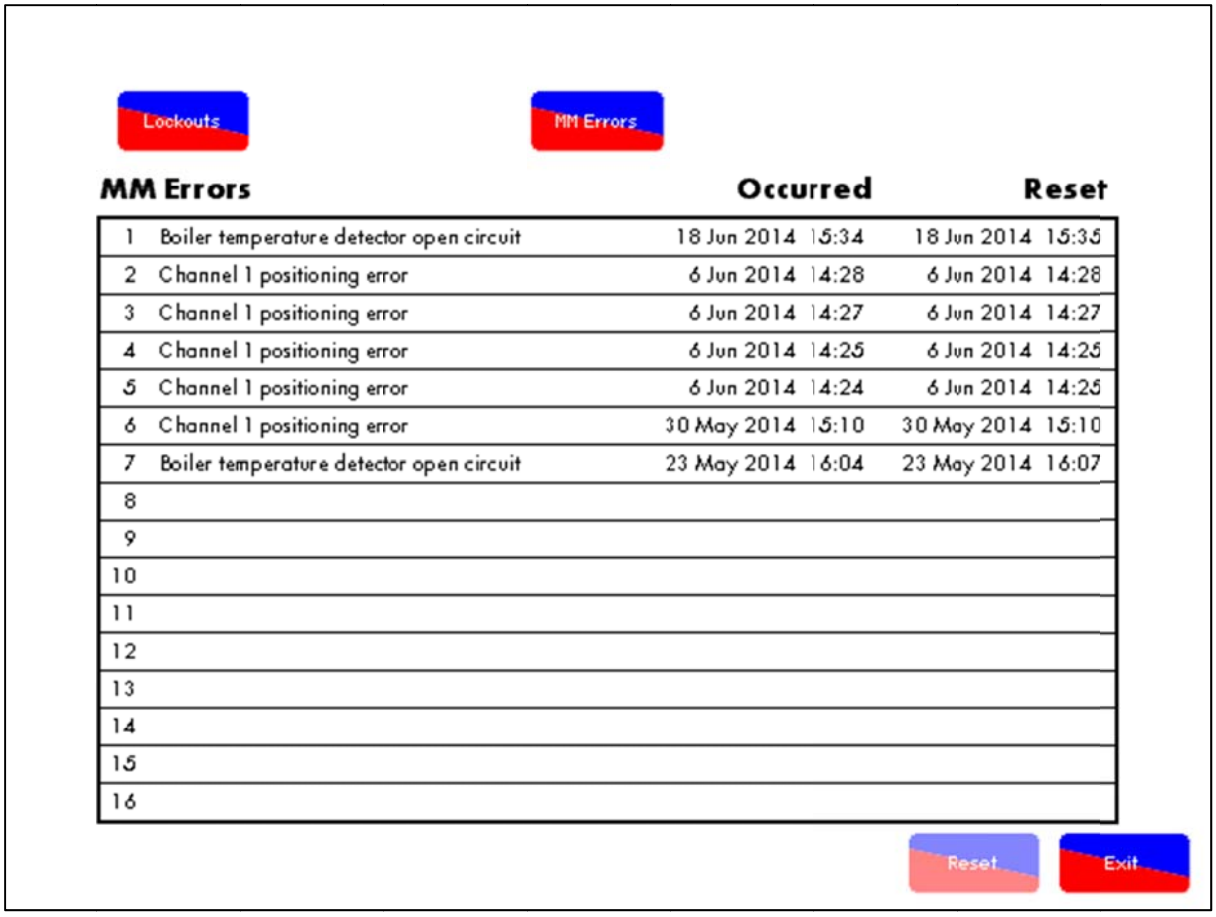


Figure 3.1.22.i M.M. Errors screen

After entering the fault log screen, press 

to view up to 16 M.M. errors with the following information:

- The cause of the error (Please refer to Section 4.1 for a list of error codes).
- The date and time when the error occurred.
- The date and time when the error was reset.

After the M.M. has been restarted the error screen will reappear until the cause of the error has been resolved. To reset an error power cycle the M.M.

3.1.23 Expansion Board Alarms Screen

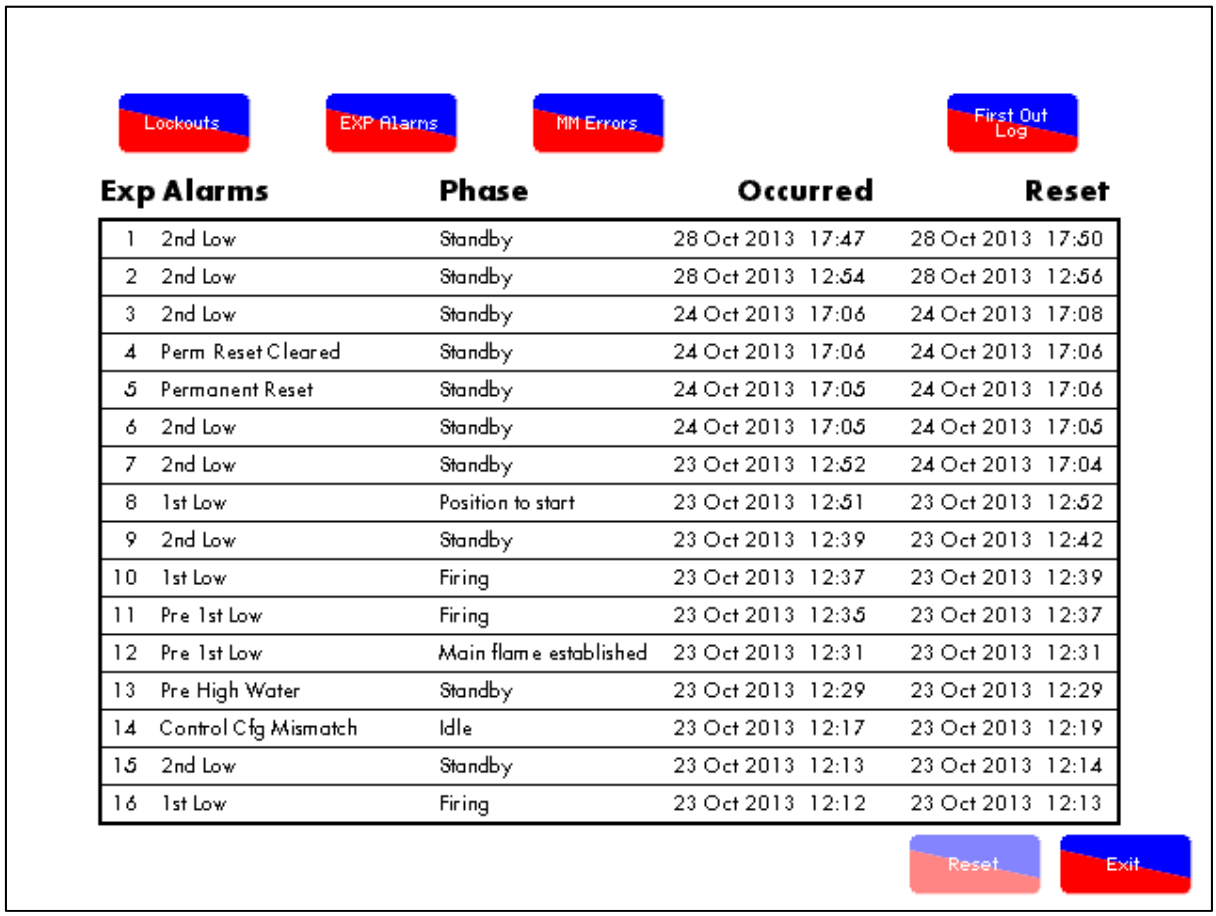


Figure 3.1.23.i Expansion Board Alarms Screen

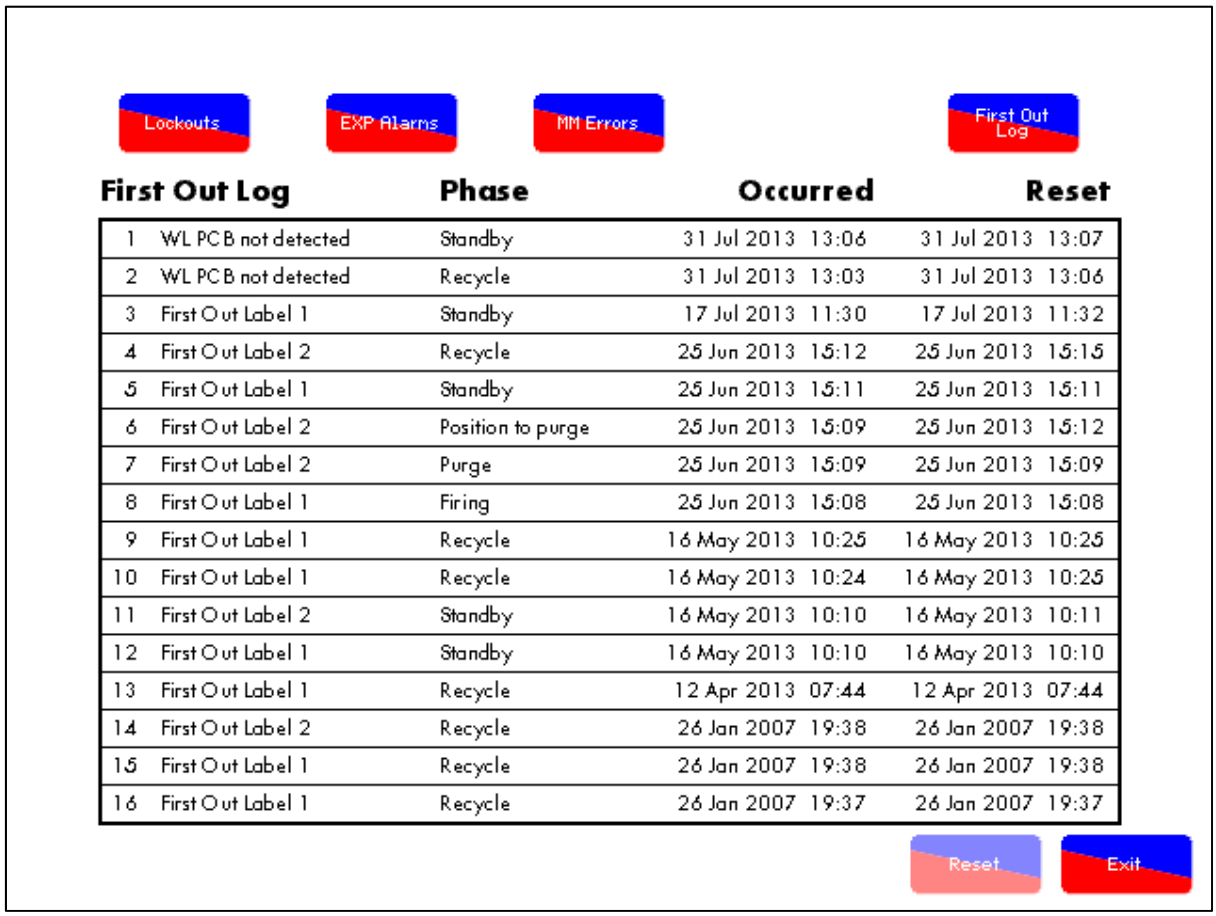
If an expansion board is active, on the fault log screen press 

to display the last 16 expansion board alarms, with the following information:

- The type of Expansion Board alarm
- Phase of the firing sequence at which the lockout occurred
- The date and time at which the alarm occurred
- Date and time when the alarm was reset

To reset an expansion board alarm, press Reset.

3.1.24 First Out Alarms Screen



First Out Log		Phase	Occurred	Reset
1	WL PCB not detected	Standby	31 Jul 2013 13:06	31 Jul 2013 13:07
2	WL PCB not detected	Recycle	31 Jul 2013 13:03	31 Jul 2013 13:06
3	First Out Label 1	Standby	17 Jul 2013 11:30	17 Jul 2013 11:32
4	First Out Label 2	Recycle	25 Jun 2013 15:12	25 Jun 2013 15:15
5	First Out Label 1	Standby	25 Jun 2013 15:11	25 Jun 2013 15:11
6	First Out Label 2	Position to purge	25 Jun 2013 15:09	25 Jun 2013 15:12
7	First Out Label 2	Purge	25 Jun 2013 15:09	25 Jun 2013 15:09
8	First Out Label 1	Firing	25 Jun 2013 15:08	25 Jun 2013 15:08
9	First Out Label 1	Recycle	16 May 2013 10:25	16 May 2013 10:25
10	First Out Label 1	Recycle	16 May 2013 10:24	16 May 2013 10:25
11	First Out Label 2	Standby	16 May 2013 10:10	16 May 2013 10:11
12	First Out Label 1	Standby	16 May 2013 10:10	16 May 2013 10:10
13	First Out Label 1	Recycle	12 Apr 2013 07:44	12 Apr 2013 07:44
14	First Out Label 2	Recycle	26 Jan 2007 19:38	26 Jan 2007 19:38
15	First Out Label 1	Recycle	26 Jan 2007 19:38	26 Jan 2007 19:38
16	First Out Label 1	Recycle	26 Jan 2007 19:37	26 Jan 2007 19:37

Figure 3.1.24.i First Out Alarms Screen

Press 

to display the last 16 First Out alarms with the following information:

- Description of first out
- Phase in which first out alarm occurred
- Date and time occurred
- Data and time reset

To reset a non-recycling First Out press Reset.

Note: When a First Out is set to Recycle, the First Out alarm will reset itself if the applicable First Out connection becomes inactive (i.e.no longer failing).

3.2 Start-Up Sequence

The M.M. goes through a series of internal checks and flame safeguard, before starting up a burner; these are relevant to the burner application. Any errors or lockouts which might occur in the start-up sequence will provide information on the time and date occurred, and the phase in which it occurs. If any errors or lockouts occur, please contact Autoflame Engineering Ltd or your local Autoflame Tech Centre.

The following start-up sequence is shown for an example burner application. The system has been set up with these burner control features.

- 3 Valve proving system
- No golden start
- No FGR
- Interrupted pilot
- UV Scanner
- Firing on gas
- Air switch
- Air sensor

3.2.1 Recycle

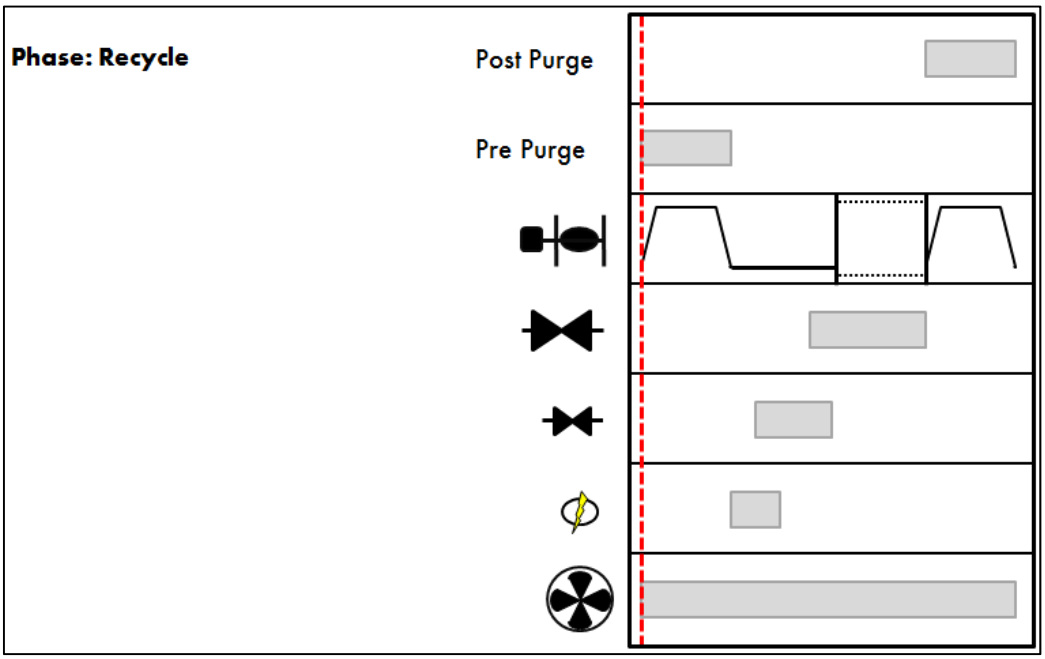


Figure 3.2.1.i Recycle

When the burner enters the Recycle phase, both the fuel valves and air damper go to their respective 'closed' positions, and the burner is not firing.

The UV scanner will be in operation as the burner is off in this phase, so there should not be any flames. The error that might occur here is 'Simulated Flame,' which could be the result of not adding a burner post-purge for an application where after-burn is likely, following a burner shutdown. See option/parameters 118 and 135.

While the M.M. is in the Recycle phase, if T53 is ON, there will be a time delay before the burner starts up. See option/parameter 119.

3.2.2 Standby

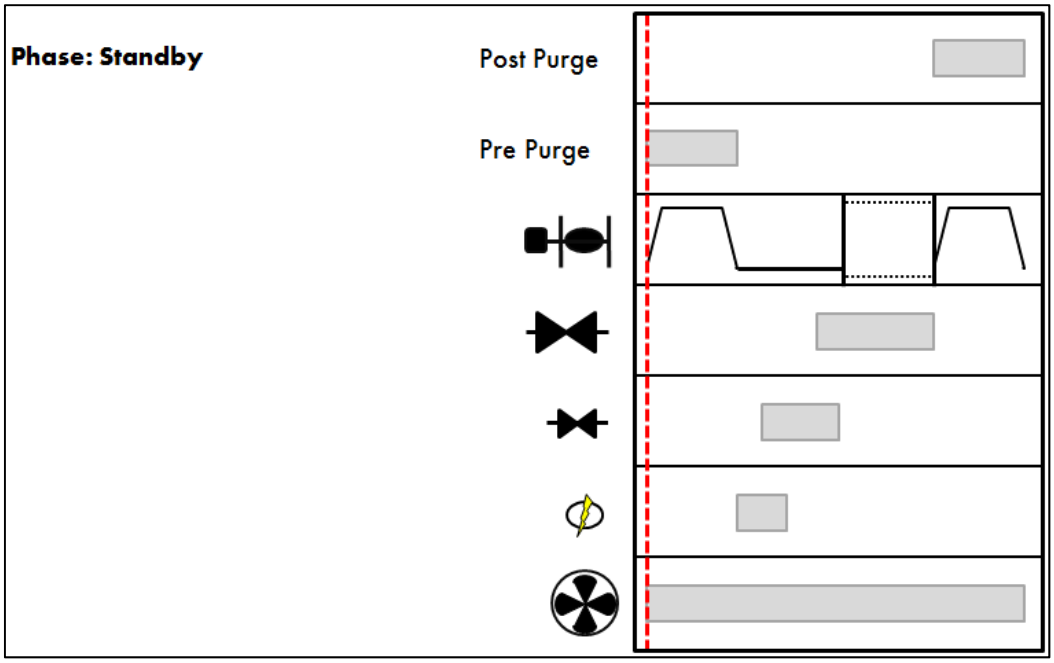


Figure 3.2.2.i Standby

The burner will go into Standby before the safety checks begin to initiate the burner start-up sequence.

The M.M. will remain in this phase if it is waiting for a call for heat via the internal stat, subject to the required setpoint and the load demand. The external safety interlock circuit is tied into Terminal 53, so this also must be ready for the burner to be switched on, to move to the next phase.

The M.M. will also sit in Standby if the internal stat has been switched off. It will move to the next phase when the actual temperature/ pressure of the system has reached the burner's on range, set as an offset value of the required temperature/ pressure. See options 9, 10 and 11.

If there is water level control for a steam boiler application, any alarms on the water level will need to be reset before the M.M. comes out of Standby. See options 16, 41, 42, 43, 44, 53 and 54.

The Standby phase is also part of the Intelligent Boiler Sequencing, so the M.M. will also be in Standby if it is a lag boiler and not required to contribute to the system.

3.2.3 Internal Relay Tests

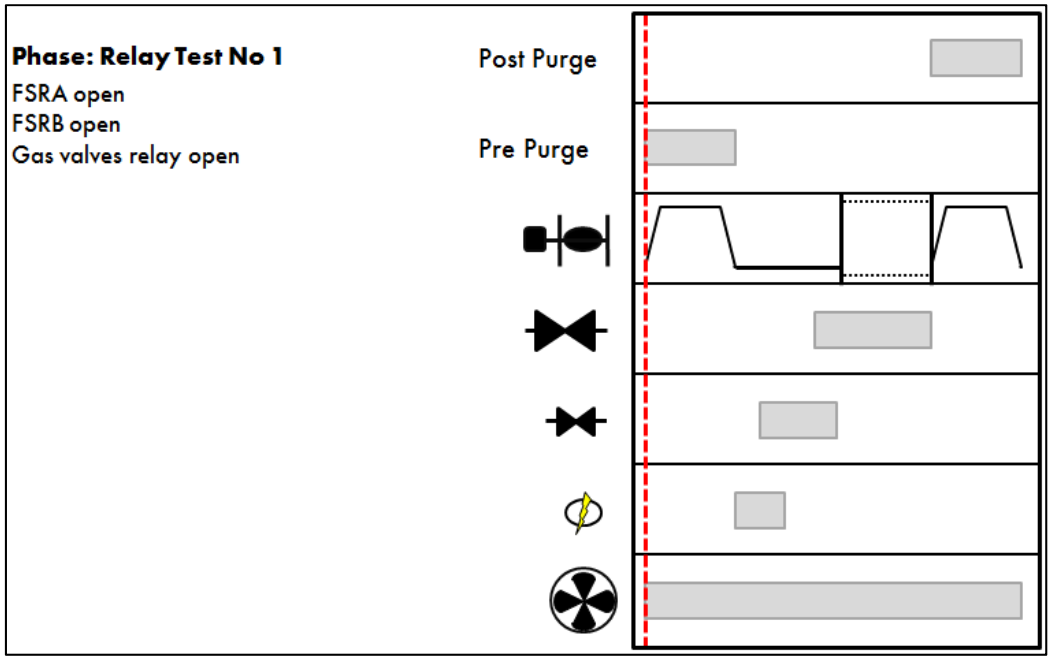


Figure 3.2.3.i Relay Test 1

During the Internal Relay Tests phase, the M.M. will check its internal flame safe relays 1 to 5. Should any errors occur now for the relay checks such as 'Relay Test 4 Failure,' this is an indication of an internal fault within the M.M. or a damaged relay.

Relay Test 1: Motor output

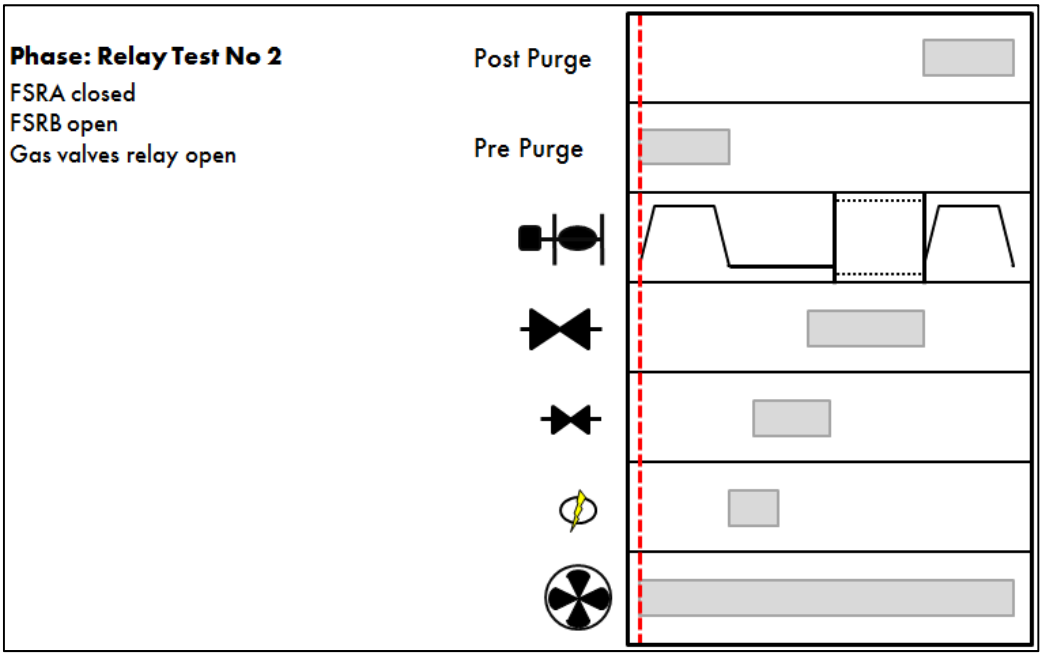


Figure 3.2.3.ii Relay Test 2

Relay Test 2: Pilot valve

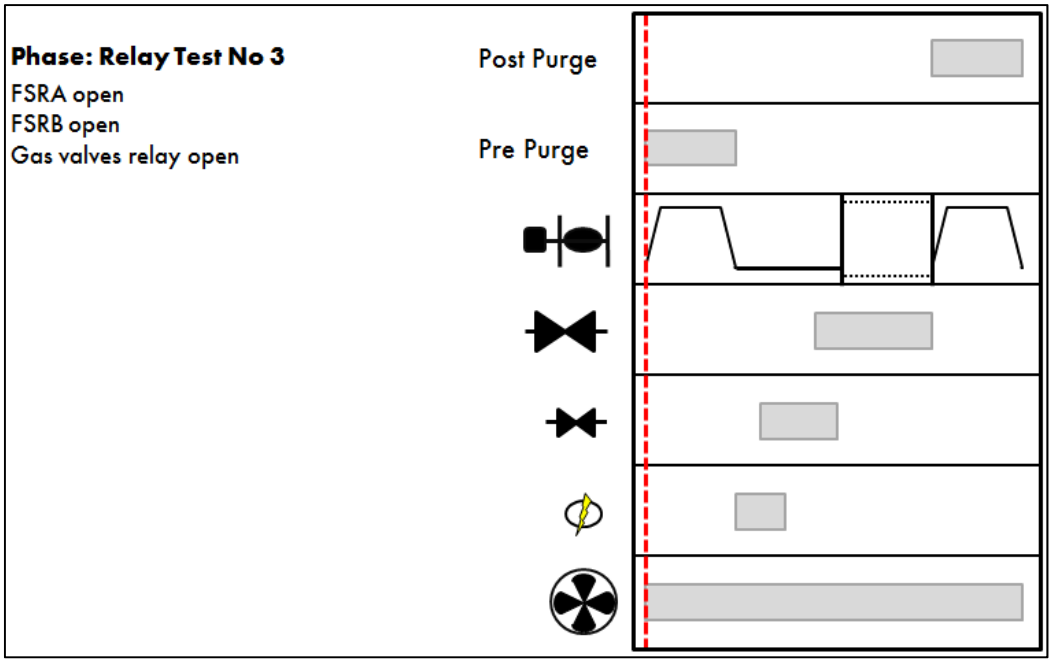


Figure 3.2.3.iii Relay Test 3

Relay Test 3: Main valve 1

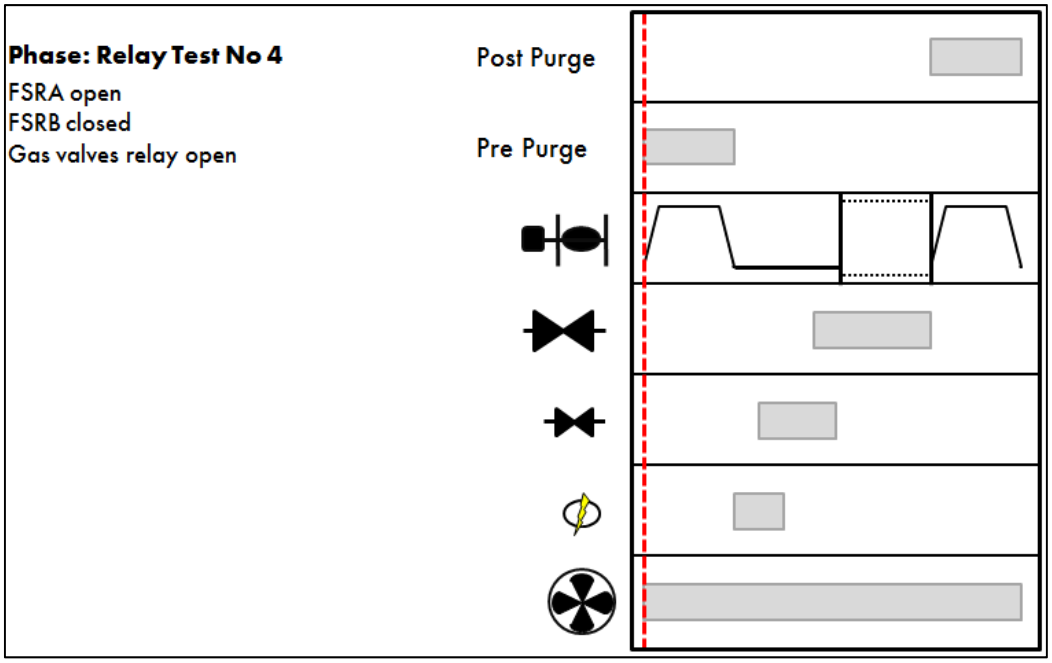


Figure 3.2.3.iv Relay Test 4

Relay Test 4: Main valve 2

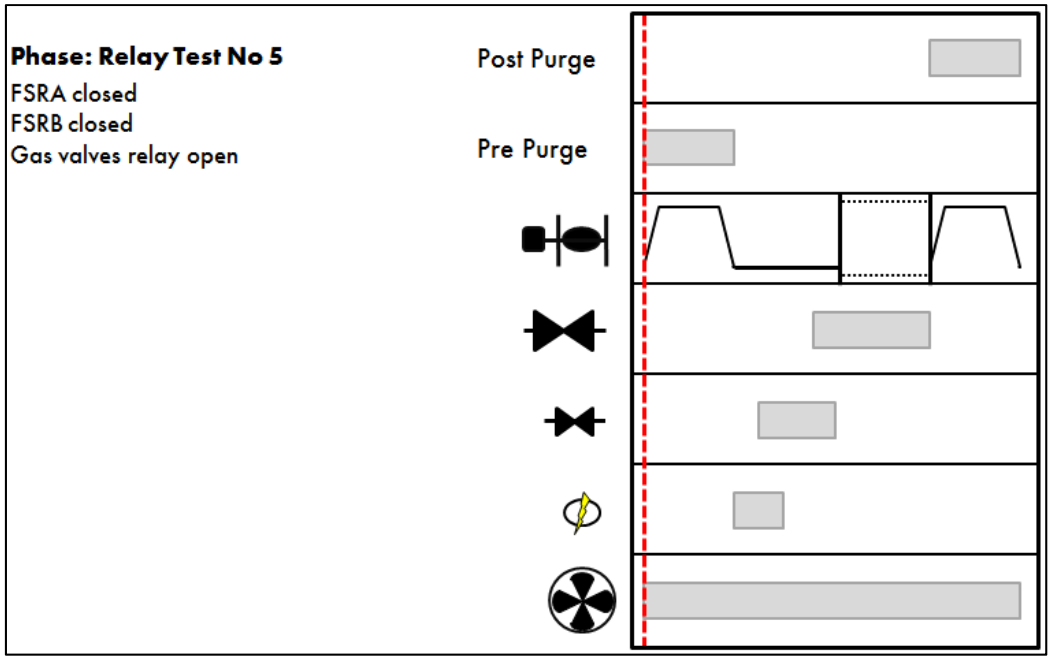


Figure 3.2.3.v Relay Test 5

Relay Test 5: Vent valve

3.2.4 Proving CCT Set

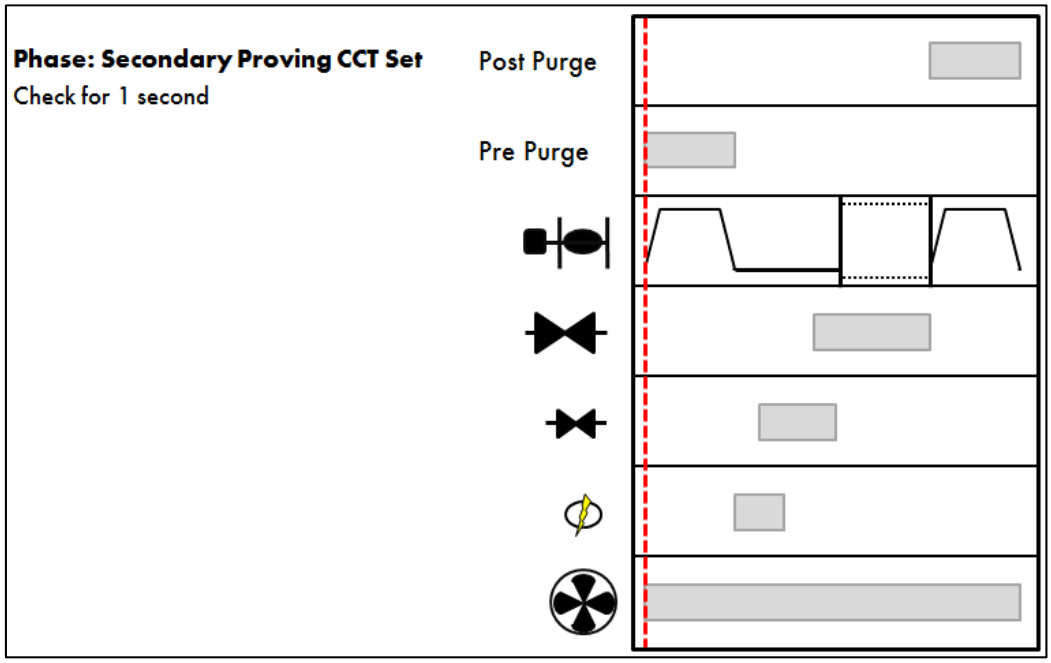


Figure 3.2.4.i Secondary Proving CCT Set

During this 'Proving CCT Set' phase, a check is made for a permanent line voltage input on the non-recycling interlock, terminal 52. This input should be maintained throughout the firing cycle.

Note: Delay to purge can be added during the Proving CCT phase.

3.2.5 CPI Input

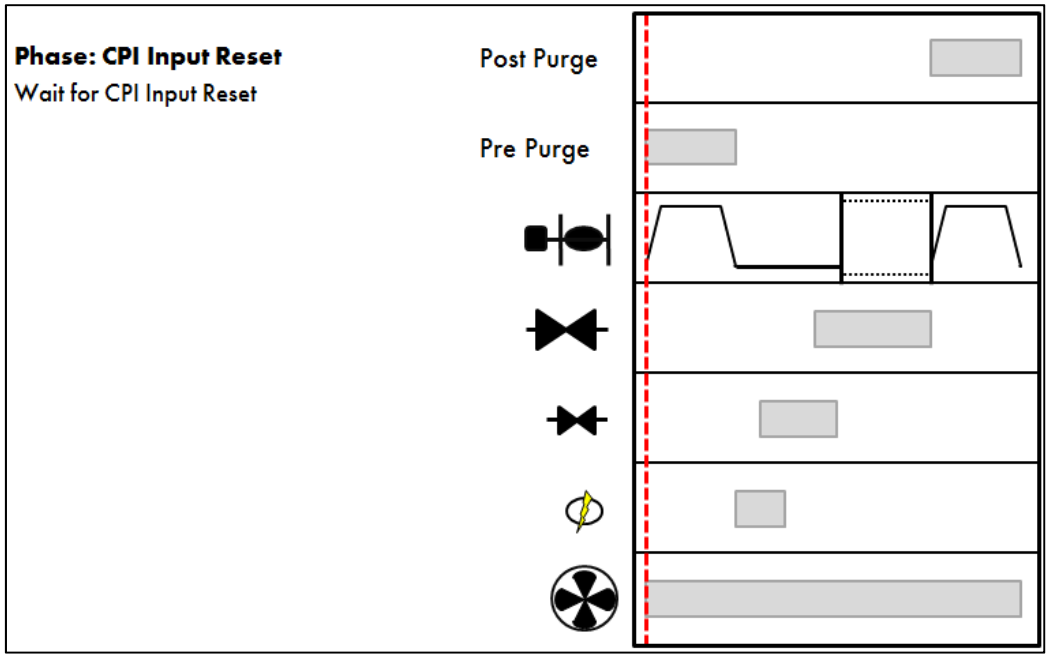


Figure 3.2.5.i CPI Input

A check is made on terminal 55 for the proof of closure switch. If terminal 55 does not see an input within 5 seconds, a lockout will occur.

3.2.6 3 Valve Proving System

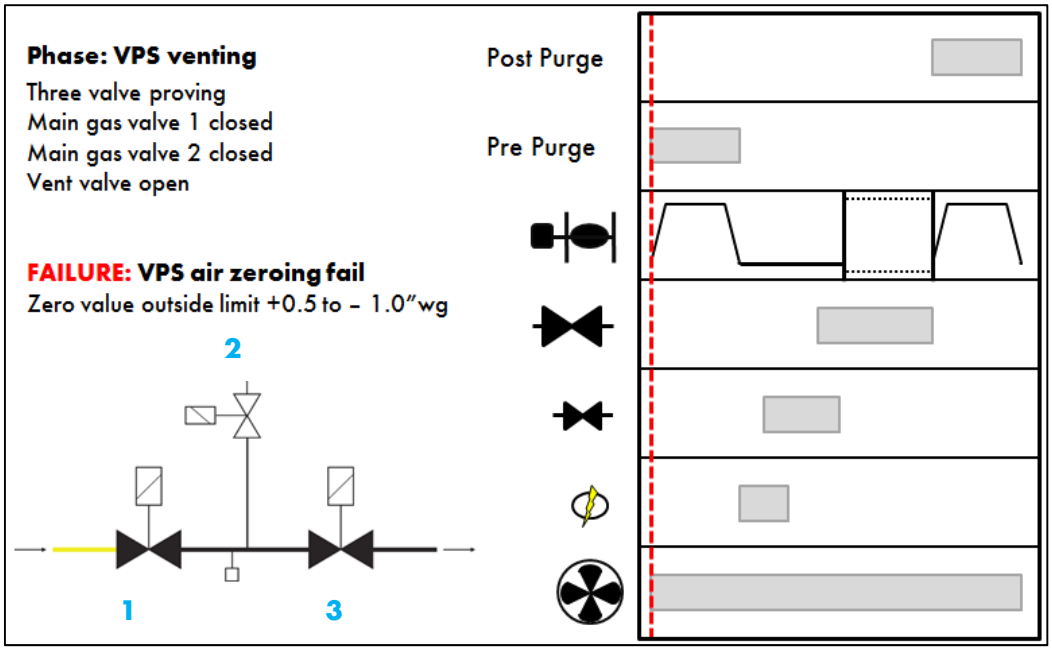


Figure 3.2.6.i VPS Venting

In this example, the M.M. is using 3 Valve Proving to check the integrity of the gas valves for any leaks, however 2 Valve Proving is also available on the Mk7 M.M. See option/parameter 130. The following are shown above:

1. Main gas valve 1
2. Vent valve
3. Main gas valve 2

During the VPS Venting phase, the gas valves are vented to zero. The main gas valves outputs are off (closed) and the vent valve output is off (opened) for a normally open vent valve, for any excess gas to vent to atmosphere, so now the gas sensor is zeroed. If the gas sensor cannot be zeroed, the burner will lockout with 'VPS air zeroing fail,' indicating that there could be a fault with the vent valve.

Note: If using two valve proving, the venting valve is operated by the main gas valve 2 output.

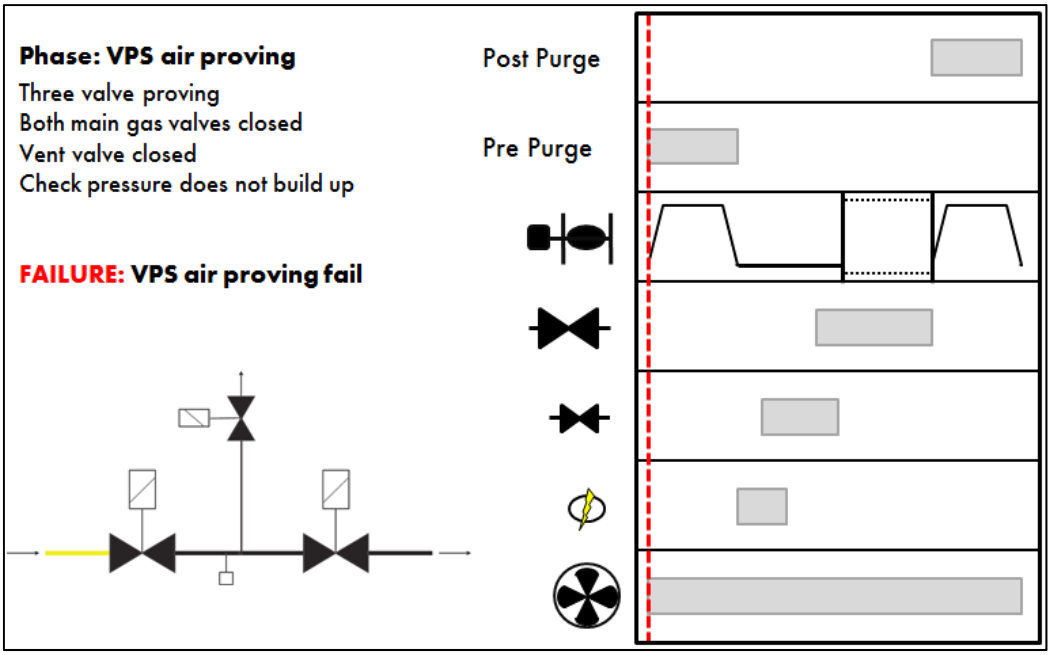


Figure 3.2.6.ii VPS Air Proving

In the VPS Air Proving phase, the vent valve output is on (closed) for a normally open vent valve and main gas valves outputs are off (closed), to check for a pressure increase. Any pressure increase will cause a 'VPS air proving fail' lockout, as this means that main gas valve 1 has failed.

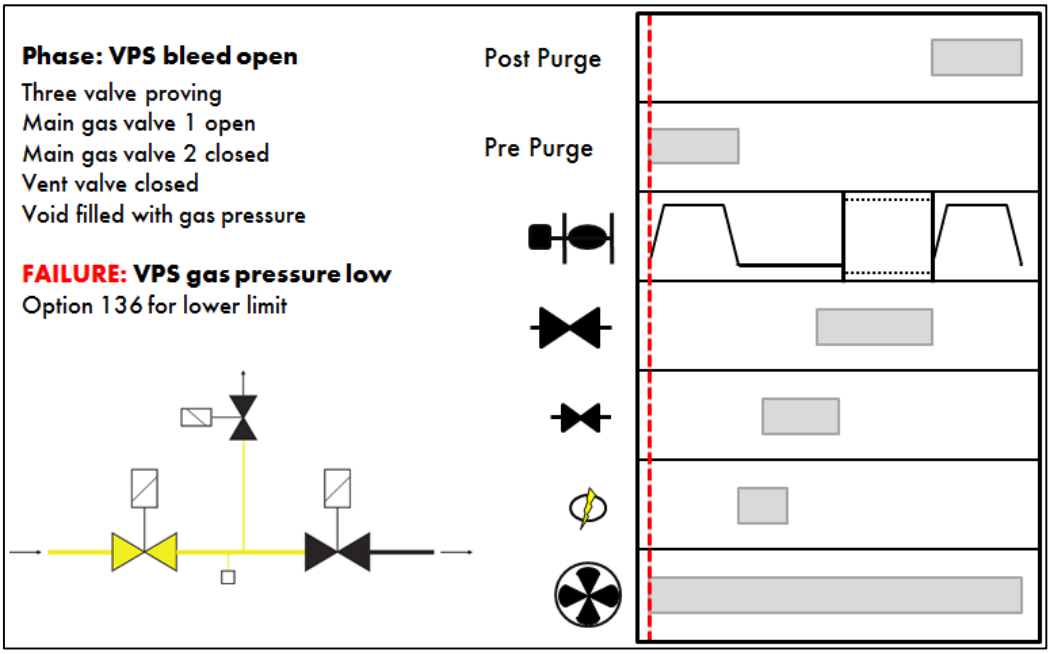


Figure 3.2.6.iii VPS Bleed Open

The 'VPS bleed open' phase switches the main gas valve 1 output on (open), letting gas through to fill the void. A static line test is done to check that the pressure is at the commissioned gas pressure. If the lockout 'VPS gas pressure low' appears, it means there is not enough gas, or there may be a problem with the gas supply so the main gas valve 1 may not be operating correctly to allow sufficient gas in (a gas booster may be required). See option/parameter 136.

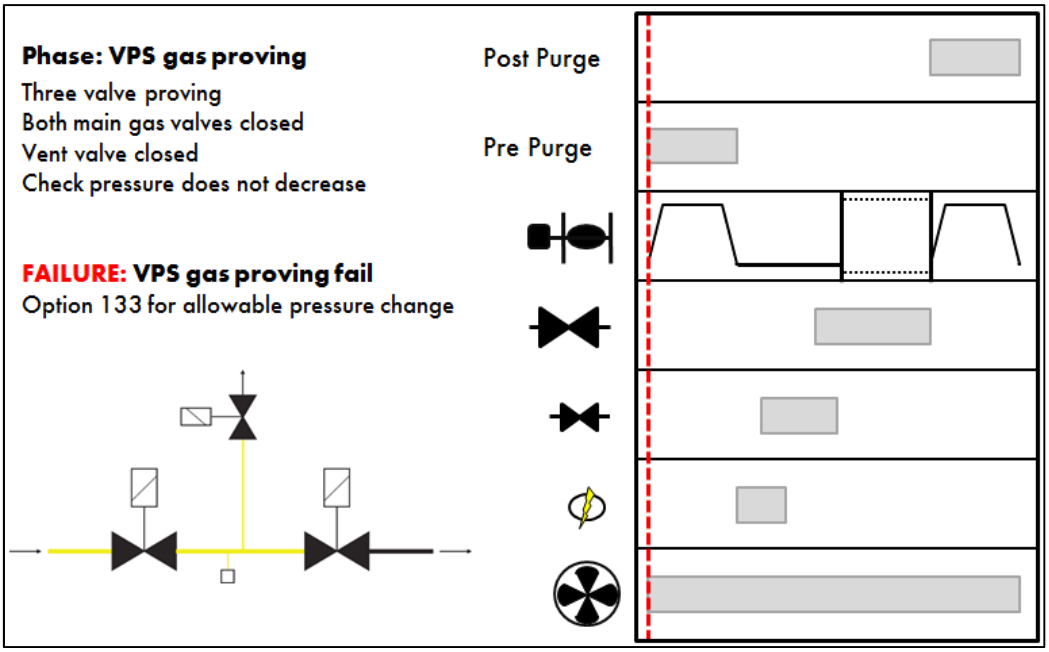


Figure 3.2.6.iv VPS Gas Proving

Both main gas valves 1 and 2 outputs are off (closed) and the vent valve output is on (closed) for a normally open vent valve during the VPS gas proving phase to check for any gas leaks. The lockout 'VPS gas proving fail' indicates that there is a fault within the vent valve or the main gas valve 2. See option/parameter 133.

3.2.7 Zero Air Sensor

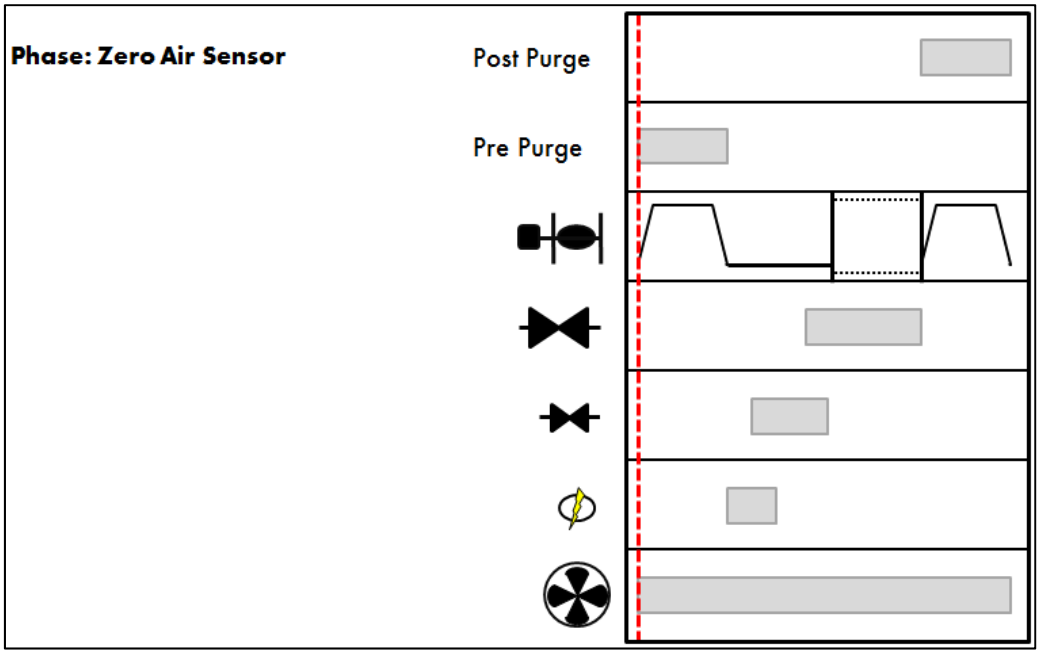


Figure 3.2.7.i Zero Air Sensor

Before the burner motor starts up, the air sensor is zeroed. If the air sensor cannot be zeroed, the 'zero air sensor fail' lockout will appear as the air sensor is detecting pressure when there should not be; there may be some draft.

If there is a live input on terminal 54 or high pressure on the sensor, 'waiting for air switch' will appear indefinitely without a lockout.

3.2.8 Purge

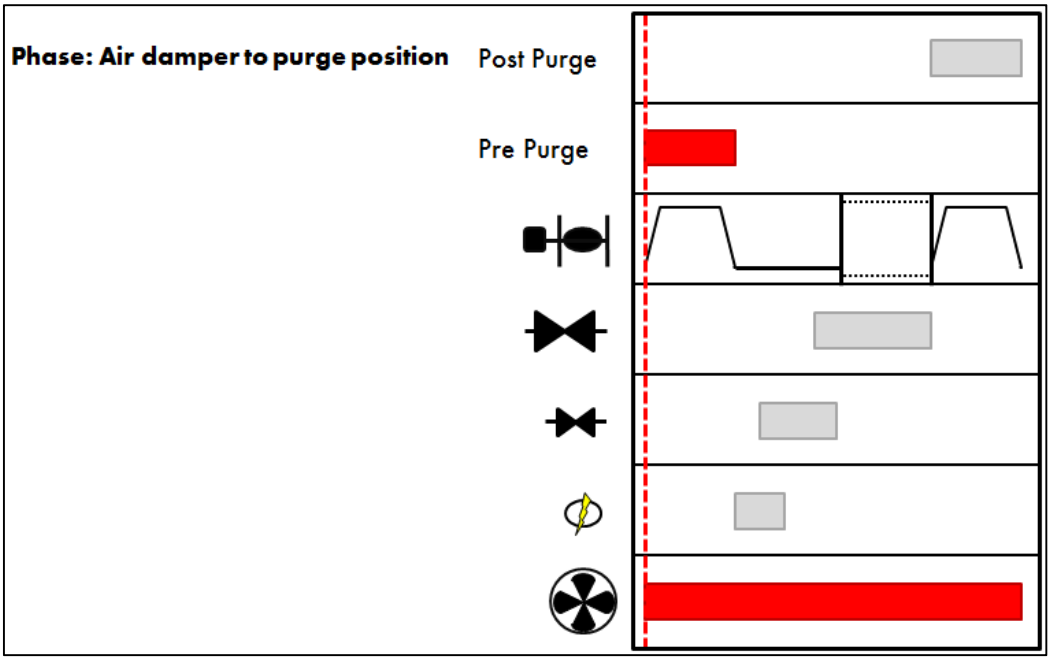


Figure 3.2.8.i Air Damper to Purge Position

Once all the internal flame safe relays and the gas valves are checked, the channels move to their commissioned purge positions and the burner motor output is switched on.

Note: If VSD is fitted and the feedback does not match the commissioned signal, the system will sit at position to purge indefinitely without a lockout.

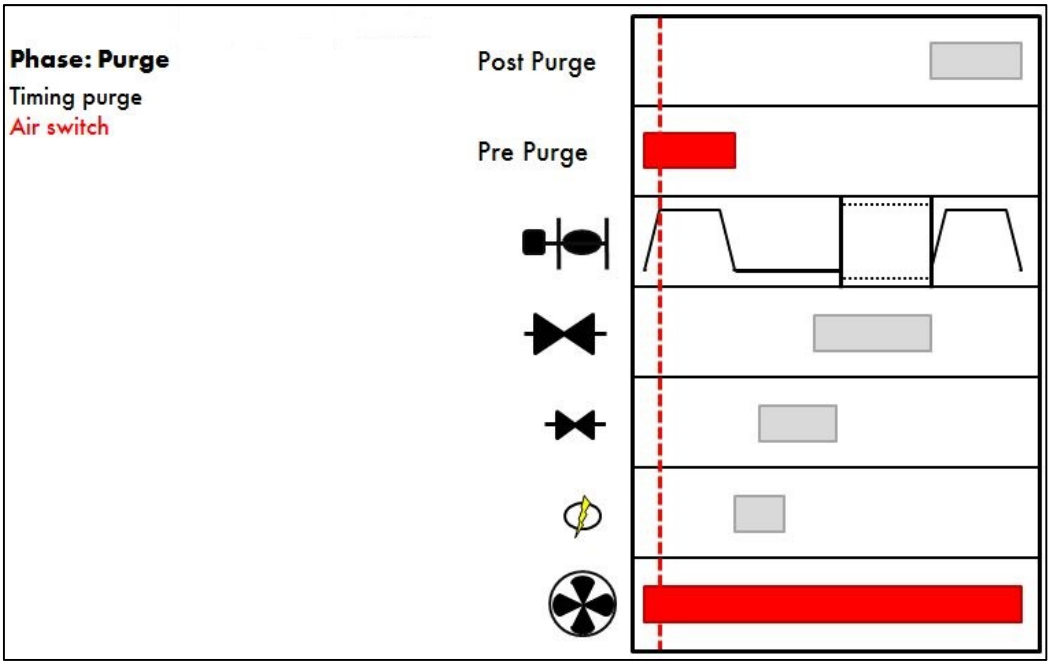


Figure 3.2.8.ii Purge

While the M.M. is in position to purge, the air switch is delayed for a set time period, and then checked for minimum air pressure limit. See option/parameter 121. The burner will then go to 'Purge,' where the air pressure is continuously monitored to be above the minimum pressure limit, via an air pressure sensor or using an air switch for an input on terminal 54. See option/parameter 141.

3.2.9 Ignition

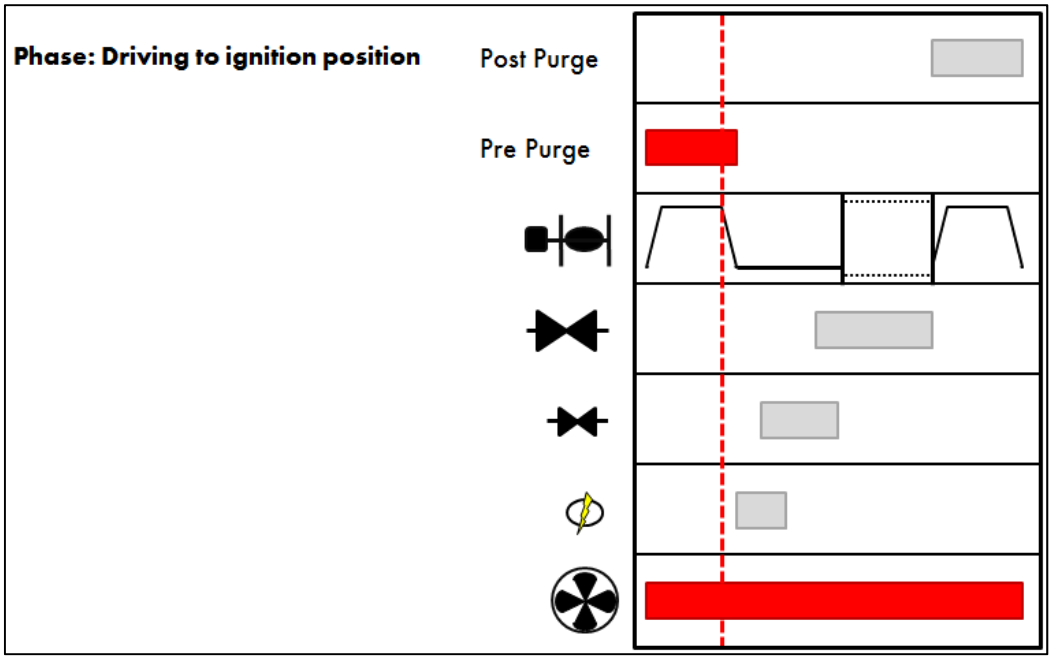


Figure 3.2.9.i Driving to Ignition Position

The M.M. will go into 'Position to Start' mode; the channels move to their commissioned start position.

Note: If VSD is fitted and the feedback does not match the commissioned signal, the system will sit at position to purge indefinitely without a lockout.

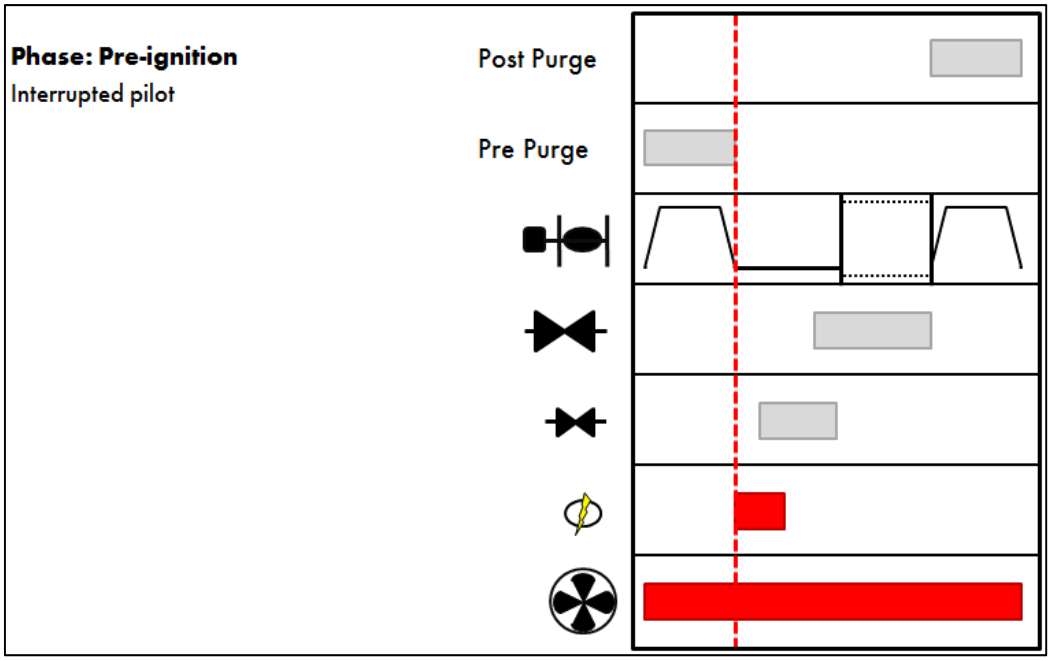


Figure 3.2.9.ii Pre-Ignition

In the 'Pre-Ignition' phase, the ignition transformer output is switched on before the pilot gas valve output is switched on (open). See option/parameter 113.

3.2.10 Pilot

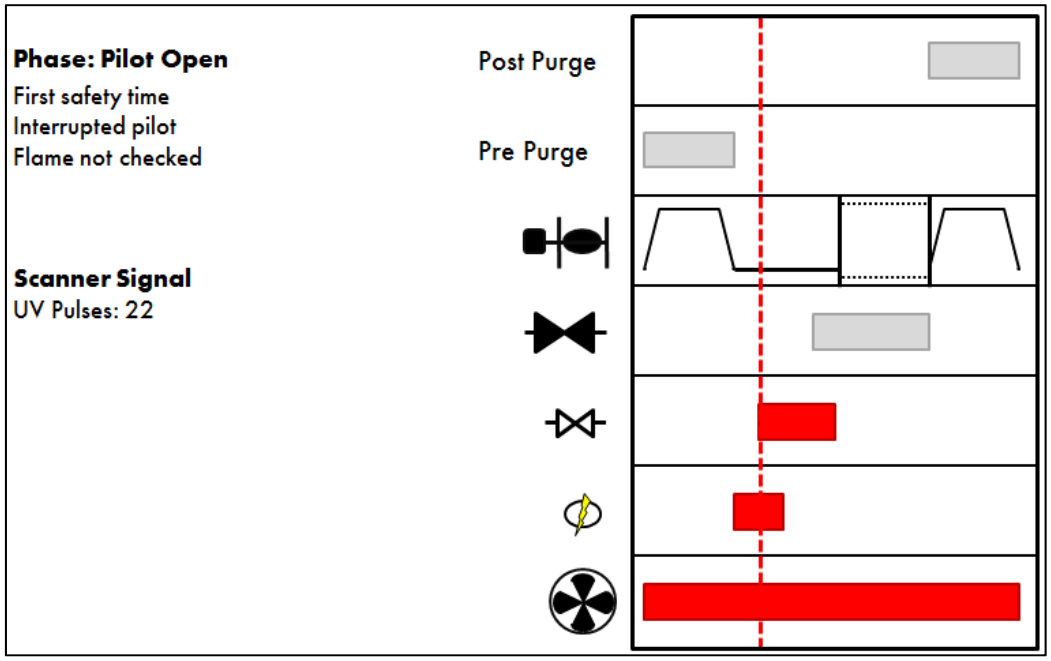


Figure 3.2.10.i Pilot Open

The system enters a first safety time in the 'Pilot Open' phase, which is the time when the pilot valve output is switched on (open) before the UV scanner checks for any flame signal. See option/parameter 114.

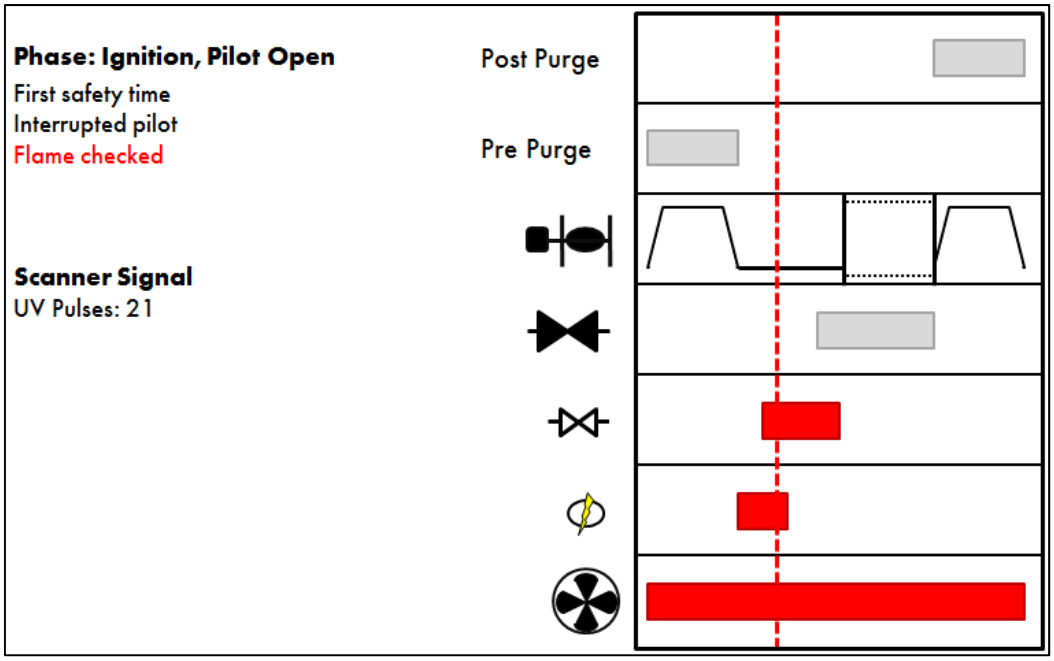


Figure 3.2.10.ii Ignition, Pilot Open

At the end of the first safety time period, the pilot flame is checked by the UV scanner. If the pilot goes out, the lockout 'no flame signal' will appear on the screen. Check the burner flame, pilot valves and UV scanner.

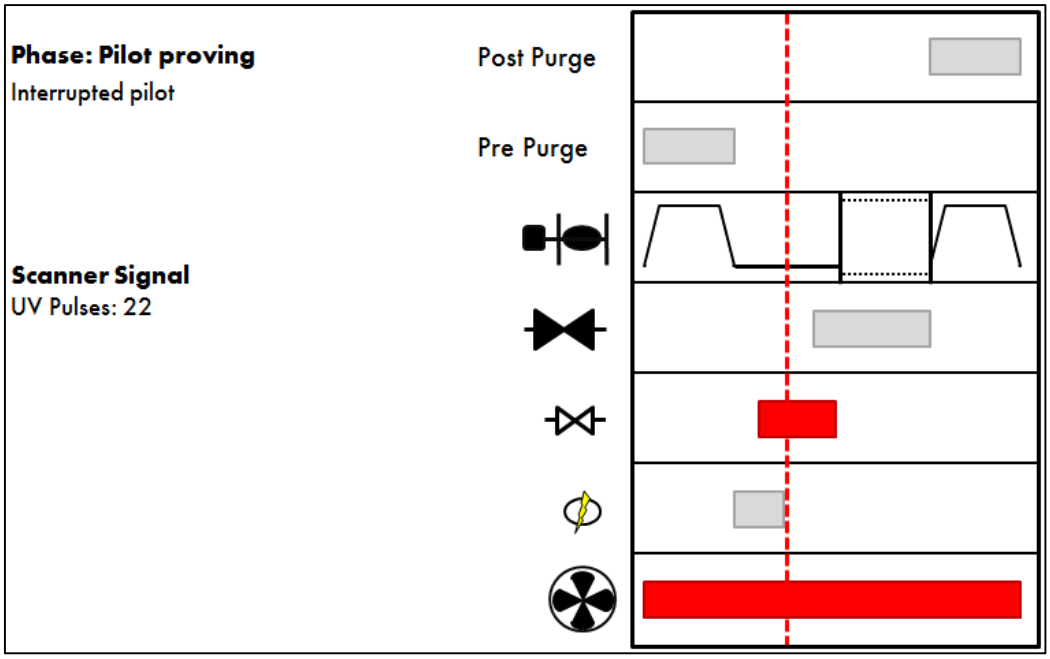


Figure 3.2.10.iii Pilot Proving

During the 'Pilot Proving' phase, the ignition transformer output is turned off; this gives the pilot a chance to stabilise. The flame is checked to ensure the pilot is strong enough. If the pilot goes out, a 'No Flame Signal' lockout will appear. See option/parameters 115 and 120.

3.2.11 Proving

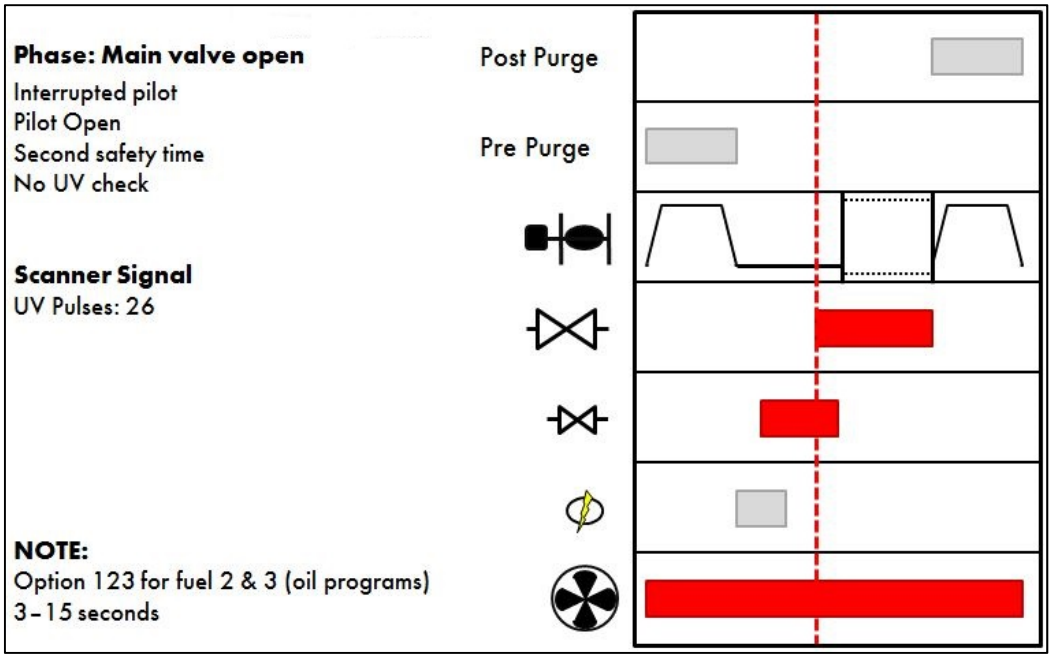


Figure 3.2.11.i Main Valve Open

The second safety time period begins, where the flame is not checked in the 'Main Valve Open' phase. The main gas valve outputs 1 and 2 are switched on (opened) and the pilot valve output is maintained on (opened), as well as the vent valve output switched on (closed) for a normally open vent valve. This second safety gives a chance for the main flame to light and stabilise prior to the pilot valve output being turned off (closed). The pilot might blow out if there is too much gas coming through from the main valve, or if the pilot is not strong enough. See option/parameter 116.

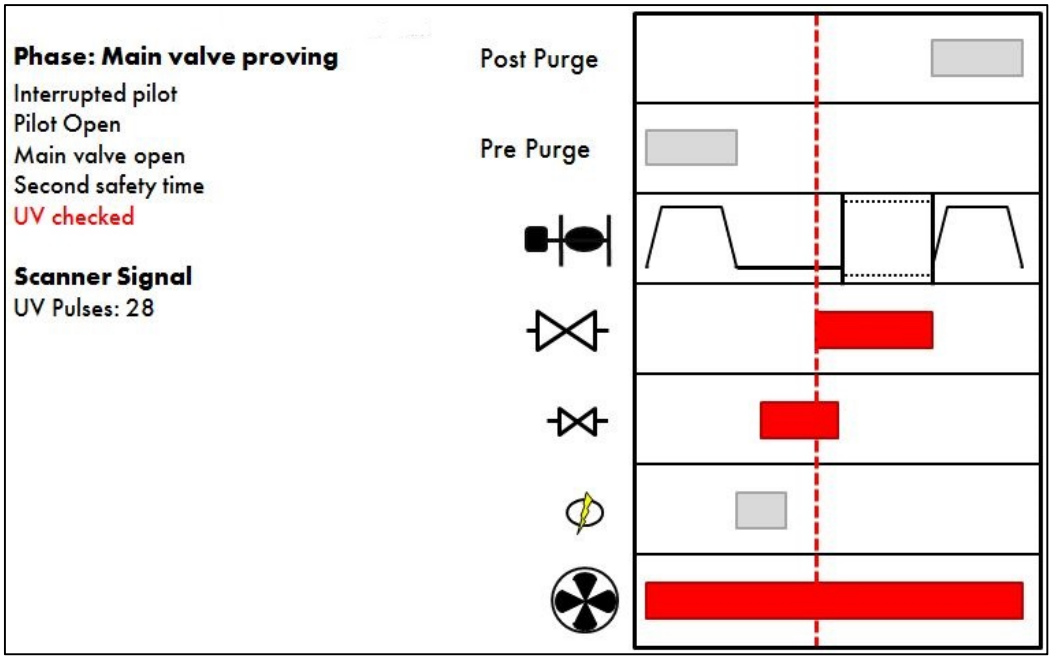


Figure 3.2.11.ii Main Valve Proving

At the end of the second safety time, the UV scanner now checks the flame; the 'No flame signal' lockout will appear if the flame has gone out. Check the burner flame, check the UV scanner and the main gas valves.

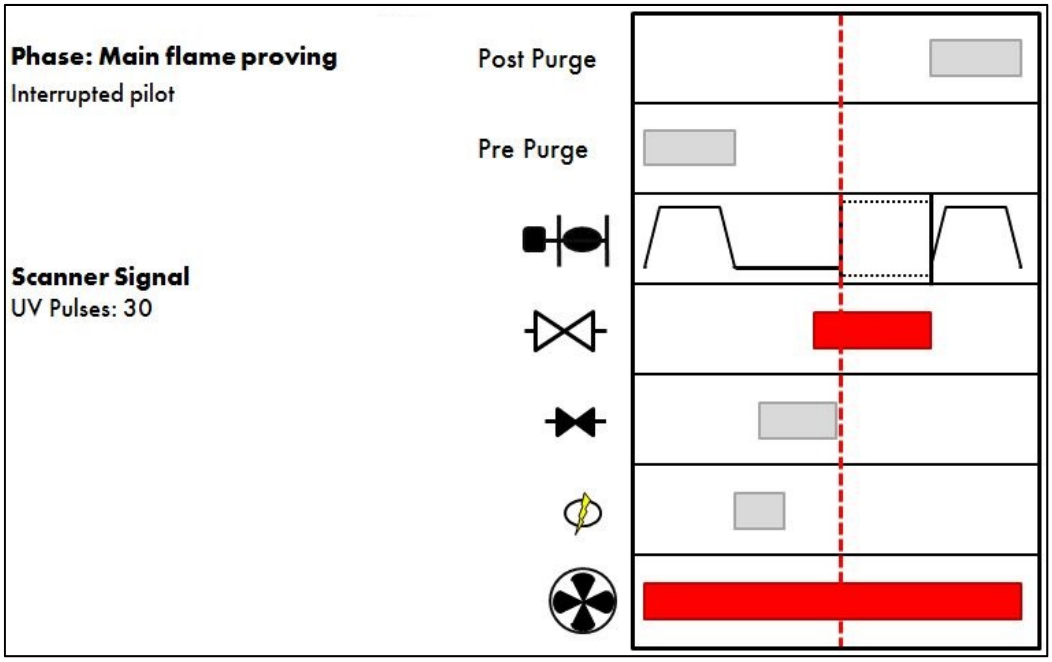


Figure 3.2.11.iii Main Flame Proving

There is a time period set for a delay to when the burner begins its modulation in order to allow the main flame to stabilise in the 'Main flame proving' phase. See option/parameter 117.

3.2.12 Firing

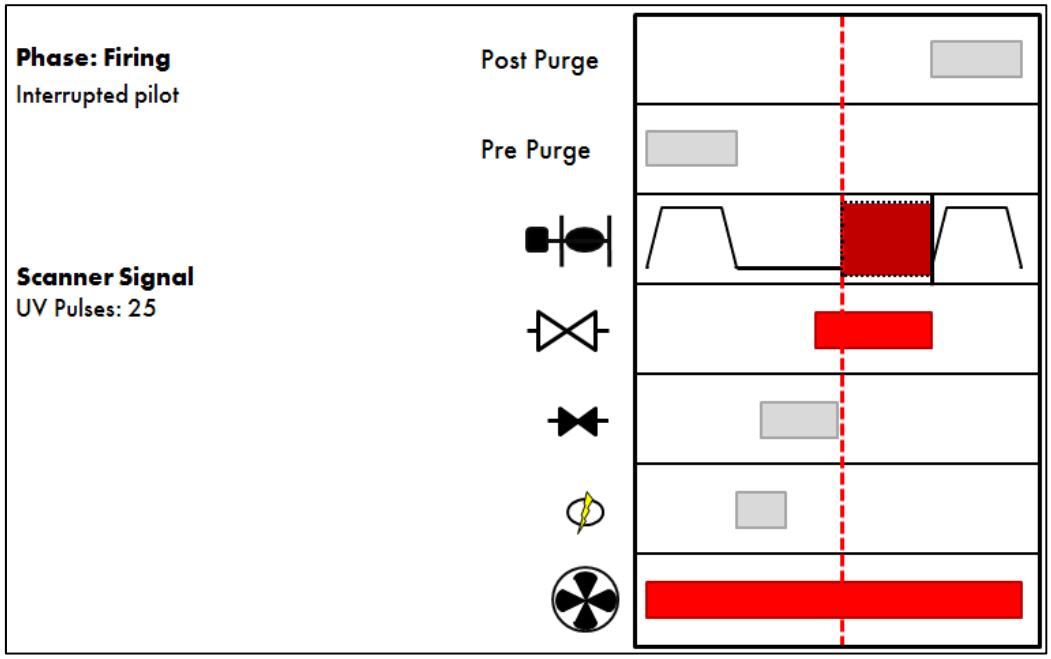


Figure 3.2.12.i Firing

The burner is now firing, and its firing rate will modulate up and down to maintain the required temperature/ pressure, and keep within the sequencing operation that has been set-up. The air and gas pressure limits can be continuously monitored if optioned. See option/parameters 136, 137 and 147.

3.2.13 Post-Purge

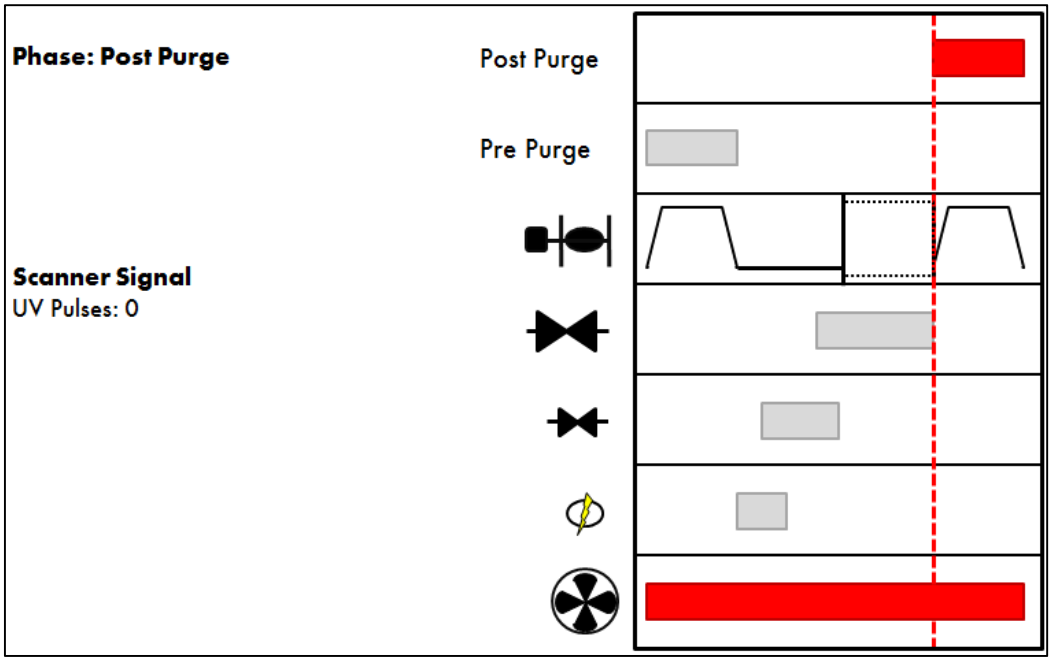


Figure 3.2.13.i Post-Purge

The main valve outputs are switched off (closed) and the vent valve output switched on (closed) for a normally open vent valve, at the same time. The 'Post-Purge' time can be set to blow air through the boiler when the burner shuts down in normal conditions (internal/external stat). See option/parameters 118 and 135. Once completed the M.M. will go into the Recycle phase. The process will start again when burner is turned on, the temperature/ pressure has dropped, or if the M.M. is coming out the warming phase in the sequencing loop.

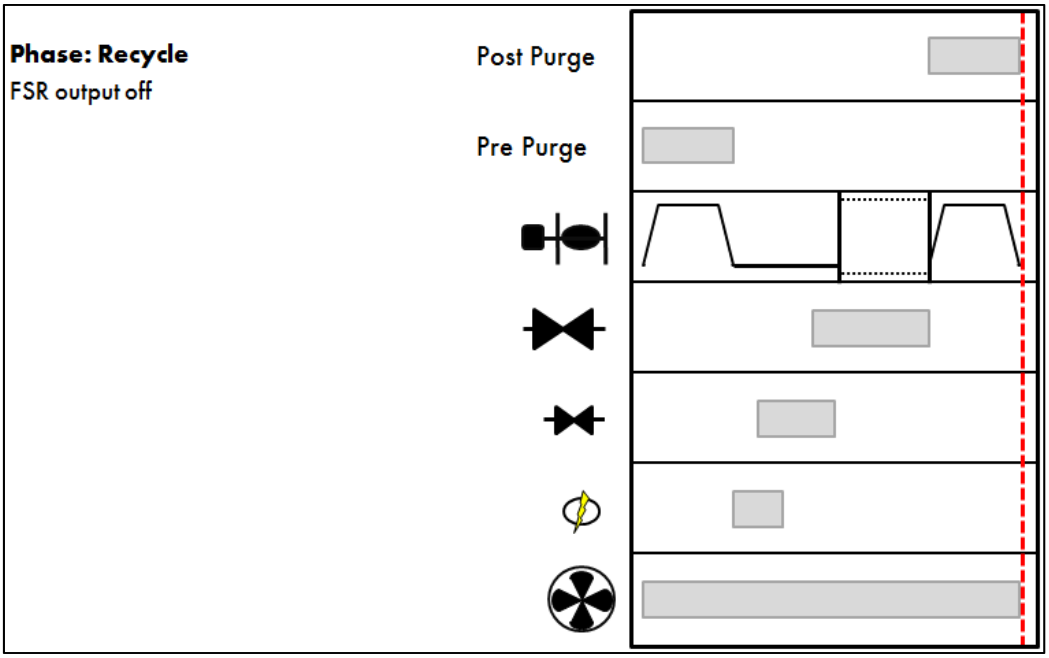


Figure 3.2.13.ii Recycle (Repeat)

4 ERRORS AND LOCKOUTS

4.1 Key to Errors

Self-Diagnostic Fault Identification Software

The "Error Checking" software, which is included in every M.M. module, continually interrogates the system for component or data handling failure. This intensive self-checking programme is inflicted on all peripherals such as servomotors and load detectors as well as the main M.M. system hardware. The safety related areas, both hardware and software, have been examined and accepted for CE, UL, and FM.

Any error identified by the system is indicated by "ERROR" being displayed and the relevant error number. In the case of E.G.A. related faults, "ERROR EGA" is displayed, please refer to the E.G.A. Set-Up and Trim Guide manual.

To reset an M.M. error the unit must be reset. Lockouts can be reset by pressing the 'Reset' button for three seconds or line input voltage on terminal 56.

Error Fault Type	**Code No**	
CH1 Positioning Error	01	Check wiring & motor (Voltage should be between 0.21V and 3.6V)
CH2 Positioning Error	02	
CH3 Positioning Error	08	
CH4 Positioning Error	09	
CH1 Gain Error	41	Check wiring & potentiometers are zeroed correctly
CH2 Gain Error	42	
CH3 Gain Error	43	
CH4 Gain Error	46	
CH5 VSD Error	80	CH5 variable speed drive error
CH6 VSD Error	81	CH6 variable speed drive error
CH5 VSD Feedback Error	83	CH5 variable speed drive feedback signal different to commissioned values
CH6 VSD Feedback Error	84	CH6 variable speed drive feedback signal different to commissioned values
Load Detector	03	Open circuit on load sensor
12V/5V Supply Error	44	Internal 5V/12V supply outside limits. Check 12V on Terminals 40 & 41
Gas Sensor Re-commission Error	GAS RECOMM	Reset Option/Parameter 150 back to 0 and reset Options/Parameters 136/137 back to original values
Air Sensor Re-commission Error	AIR RECOMM	Reset Option/Parameter 150 back to 0 and reset Option/Parameter 147 back to original value
Watchdog - Error CR2	45	Unit hardware failure Option/Parameter 110 is set to 0

Error Fault Type	Code No	
A/D Converter Error	47	Check 12V supply on terminals 40, 41
Twin Burner Communications Failed	100	Flashing error – no communications between the M.M. units
Air Pressure Outside Limits	82	During run mode actual air pressure outside limits, commissioned +/- 0.3 "wg (see Option 147)
Gas Pressure Sensor MM70008 optioned together with psi units	110	See options 124 & 133 to 137. PSI display cannot be chosen for this sensor range
WL probes detected WL not optioned Check WL configure	251	Water level probes are detected but the M.M. is configured for operation without the water level. Check the second password screen
Incompatible WL software		Software set mismatch

4.2 Burner Lockouts

Lockout Message	Cause
CPI input wrong state	Proof of closure switch opened during ignition sequence Check Terminal 55 and proof of closure switches (CPI = close position interlock / proof of closure)
No air proving	No air pressure during start/firing Check Terminal 54 and air switch
VPS air proving fail	Leak detected during 'air proving' part of VPS Check 1st main valve
VPS air zeroing fail	Valve opens to vent, zero value outside limit +0.5 to -1.0" wg Check vent valve
VPS gas proving fail	Leak detected during 'gas proving' part of VPS Check 2nd main valve and vent valve Check pilot valve if using single pilot (Option 130)
VPS gas pressure low	Gas pressure below minimum application pressure Check Option 136 for minimum allowable pressure
No flame signal	No flame signal during ignition/firing
Simulated flame	The flame is present when it should not be. Call for service immediately. This is potentially a dangerous condition.

Lockout Message		Cause
Fail safe relay fault	57	These terminals are self checked within the Mk.7 M.M. If a voltage is detected when the output is off (and vice versa) a lockout occurs.
Vent valve output fault	62	
Main gas output 1 fault	61	
Main gas output 2 fault	60	
Start gas output fault	59	
Motor output fault	58	
Ignition output fault	63	
Shutter fault		UV signal detected during shutter operation on UV self check Check wiring on Terminals 21/22
Prolonged lockout reset		Prolonged voltage present on Terminal 56/lockout reset button permanently pressed
No CPI reset		Proof of closure switch not made after valves closed after firing Check Terminal 55 and proof of closure switches
Gas pressure low limit		Gas pressure low limit exceeded when using a gas sensor Check Option 136
Gas pressure high limit		Gas pressure high limit exceeded when using a gas sensor Check Option 137
Gas pressure low		Low gas pressure before start up
UV short circuit		Connections to UV tube shorted
IR Scanner comms timeout		IR scanner optioned but no IR scanner communications detected. Check wiring and fuse 6(500 mA)
Oil pressure low limit		Oil pressure low limit exceeded when using an oil sensor Check Option 139
Oil pressure high limit		Oil pressure high limit exceeded when using an oil sensor Check Option 140
Purge air pressure low		Insufficient air pressure during purge Check Option 141
Option #141 incorrect		Option 141 is set without Option 148
Freeze timeout		Pilot turndown test time exceeded (10 minutes)
Terminal 86 inverse		Terminals 85/86 both have an input or Terminals 85/86 both do not have an input when using the flame switch or IR sensor operation- see Option 122.
Terminal 85-86 fault		Electronics fault on either Terminal 85 or 86.
Prove CCT fail		Loss of input on Terminal 52. Terminal 52 must see an input at all times from the position to purge to the end of the post purge (CCT = closed circuit).

Lockout Message	Cause
Watchdog fault 1a Watchdog fault 1b Watchdog fault 1c Watchdog fault 1d Watchdog fault 2a Watchdog fault 2b Watchdog fault 2c Watchdog fault 2d	Internal fault diagnostics – contact Autoflame and report code displayed.
RAM test failed Prom test failed CPU test failed Input fault BC input short Lockout 198, 199, 200, 201, 202	Internal fault diagnostics – contact Autoflame and report code displayed.
Terminal 86 inverse	Terminals 85/86 both have an input or Terminals 85/86 both do not have an input when using the flame switch or IR sensor operation- see Option 122.
Terminal 85-86 fault	Electronics fault on either Terminal 85 or 86.
Prove CCT fail	Loss of input on Terminal 52. Terminal 52 must see an input at all times from the position to purge to the end of the post purge (CCT = closed circuit).
Option 118 incorrect	If using the NFPA post purge (Option 135 = 2) then Option 118 must have a setting of 15 or above.
Boiler DP proving	If using boiler differential proving (Parameter 92 = 2), and the input on Terminal 85 is reset then this lockout will occur.
Gas Sensor Related	
Sensor supply voltage	12V supply to sensor outside limits (11.75 - 12.25V)
Zero low gas sensor	see Application and Possibilities manual for zero limits
Zero high gas sensor	see Application and Possibilities manual for zero limits
Signal dev - gas sensor	redundant signals from sensor do not match
Counts low - gas sensor	sensor fault - stuck on signal value
Counts high - gas sensor	sensor fault - stuck on reference value
Signal high - gas sensor	gas pressure exceeds maximum range value
Gas sensor (+ number)	sensor/Mk7 internal fault - report to Autoflame
Air Sensor Related	
Sensor supply voltage	12V supply to sensor outside limits (11.75 - 12.25V)
Zero low air sensor	lower limit is -1.0”w.g.
Zero high air sensor	upper limit is +0.5"w.g.
Signal dev - air sensor	redundant signals from sensor do not match
Counts low - air sensor	sensor fault - stuck on signal value
Counts high - air sensor	sensor fault - stuck on reference value
Signal high - air sensor	air pressure exceeds maximum range value
Air sensor (+ number)	sensor/Mk7 internal fault - report to Autoflame

5 STANDARDS

BS EN 12067-2:2004

BS EN 298:2003

BS EN 230:2005

BS EN 230:2005

BS EN 1643:2000

ISO 23552:2007

ANSI/UL 1998 Second Edition

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Notes

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