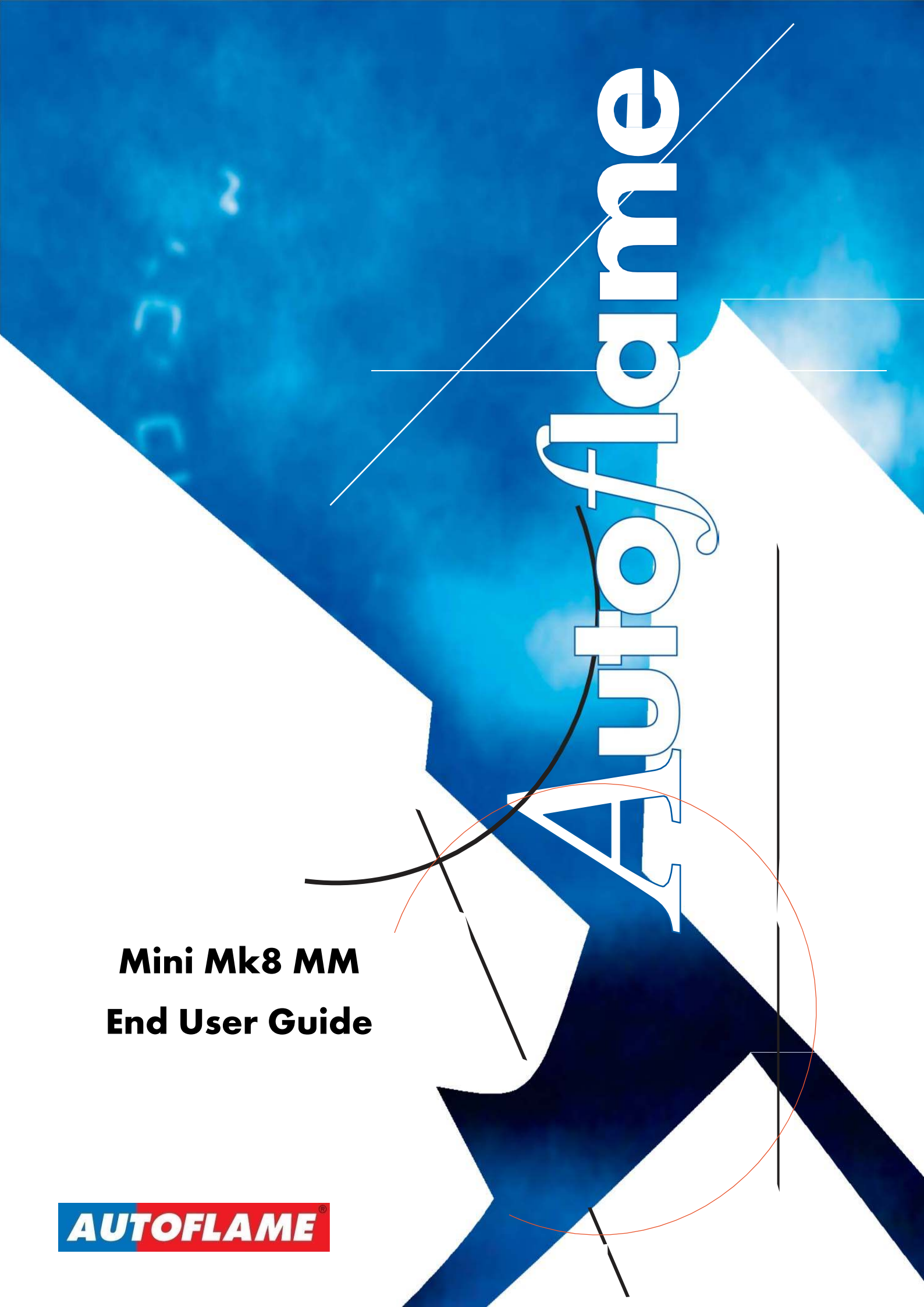

Mini Mk8 MM

End User Guide

AUTOFLAME®

Mini Mk8 MM

End User Guide

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Company:

Department:

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 (MM) / Flame Safeguard

- Fuel/Air ratio control
- Full colour touch screen
- 120V or 230V Standard operation 50/60Hz
- Controls up to 3 servomotors and 1 variable speed drive (VSD/VFD)
- 2 independent fuel programmes
- Fully adjustable PID load control for temperature or pressure
- Internal flame safeguard – full flame supervision with self-check UV, IR and ionisation
- Gas valve train leak supervision and high/low gas pressure monitoring
- Air pressure proving and monitoring
- 64 Lockouts/errors stored with date, time, phase and reset
- System log stored with date, time and status
- Single point change function for adding, removing and adjusting fuel/air positions on the commission curve
- User definable optimum ignition position – golden start
- User definable flue gas recirculation start position
- Variable servomotor travel speed
- Adjustable burner control safety times
- External voltage load control
- Outside temperature compensation of boiler setpoint
- Second setpoint with run times
- Hand/auto/ low flame hold
- Various boiler load detectors available
- Fuel flow metering capability – instantaneous and totalised
- Password protection of all safety related functions
- Infra-red port for upload/download of commissioning data

Exhaust Gas Analyser (EGA)

- 3 Parameter Trim of O_2, CO_2, and CO
- Analysis of O_2, CO_2, CO, NO, exhaust gas temperature, efficiency and delta temperature
- 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 or 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 (2 port valve operation)
- Standby setpoint and warming for lag boilers via a standby pressure and timing sequence aqua-stat

Remote Control/ Data Transfer Interface (DTI)

- Direct Modbus communications from MM include remote setpoint and firing rate adjustment, enable/disable
- DTI will collect operational data for up to 10 MM modules, 10 EGA 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

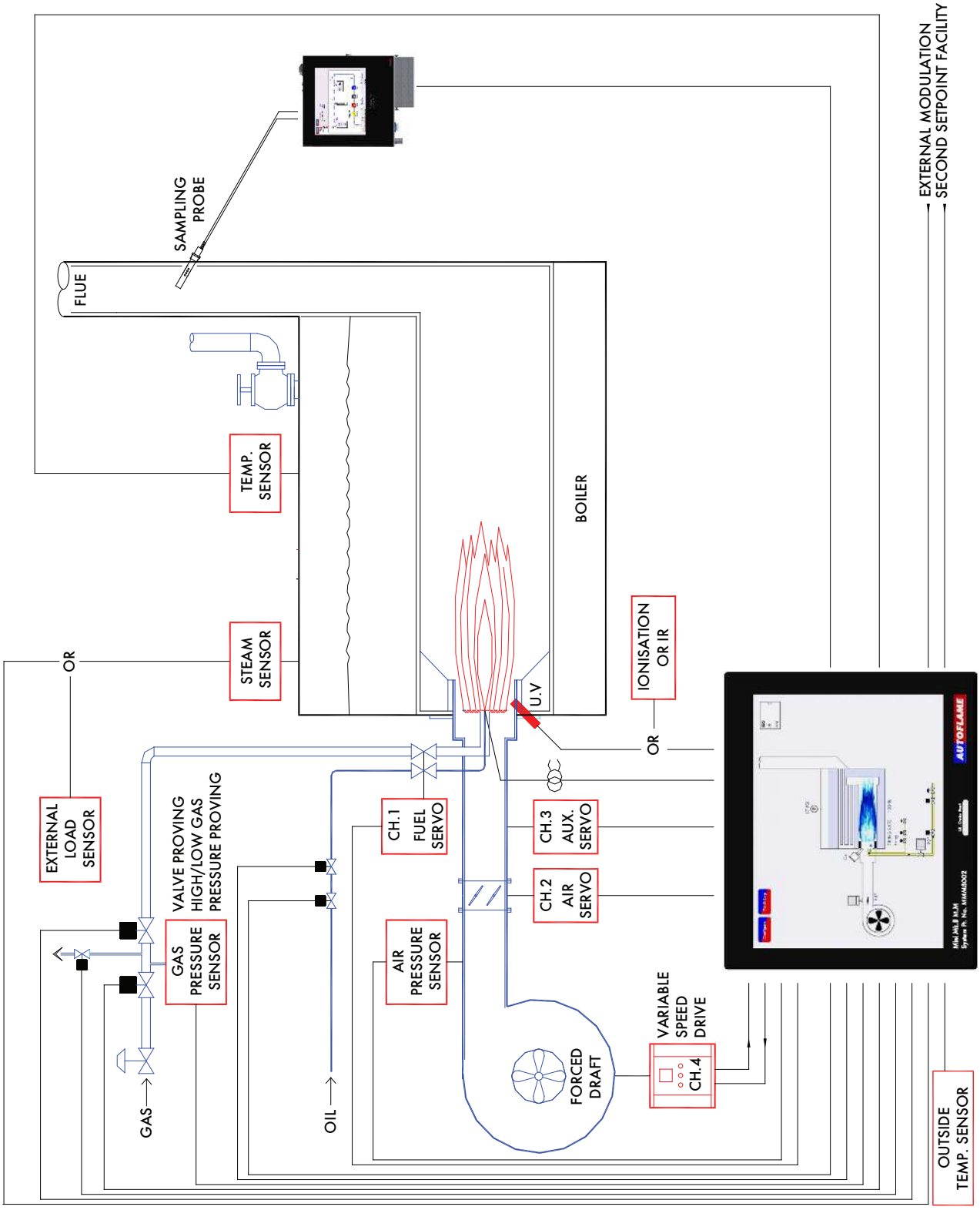
PC Compatible

- Download all commissioning data from an MM module to a PC via Download Manager
- Upload commissioning data from a PC to an MM module via Download Manager

Universal Digital & Analogue Input/ Output Module

- Detailed logging inputs and outputs when coupled with the Mk7 DTI
- 16 Line inputs (120V/230V)
- 6 Analogue inputs and 6 analogue outputs (0-10V, 0-20mA or 4-20mA)
- 8 Volt free contacts
- Configurable alarms through Mk7 DTI

1.2 System Example



1.3 Micro-Modulation (MM)

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 an 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 burner's fuel to air ratio was 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, which 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 MM 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 allowed 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 can achieve '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.

2 ELECTRICAL SPECIFICATIONS

2.1 Classifications

Classification according to EN298

Mains Supply:	230V, +10%/-15%} 120V, +10%/-15%}	47-63 Hz, unit max. consumption 140W
Climate:	Min. Temperature	0°C (32°F)
	Recommended Temperature	Less than 40°C (104°F)
	Max. Temperature	60°C (140°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.	

2.2 Inputs and Outputs

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 5A
		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	

120V 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 5A
		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	

Note:

- The high and low voltage connections are not safe to touch. Protection against electric shock is provided by correct installation. **CAUTION – ELECTRIC SHOCK HAZARD.**
- Control voltage cabling should be maximum 10m, screened (if not screened then less than 1m, however servomotors can be unscreened up to 10m).
- Any cabling over 10m must have additional surge protection.
- Low voltage cables should be screened cable as specified in section 2.3.
- The burner 'High Limit Stat' must be a manual reset type.
- There is a lid (back plate) fitted onto the back of the Mini Mk8 MM with a Warning label to prevent any unauthorised fuse replacements.

2.3 Cable Specifications

Low Voltage
The screened cable used for low voltage wiring from the MM to the servomotors, detectors and variable speed drive must conform to the following specification:

U.V. cable length should not exceed 25m; all other screened cable should not exceed 50m.

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
16-2-8C 8 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 communication connections between MMs for sequencing applications as well as between MMs to EGAs, MMs to a DTI and DTI to BMS systems.

Communication cable should not exceed 1km.

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. Low voltage and data cable can be ordered directly from Autoflame Engineering, please contact Autoflame Sales.

When using a VSD, please review the manufacturer's guidelines on installations to prevent EMC including the recommendations for reactors and filters.

2.4 Terminals Description

S	All terminals marked S are internally connected, provided for connections to the various screened cables.
1	Current Input, 0-20mA/ 4-20mA. For channel 4 only. Can be connected to the current output of a VSD or tachometer system or 4-20mA servomotor feedback
2	Voltage Input, 0-10V. For channel 4 only. Can be connected to the voltage output of a VSD or tachometer system
3	0V common for Terminals 1 or 2
10	Current Output, 0-20mA/ 4-20mA. For channel 4 only. Can be connected to the current input of a VSD or tachometer system or 4-20mA servomotor feedback
11	Voltage Output, 0-10V. For channel 4 only. Can be connected to the voltage input of a VSD or tachometer system
12	0V common for Terminals 10 or 11
21, 22	Connections to an Autoflame self-check UV sensor
25, 26	Communications port connections to an Exhaust Gas Analyser (EGA)
27, 28	Communications port connections for DTI and/or IBS, or Modbus
29, 30	Digital communications connections to an Autoflame IR scanner (MM70017), Autoflame air pressure sensor and/or Autoflame gas pressure sensor
37	0V supply to an Autoflame temperature or pressure detector or 0-10V external modulation input
38	Signal input from an Autoflame temperature or pressure detector or 0-10V external modulation input
39	12V supply to an Autoflame pressure detector
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
46	0V Supply to channel 3 servomotor
47	+12V Supply to channel 3 servomotor
48, 49	+15V connections to an Autoflame IR scanner (MM70017), Autoflame air pressure sensor and/or Autoflame gas pressure sensor
50, 51	Connections to an Autoflame UV sensor

64	Connections to a flame rod
53	Mains voltage input – burner on/off signal, running interlock circuit
54	Mains voltage input – air proving switch
55	Mains voltage input - proving circuits, e.g. gas valve proof of closure
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
66	Mains supply – earth
67	Main supply – neutral
68	Mains supply – live/hot
69	Mains voltage output, power to servomotors and/or stepdown transformer
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
78	Switched neutral –2-port valve for IBS operation
79	Switched neutral – alarm output for MM lockout/MM error/EGA error
80	Start position interlock/ night setback input/ reduced setpoint input
81	Purge interlock/ low flame hold input/ purge pressure proving
82	Warming stat/ valve proving mains input
89	Mains voltage input – selects fuel 1 curve
90	Mains voltage input – selects fuel 2 curve

3 END USER OPERATION

3.1 Home Screen

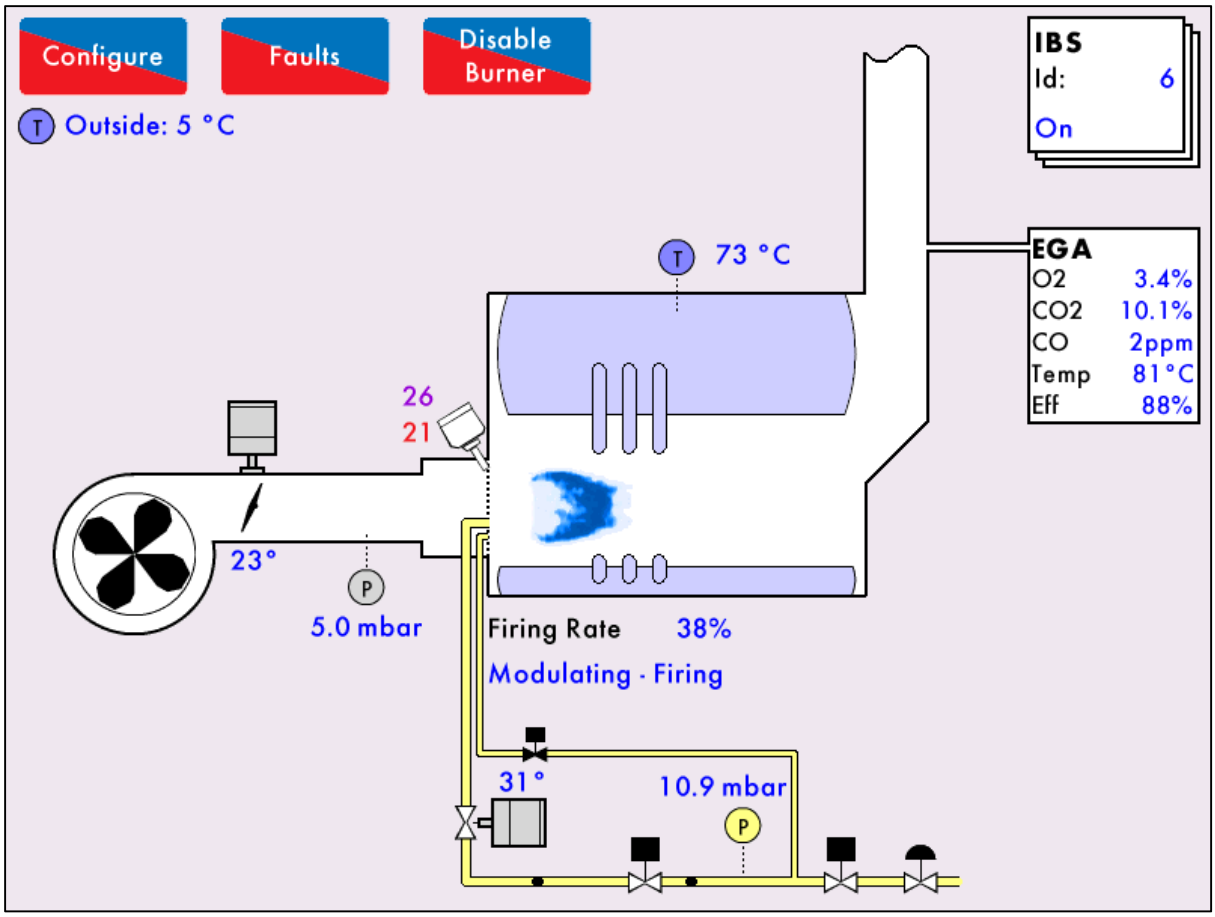
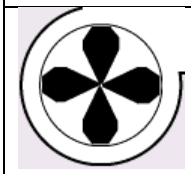
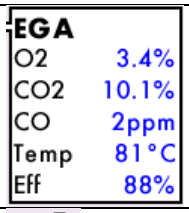
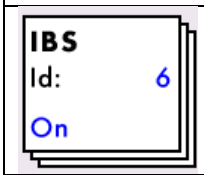
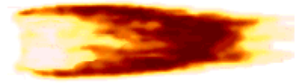
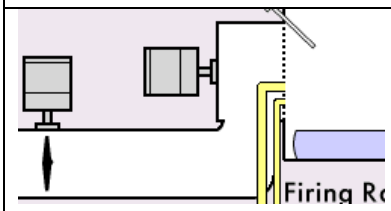
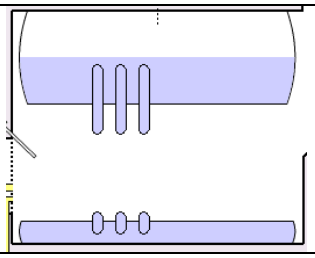
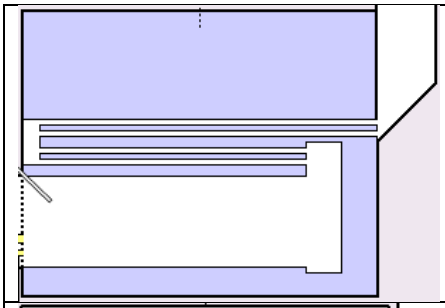
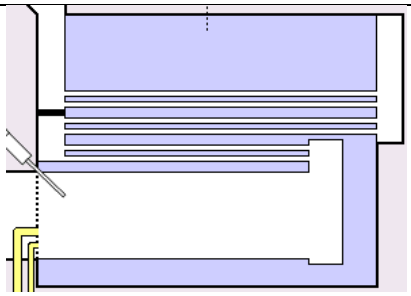
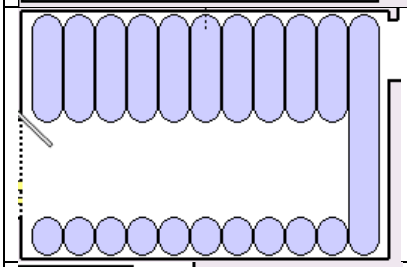
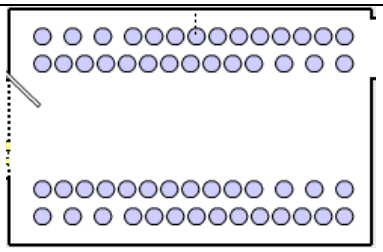
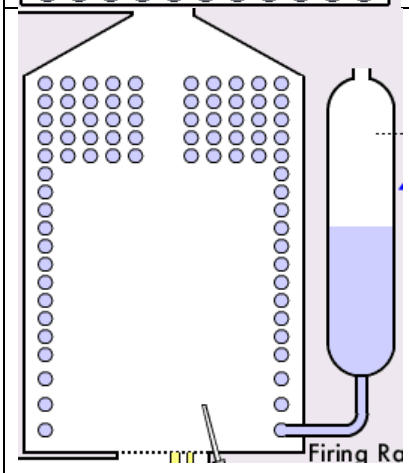
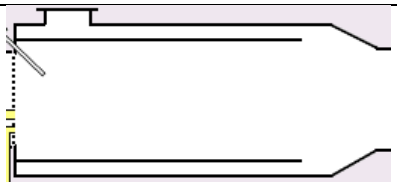


Figure 3.1.i Home

The home screen shown in Figure 3.1.i. displays the current boiler setup. It provides operating information for each component of the burner/boiler in real time. Pressing on components will display further information e.g. pressing on the servomotor image will show the servomotor position history. This boiler room setup can be configured to display what is actually on site, please see section 3.12.2 Boiler Configuration.

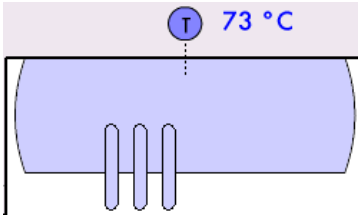
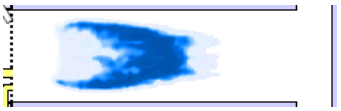
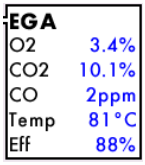
3.1.1 Home Screen Components

	Servomotor		VSD
	Flame Detector		Gas Pressure Sensor
	Air Pressure/ Boiler Steam Pressure Sensor		OTC/ Boiler Temperature Sensor
	Gas Pipe – gas flowing		Gas Pipe – no flow
	Oil Pipe – oil flowing		Oil Pipe – no flow
	Fuel Valve – solenoid open		Fuel Valve – solenoid closed
	Fuel Control Valve – open		Fuel Control Valve – closed
	Regulator		Feed Water Pump
	Feed Water Valve		Steam/ Air Atomisation
	FGR/ Induced Draft Valve		Air Damper
	Combustion Air Fan		EGA Information
	IBS Information		Induced draft
	Gas Flame		Oil Flame
	Rotary Cup Burner		Water Tube

	Three-Pass Fire Tube		Four-Pass Fire Tube
	Cast-Sectional Tube		Horizontal Coil Tube
	Vertical Coil Tube		Kiln

3.1.2 Home Screen Buttons

The Home screen comprises of various components that can be selected to navigate through the information screens of the M.M. The components display in the Home screen according to the boiler room configuration, see section 3.12.2.

Button	Component	Description
	Status	The current boiler temperature/ pressure is displayed next to the temperature/ pressure detector. Pressing on the boiler or the load detector gives access to the Status screen, see section 3.2.
	Fuel-Air	The current firing rate will display below the flame, pressing the flame gives access to the Fuel-Air Screen, see section 3.3.
	Flame Safeguard	The number of counts will be displayed for the flame scanner used. This button gives access to the Flame Safeguard screen, see section 3.4.
	Servomotor	This button is animated to display the current angular position of the servomotor, and gives access to the Channels screen, shown in section 3.5.
	VSD	This button shows the VSD input signal, and gives access to the Channels screen, see section 3.5.
	Gas Pressure Sensor	This button is animated with the current measured gas pressure, and gives access to the Gas Sensor screen, see section 3.6.
	Air Pressure Sensor	This button is animated with the current measured air pressure, and gives access to the Air Sensor screen, see section 3.7.
	Fuel Flow	Pressing on the gas/oil pipe gives access to the Fuel Flow screen, see section 3.8.
	IBS	The IBS box will show the ID number of the M.M., and its status, and if it is the lead boiler. This button gives access to the IBS screen, see section 3.9.
	EGA	The EGA box will show the current exhaust gas and temperature, and efficiency values. This button gives access to the EGA screen, see section 3.10.
	Outside Temperature Compensation	This temperature sensor is animated with the current outside temperature. This button gives access to the OTC screen, see section 3.11.

3.1.3 Enable/Disable

If option 15 is set to 2 or 3 then the burner can be enabled/ disabled by pressing 

in the Home screen (Figure 3.1.i). If option 15 is set to 0 or 1, then the burner will cannot be enabled/disabled via the home screen.

3.1.4 Faults

Figure 3.1.4.i Faults

Press 

in the Home screen (Figure 3.1.i) to view the burner lockouts, MM errors, and EGA errors. The MM will store up to 64 burner lockouts, MM errors and EGA errors. These can be reset via Online Changes, see section 3.12.5.

3.2 Status Screen

3.2.1 Status

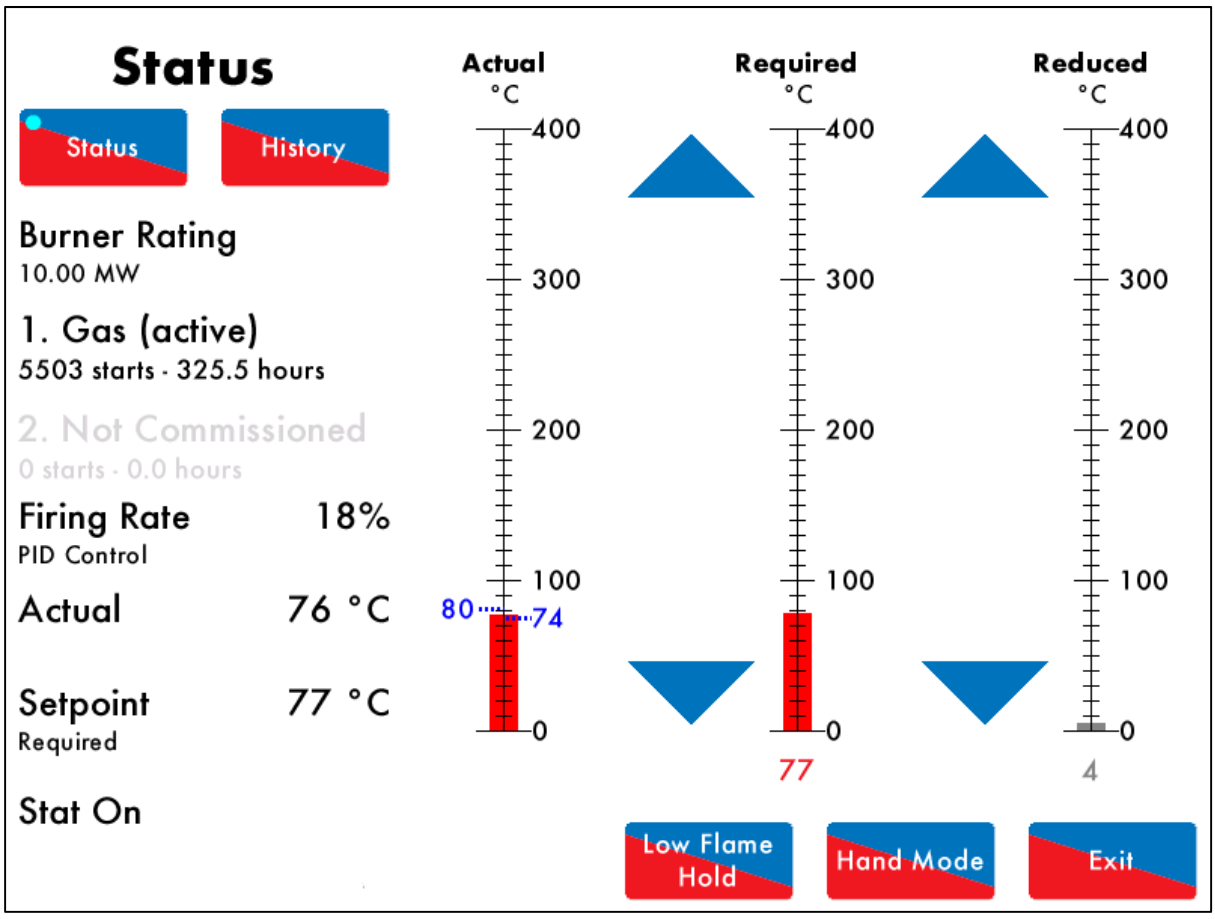


Figure 3.2.1.i Status

Press the boiler load detector button or the boiler image in the Home screen (Figure 3.1.i) to display the Status screen in Figure 3.2.1.i. The status screen gives the following information:

- Burner rating
- Current fuel selected and type
- Burner starts and run hours
- Current firing rate
- Control method – internal PID control or external modulation (see option 45)
- Actual temperature/ pressure
- Setpoint – required/ reduced temperature/ pressure
- Stat status – T53 call for heat on or off
- Burner switch on/off offset (see options 9, 10, and 11)
- Reduced setpoint (see section 3.12.7 Run Times, and option/parameter 154)
- Indication if MM is firing to meet required or reduced setpoint (red = active, grey = inactive)
- Arrows for adjusting setpoint (they do not appear if using a DTI or OTC)

Press the  arrows to change the required or reduced setpoints. If these arrows are not displayed, then either the user setpoint change has been disabled (see option 15), or the DTI is controlling the setpoint (see options 16 and 100) or OTC is enabled (see option 80).
Note: Use parameters 29 and 30 to adjust the load detector reading if required.

3.2.2 Status – History

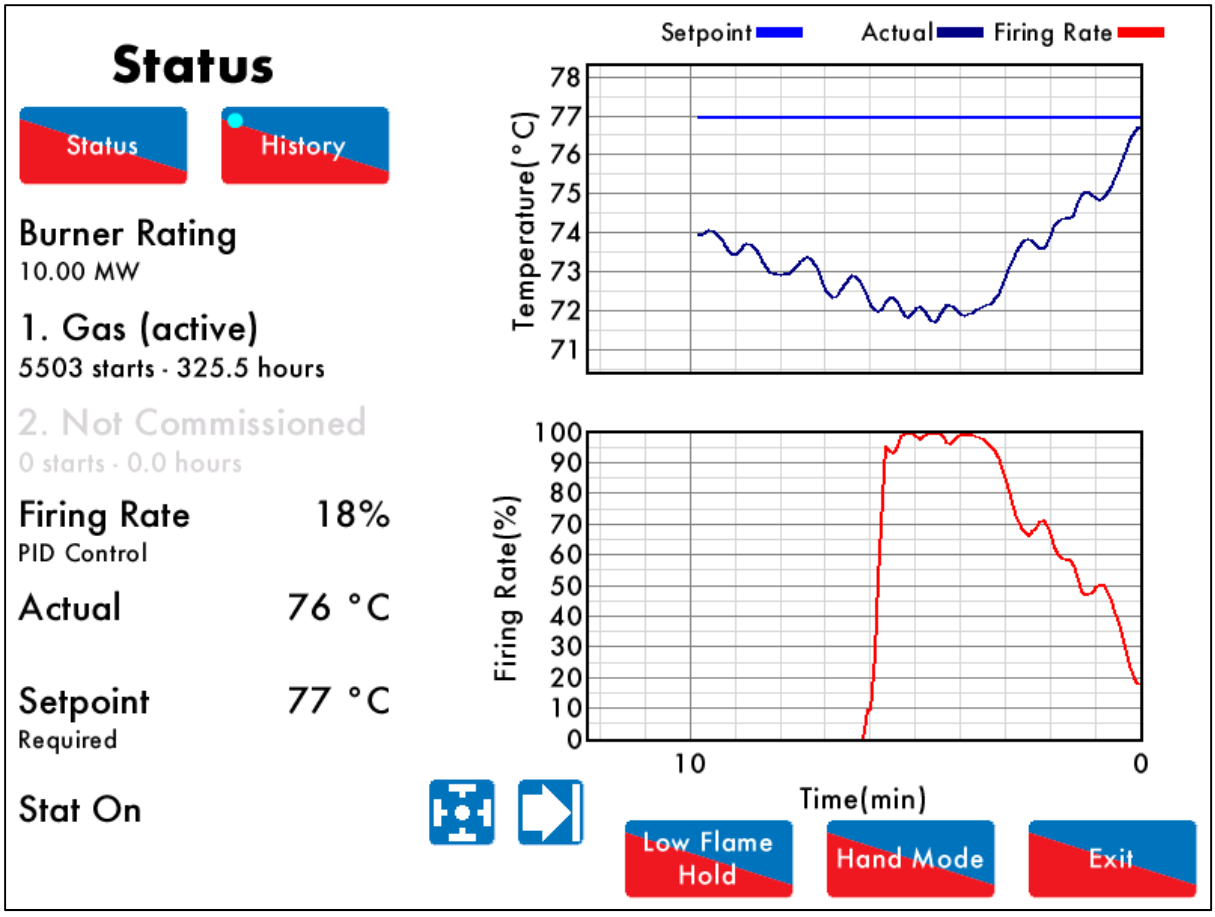


Figure 3.2.2.ii Status – History

Press 

in the Status screen (Figure 3.2.1.i) to show the Status History in Figure 3.2.2.ii. The setpoint, actual temperature/pressure and firing rate are displayed graphically. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.2.3 Status – Low Flame Hold

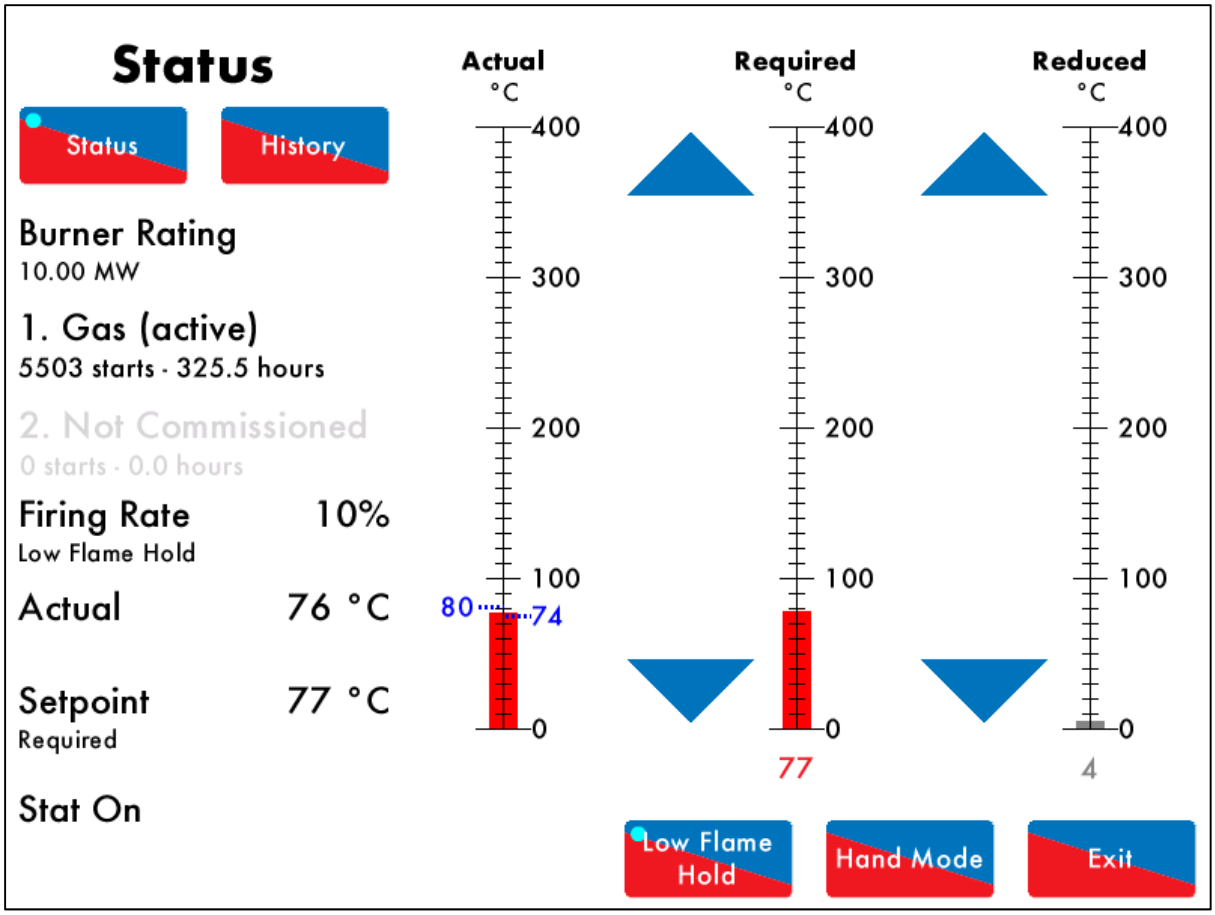


Figure 3.2.3.i Status – Low Flame Hold

Press 

on the Status screen (Figure 3.2.1.i) to put the MM in low flame hold, and press this button again to return to modulation, see Figure 3.2.3.i.

Alternatively, the Mini Mk8 MM can also be put in low flame hold via an input on terminal 81, see option/ parameter 155.

Note: If using Intelligent Boiler Sequencing, then putting the MM into low flame hold will remove the unit from the sequence loop. It will resume once low flame hold is deselected and after the next scan time elapses.

Note: If low flame hold and hand mode are both selected, then the hand mode takes priority.

3.2.4 Status – Hand Mode

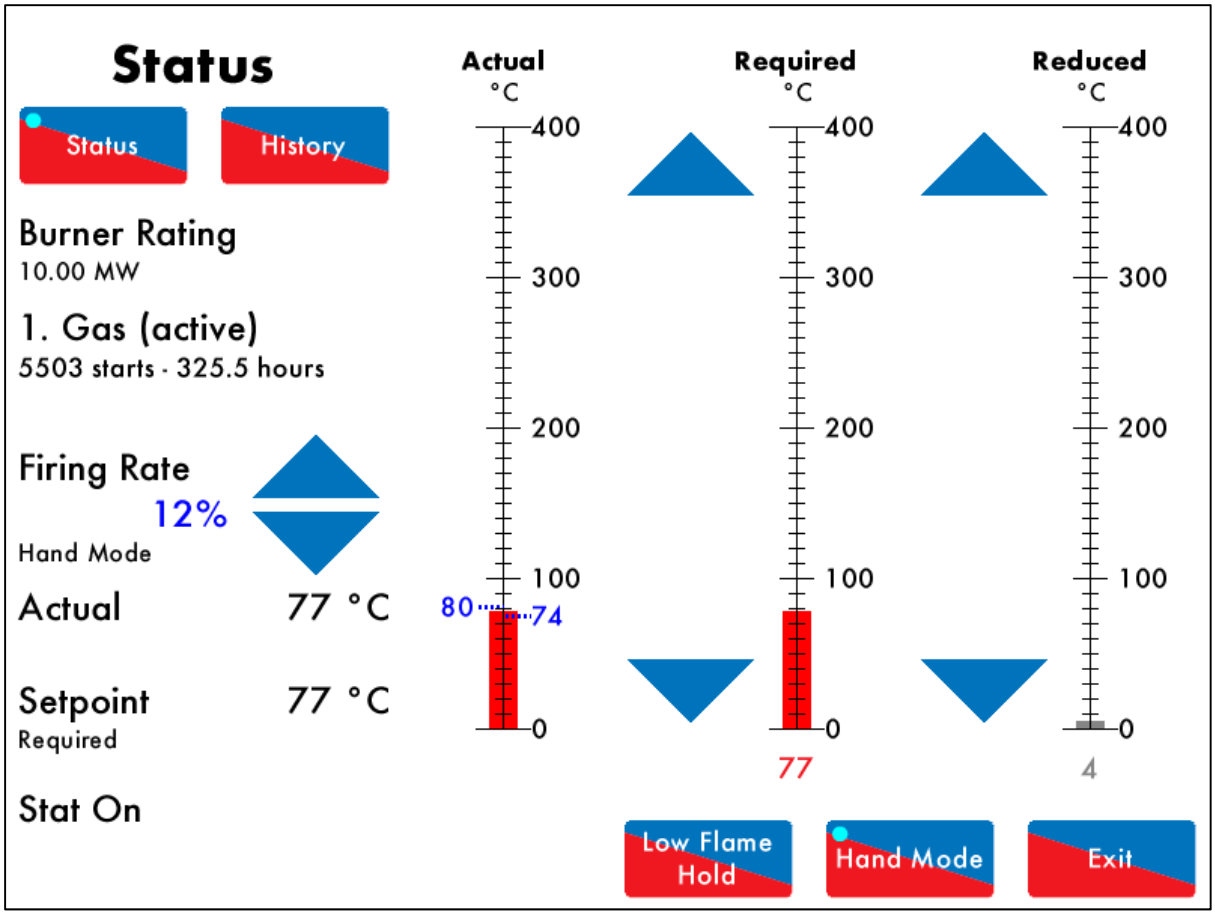


Figure 3.2.4.i Status – Hand Mode

Press 

on the Status screen (Figure 3.2.1.i) to put the MM in hand mode, where the firing rate can be driven up or down by using the  buttons (see Figure 3.2.4.i).

Alternatively, the firing rate can be set remotely via Modbus addresses 40121 and 40131, see section 5.2.

Note: If using Intelligent Boiler Sequencing, then changing the firing rate via hand mode remove the unit from the sequence loop. It will resume once low flame hold is deselected and after the next scan time elapses.

Note: If low flame hold and hand mode are both selected, then the hand mode takes priority.

3.3 Fuel-Air Screen

3.3.1 Fuel-Air – Curve

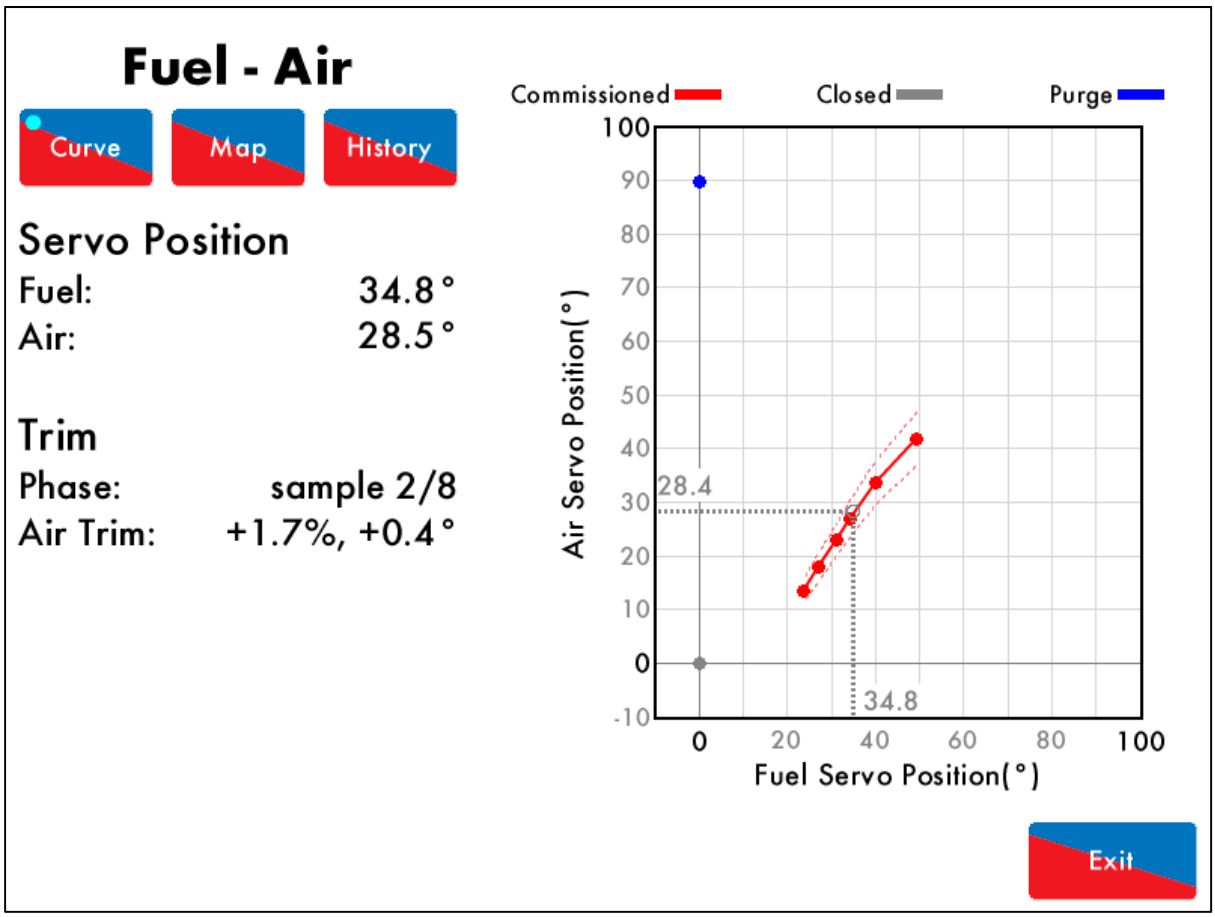


Figure 3.3.1.i Fuel-Air – Curve

Press the flame in the Home screen (Figure 3.1.i) to view the Fuel-Air screen in Figure 3.3.1.i. This shows the fuel valve and air damper angular position, the trim status and the commission curve graph.

3.3.2 Fuel-Air – Map

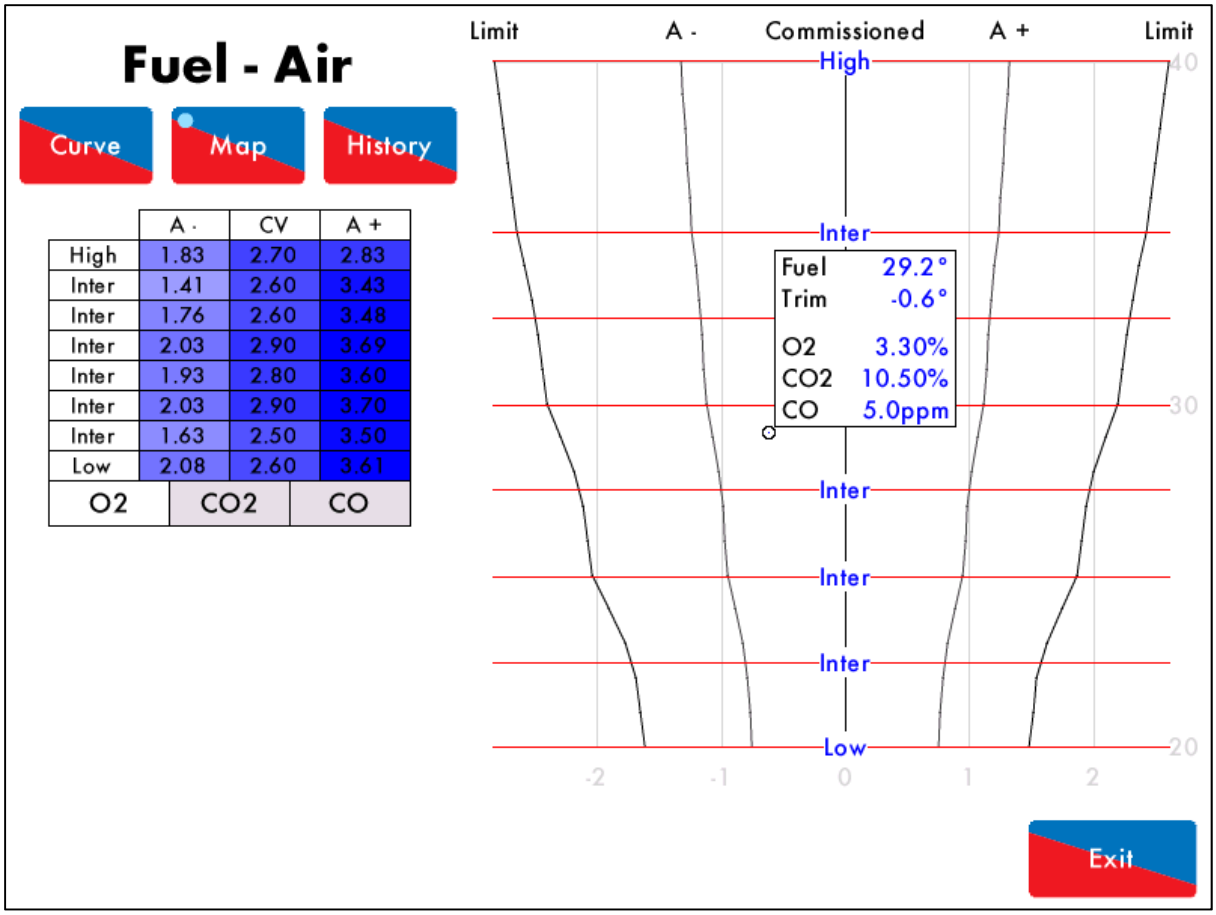


Figure 3.3.2.i Fuel-Air Map

Press 

in the Fuel-Air screen (Figure 3.3.1.i) to view the Fuel-Air Map screen shown in Figure 3.3.2.i. The air rich and fuel rich trim values are shown for each commissioned point. The graph shows EGA's current reading and if there is any trim correction on the air damper. The circle on the fuel-air map indicates the current position of the trim correction, and how far the current combustion values are from the commissioned values.

Option 12 must be set to 2 or 3 for the 3-parameter trim function to be activated.

3.3.3 Fuel-Air – History

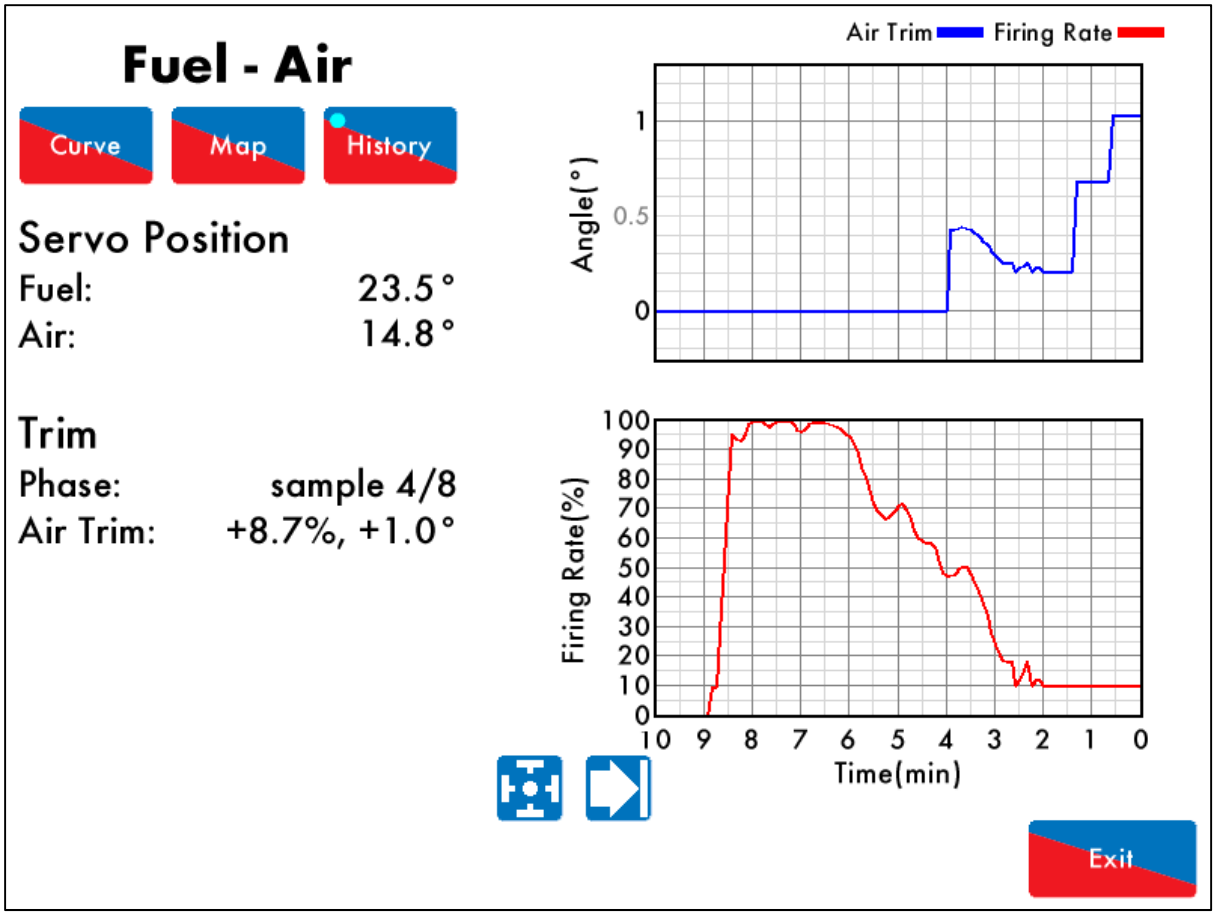


Figure 3.3.3.i Fuel-Air – History

Press 

in the Fuel-Air screen (Figure 3.3.1.i) to view the Fuel-Air History screen in Figure 3.3.3.i. The firing rate and air trim history (if an EGA is optioned for trim) is displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.4 Flame Safeguard Screen

3.4.1 Flame Safeguard

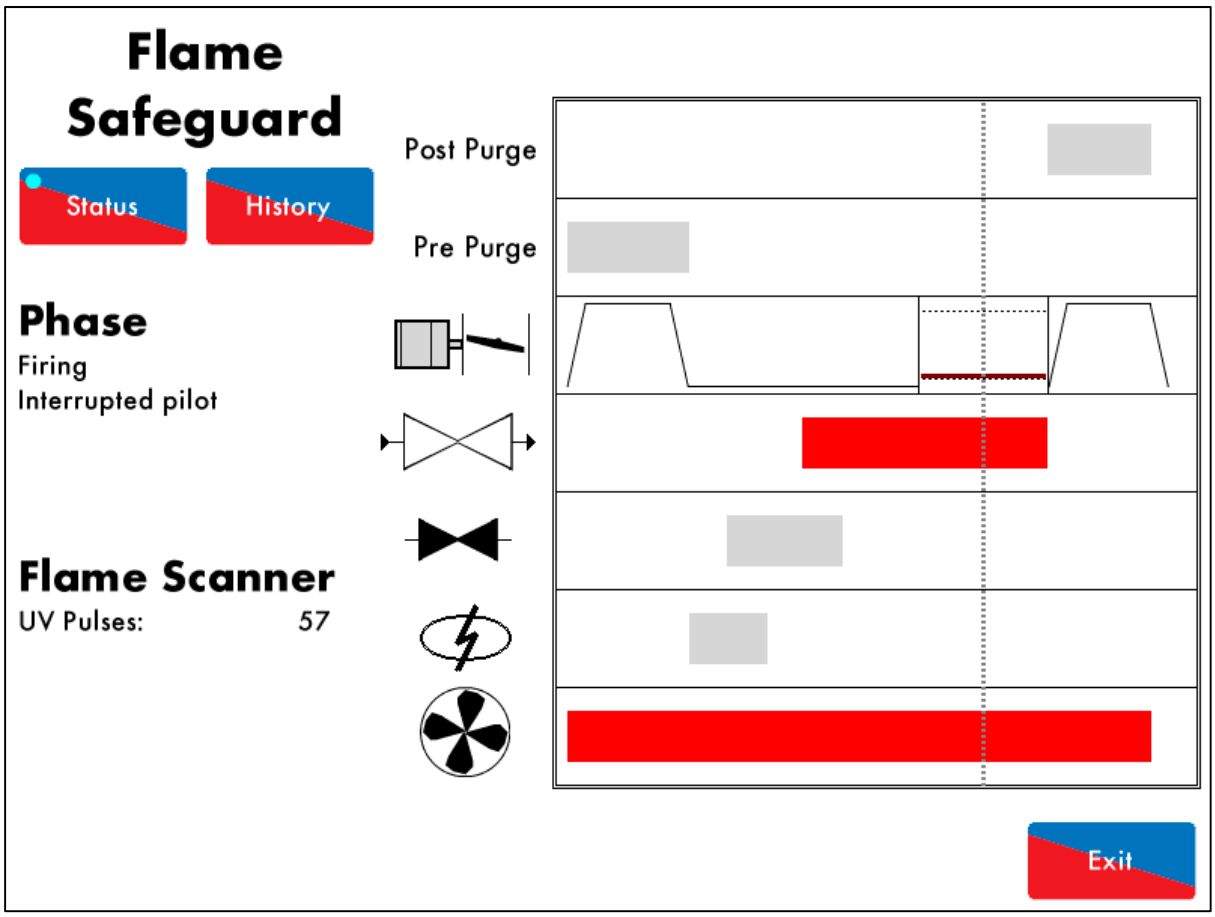


Figure 3.4.1.i Flame Safeguard – Status

Press on the flame detector in the Home screen (Figure 3.1.i) to view the Flame Safeguard screen in Figure 3.4.1.i. The Flame Safeguard screen displays the following information:

- Current phase of the MM
- Flame scanner signal strength

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 rows refer to:

- Post purge
- Pre-purge
- Air damper position
- Main fuel valve
- Pilot valve
- Ignition
- Blower motor

Please refer to section 4 for the start-up sequence of the burner.

3.4.2 Flame Safeguard – History

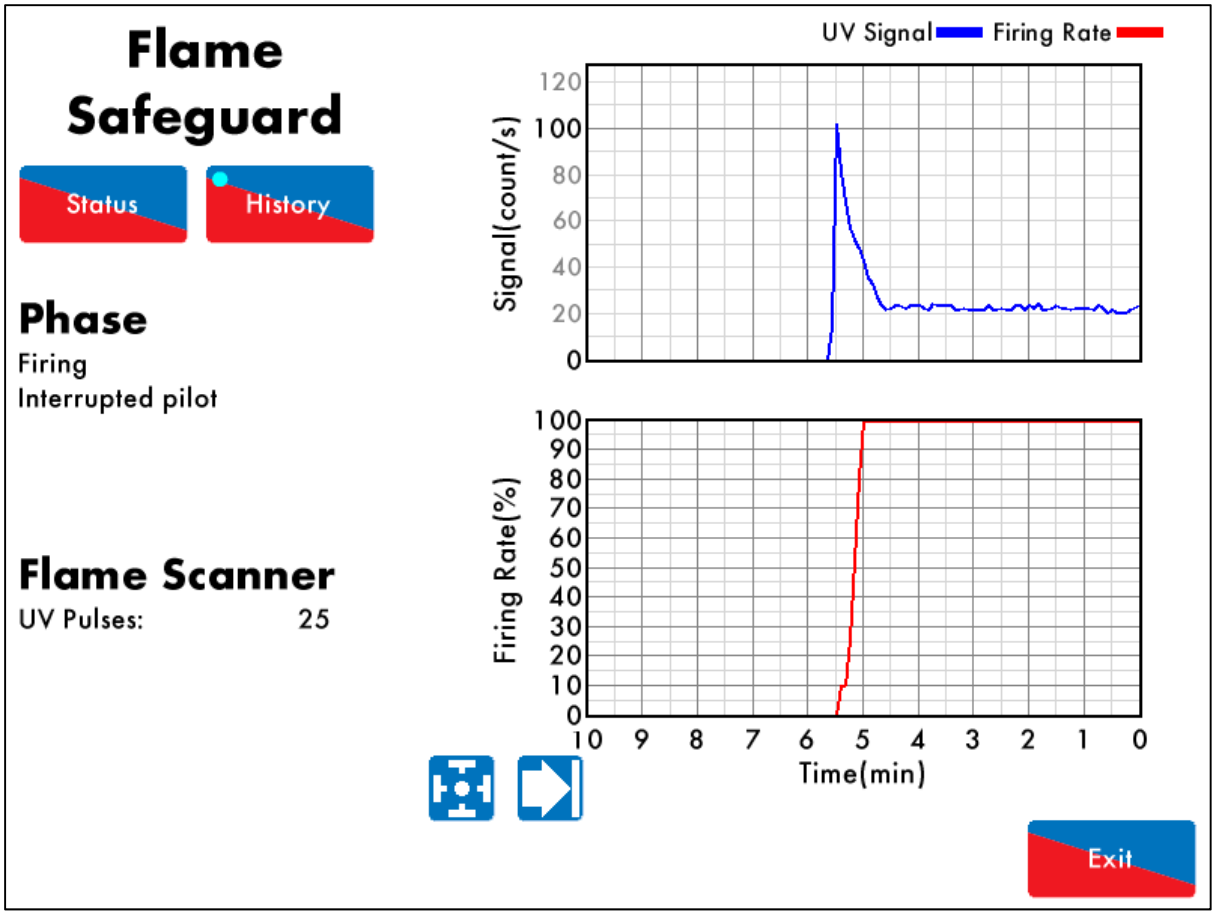


Figure 3.4.2.i Flame Safeguard – History

Press 

in the Flame Safeguard screen (Figure 3.4.1.i) to view Flame Safeguard History screen in Figure 3.4.2.i. The flame scanner signal and firing rate histories are displayed. This data is logged for 24 hours on the MM.

Use the 
buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.
.=
Note: Power cycling the MM or changing fuel will reset this data log.

3.5 Channels Screen

3.5.1 Servomotor

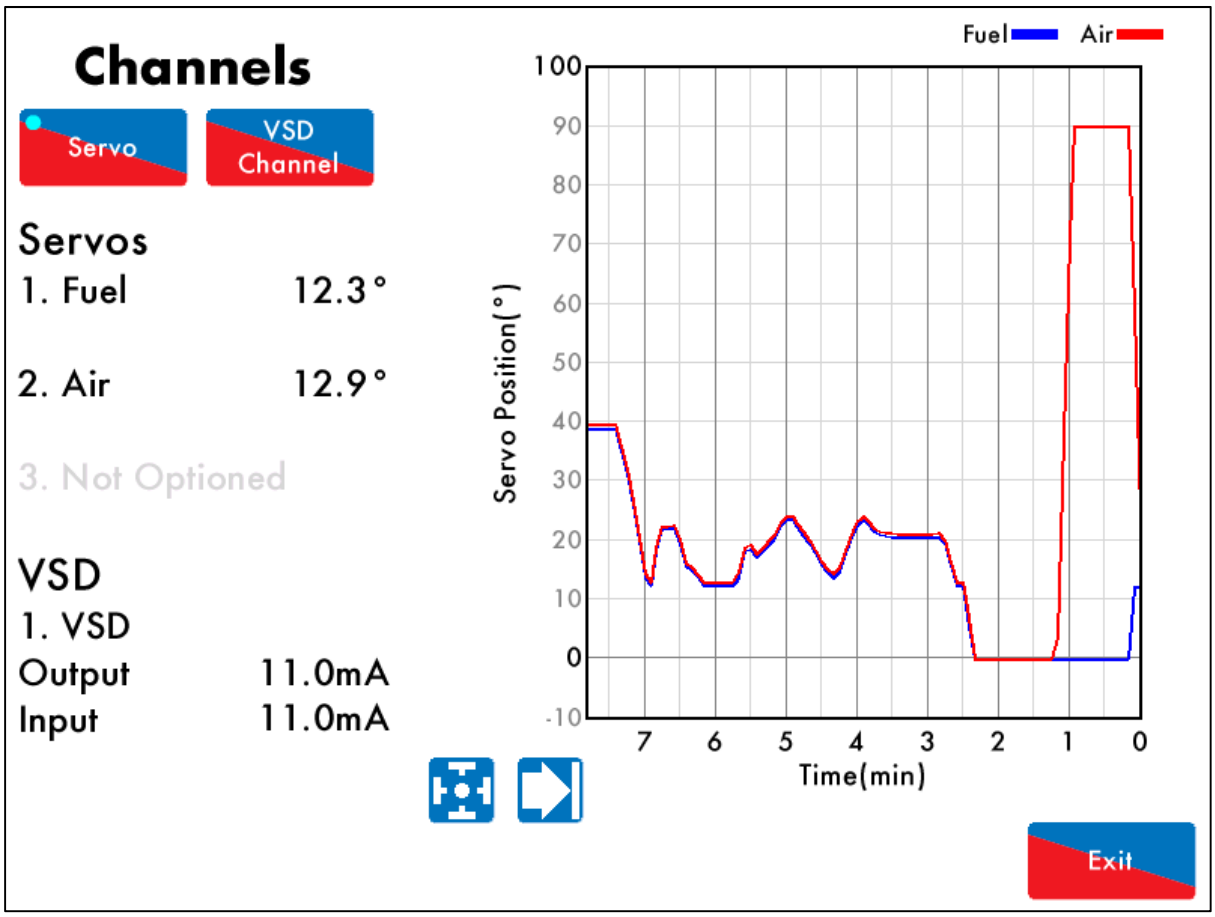


Figure 3.5.1.i Servomotor

Press on the servomotor or VSD in the Home screen (Figure 3.1.i) to view Channel screen in Figure 3.5.1.i. The following information is shown:

- Current fuel and air servomotor positions
- VSD output and input

This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.5.2 VSD Channel

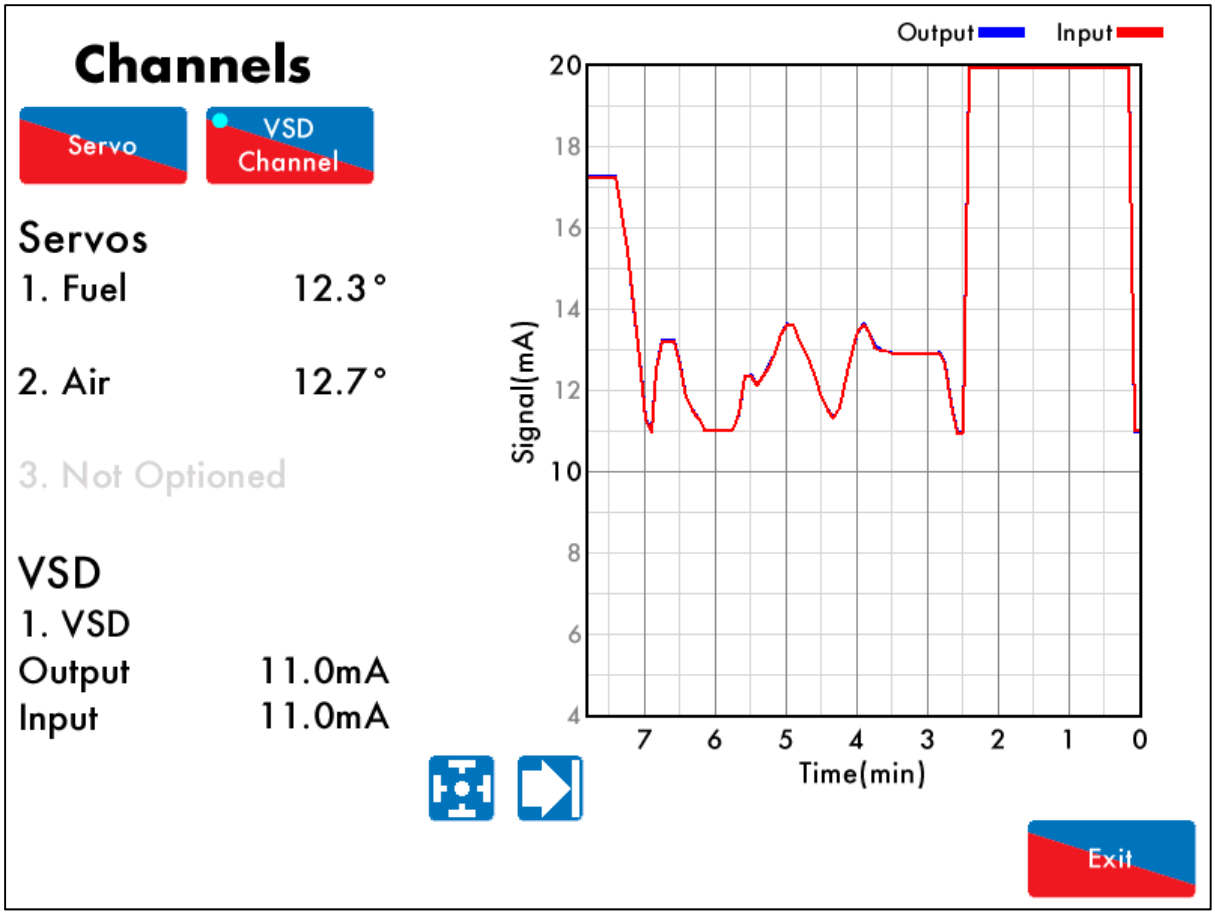


Figure 3.5.2.i VSD Channel

Press 

on the Channels screen (Figure 3.5.1.i) to view the VSD Channel screen in Figure 3.5.2.i. The VSD output and input signal histories are displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.6 Gas Pressure Sensor Screen

3.6.1 Gas Pressure

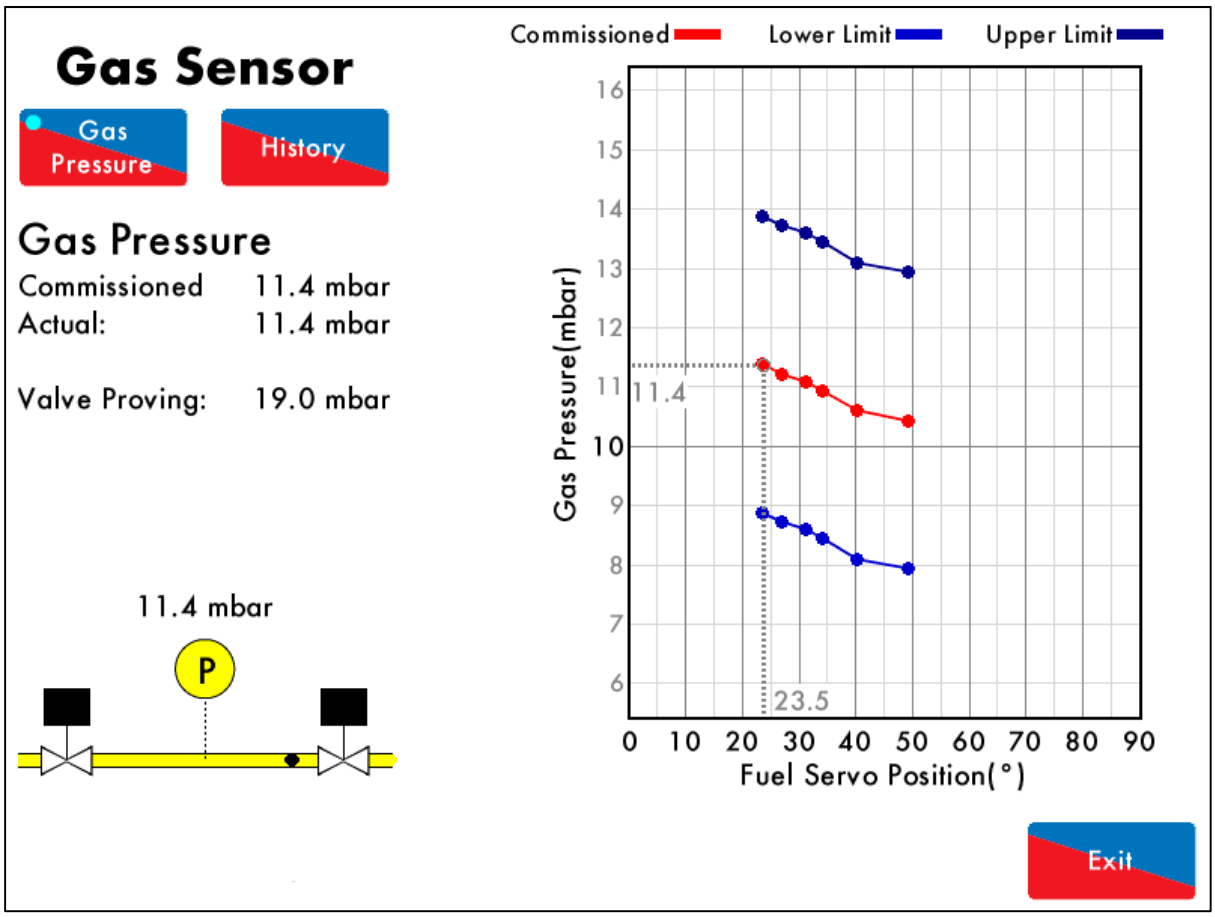


Figure 3.6.1.i Gas Pressure

Press on the gas pressure sensor in the Home screen (Figure 3.1.i) to view the Gas Pressure screen in Figure 3.6.1.i. The following information is displayed:

- Commissioned gas pressure
- Actual (current) gas pressure detected
- Valve proving gas pressure
- Status of main gas and vent valves
- Upper/ lower gas pressure limits for the fuel servomotor positions

3.6.2 Gas Sensor – History

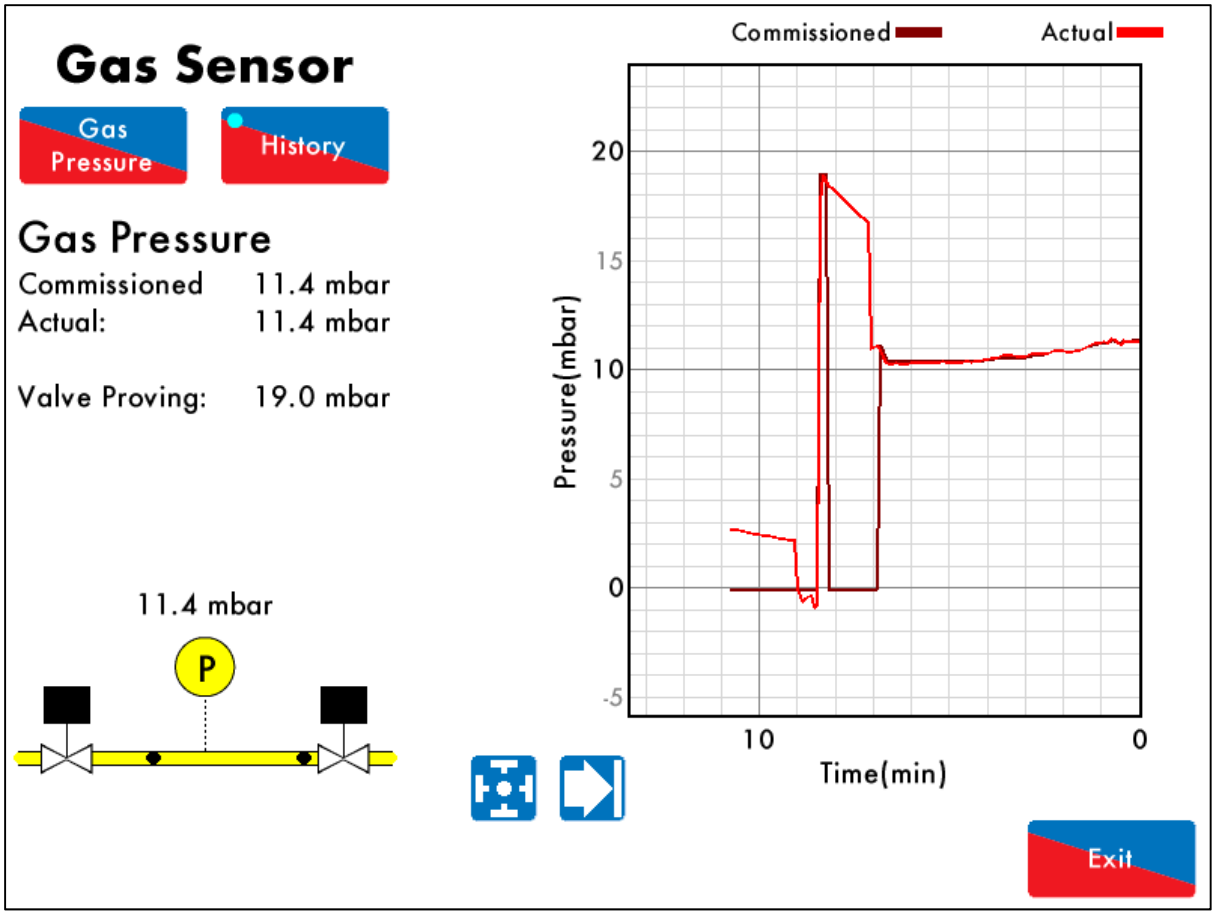


Figure 3.6.2.i Gas Sensor – History

Press 

in the Gas Pressure screen (Figure 3.6.1.i) to view the Gas Pressure History screen in Figure 3.6.2.i. The commissioned and actual gas pressure histories are displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.7 Air Pressure Sensor Screen

3.7.1 Air Pressure

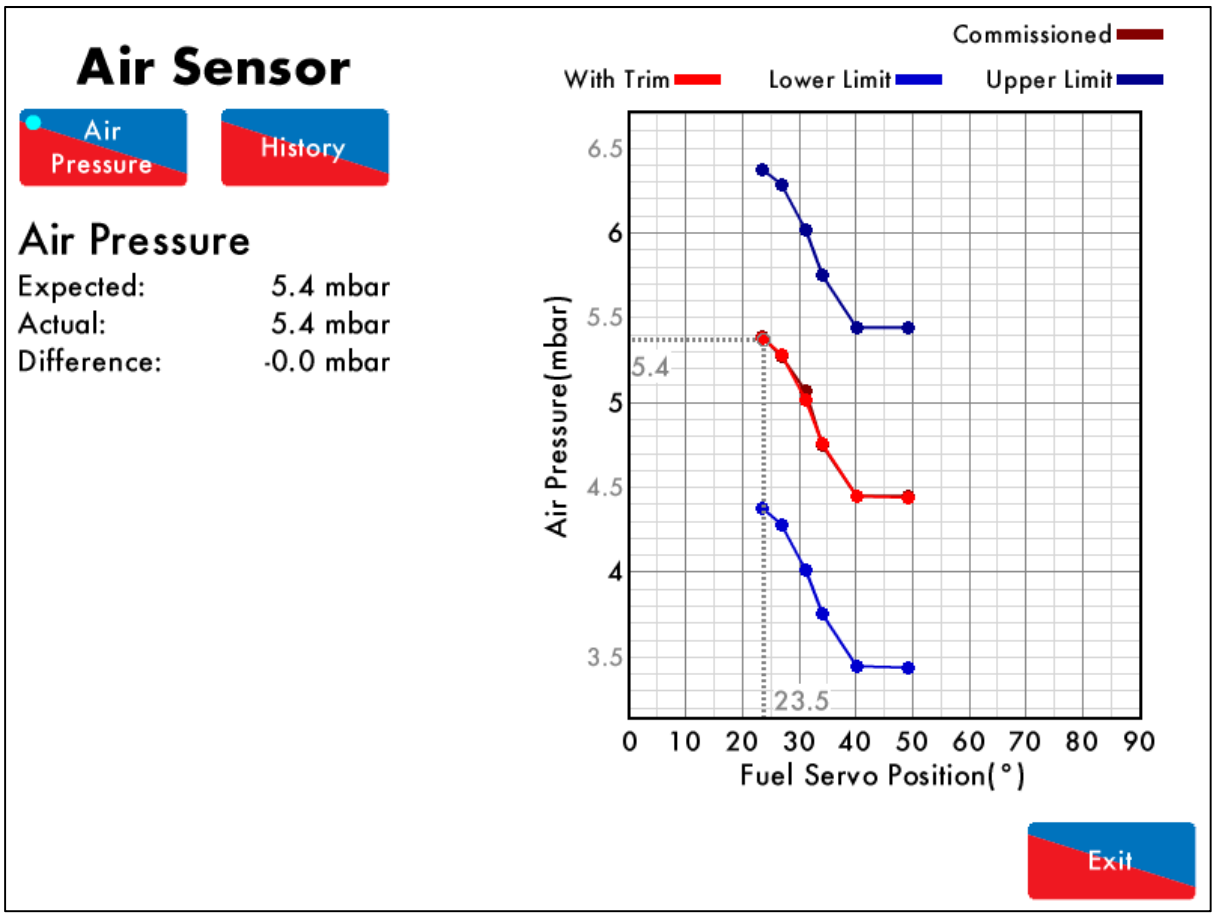


Figure 3.7.1.i Air Pressure

Press on the air pressure sensor in the Home screen (Figure 3.1.i) to view the Air Pressure screen in Figure 3.7.1.i. The expected air pressure, actual air pressure, and the difference between the expected and the actual air pressure values are displayed.

The graph shows the commissioned air pressure and its upper/ lower limits for the fuel servomotor positions, as well as the air pressure values with trim added on the air damper.

If commissioned with an EGA, the air pressure is stored during trim. The red line of air pressure is then displayed to take into account the deviation in the air from the brown commissioned line on the graph.

3.7.2 Air Sensor – History

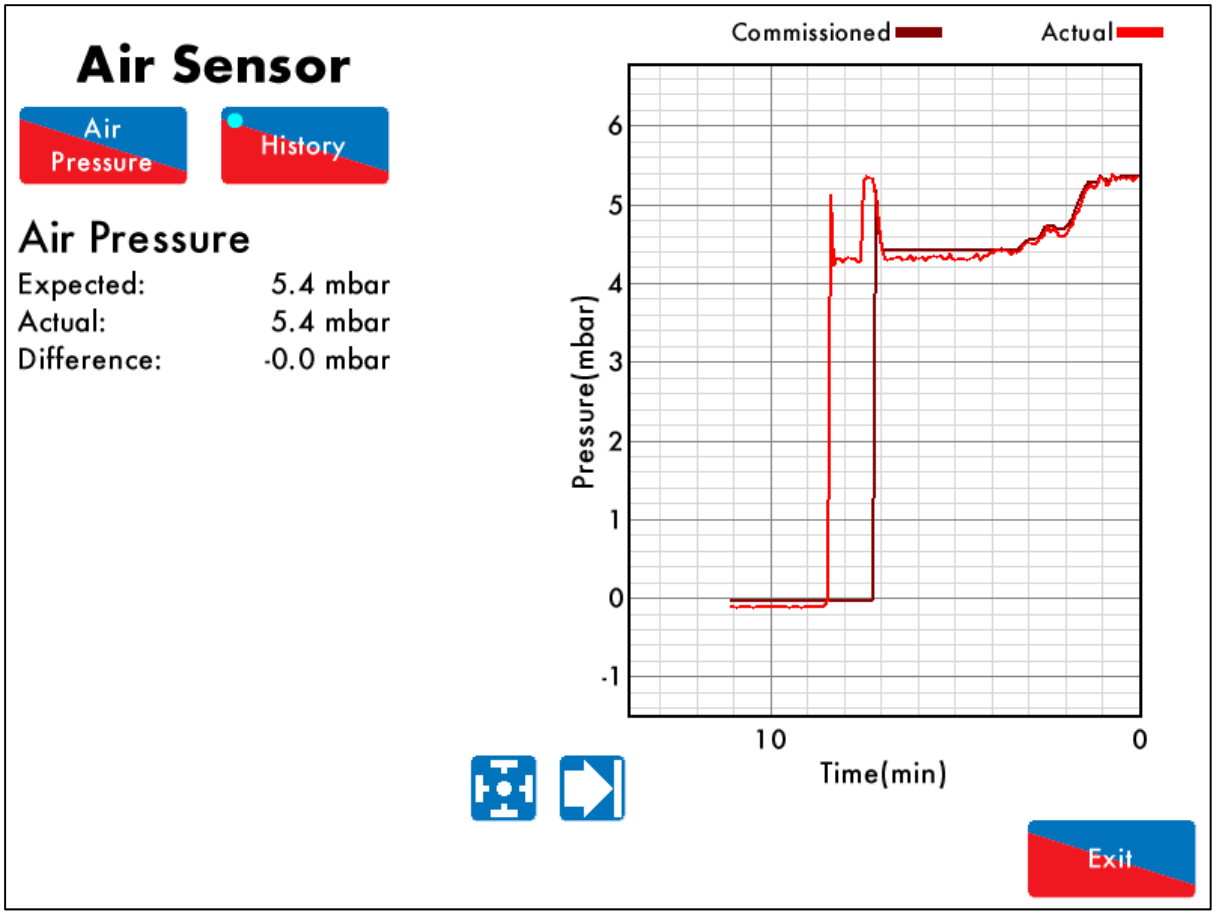


Figure 3.7.2.i Air Sensor – History

Press 

on the Air Pressure screen (Figure 3.7.1.i) to view the Air Pressure History in Figure 3.7.2.i. The commissioned and actual air pressure histories are displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.8 Fuel Flow Screen

3.8.1 Fuel Flow

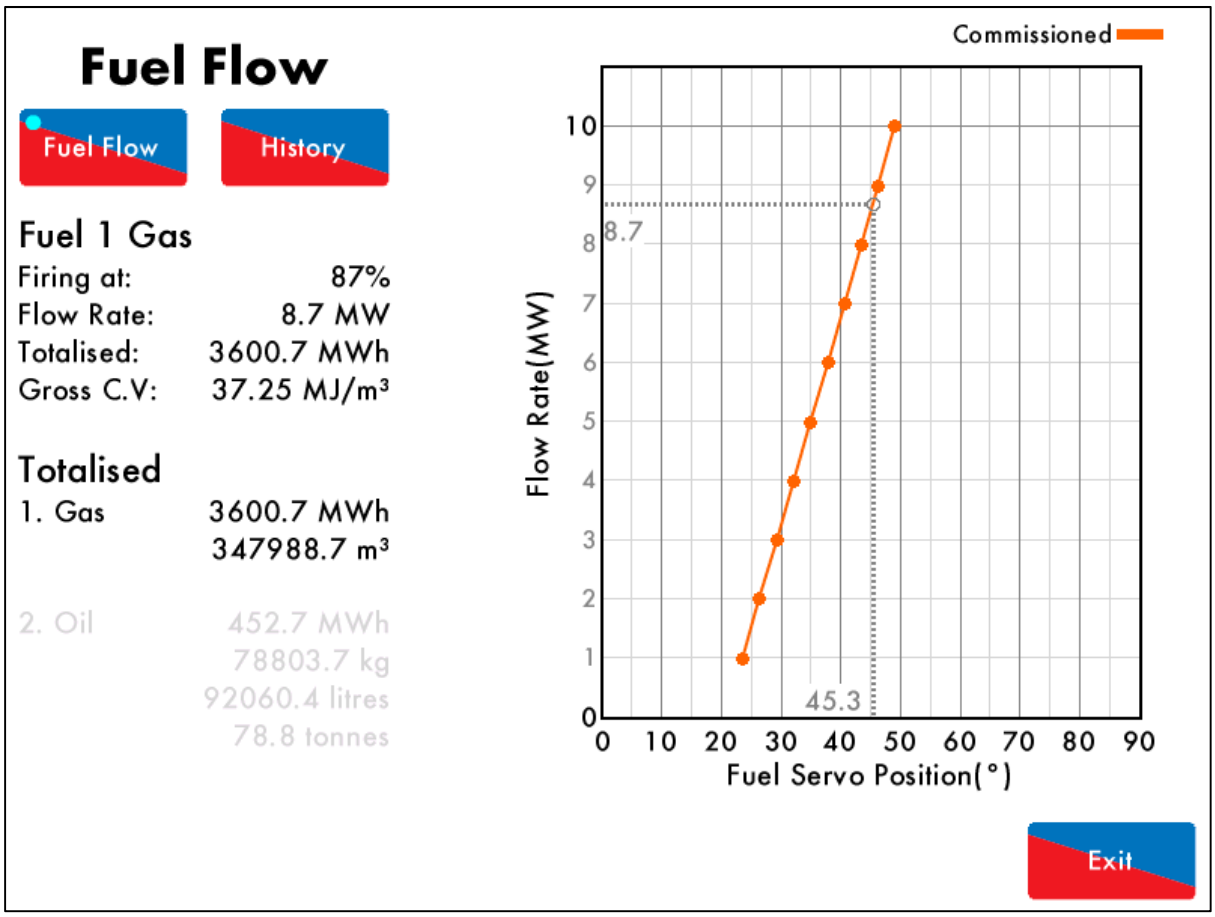


Figure 3.8.1.i Fuel Flow

Press the gas/oil pipe in the Home screen (Figure 3.1.i) to view the Fuel Flow screen in Figure 3.8.1.i. The following information is shown:

- Current firing rate
- Current fuel flow
- Gross calorific value of the fuel
- Totalised fuel flow
- Totalised fuel used

3.8.2 Fuel Flow – History

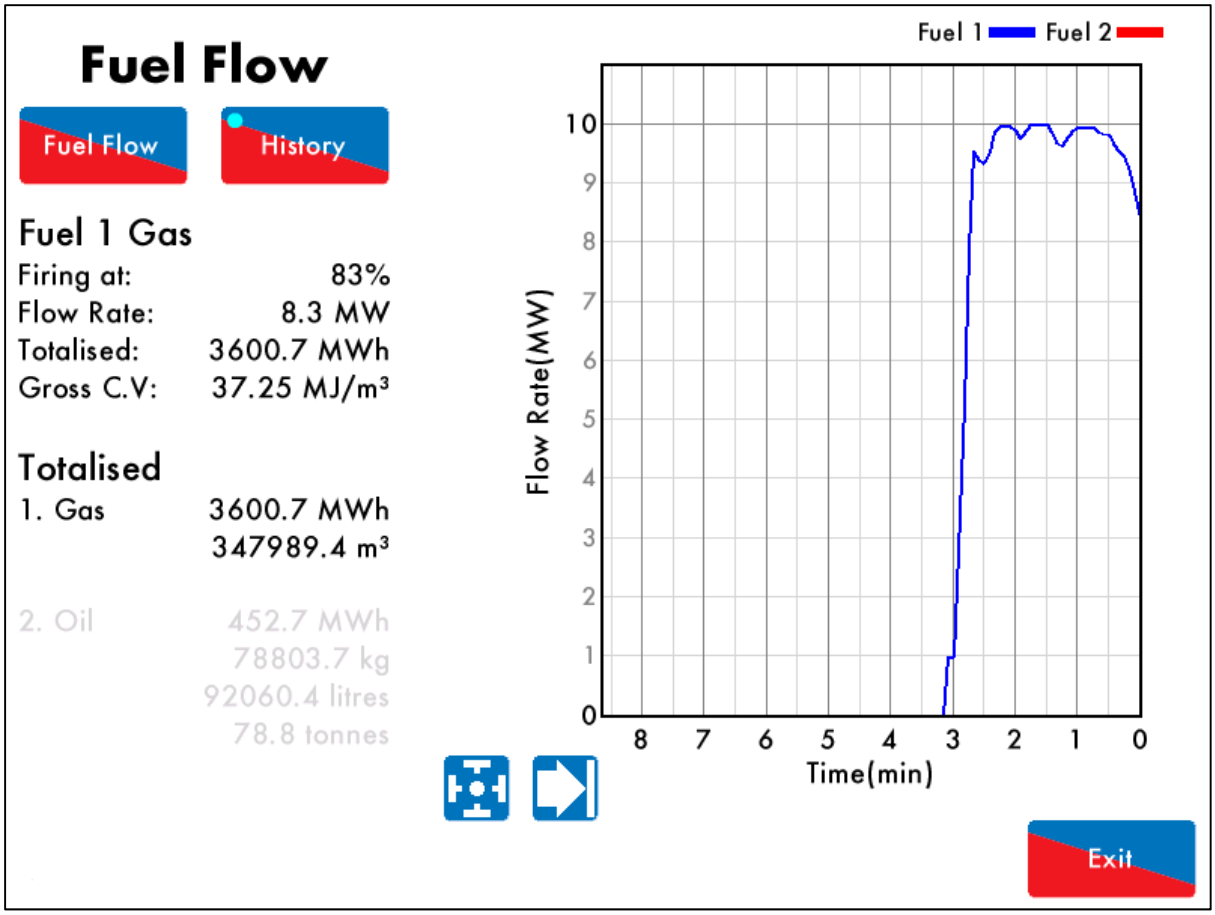


Figure 3.8.2.i Fuel Flow – History

Press 

in the Fuel Flow screen in Figure 3.8.1.i to view the Fuel Flow History in Figure 3.8.2.i. The fuel flow rate history is displayed. This data is logged for 24 hours on the MM.

Use the 
buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.9 Sequencing Screen

3.9.1 IBS – Sequencing

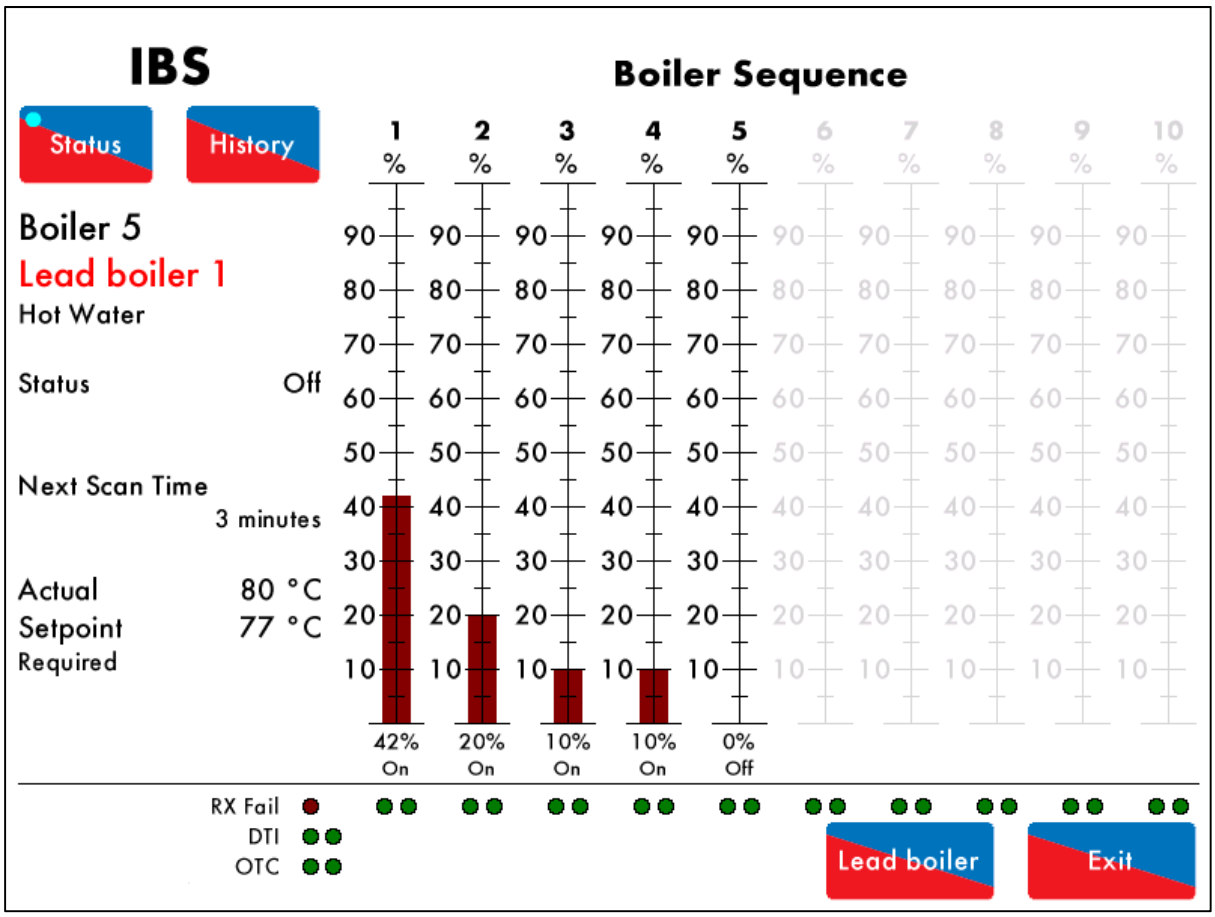


Figure 3.9.1.i IBS – Status

Press on the IBS box in the Home screen (Figure 3.1.i) to view the IBS Status screen in Figure 3.9.1.i. The following information is displayed:

- ID number of the MM
- Lead boiler
- Type of sequencing (steam/hot water)
- Current status
- Next scan time
- Actual temperature/pressure
- Required setpoint
- Number of MMs in the sequencing loop
- Current firing rates of all the MMs in the loop
- Current status of all the MMs in the loop
- Sequencing communications check

Note: To display the sequencing communications diagnostics as shown above, parameter 83 must be set to 1.

Pressing on the bars of MMs which are offline will give more information on why it has been removed from the sequencing loop.

3.9.2 IBS – Lead Boiler

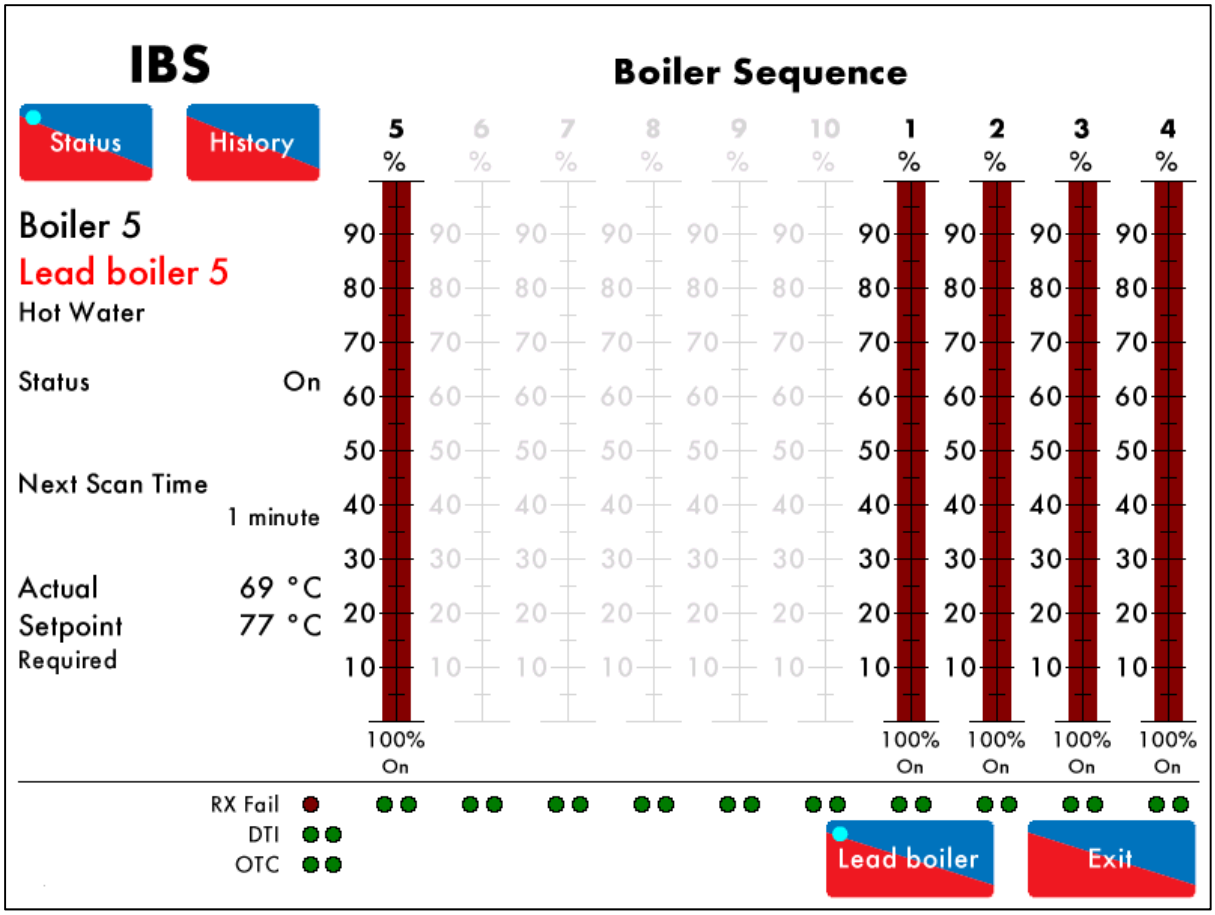


Figure 3.9.2.i IBS – Lead Boiler

Press Lead boiler in the IBS Status screen (Figure 3.9.1.i) to select that MM as the lead boiler.

Note: If another MM has already been selected as lead boiler, or no boilers have been selected as lead boiler, then the MMs will fire independently until one lead boiler has been selected.

3.9.3 IBS – History

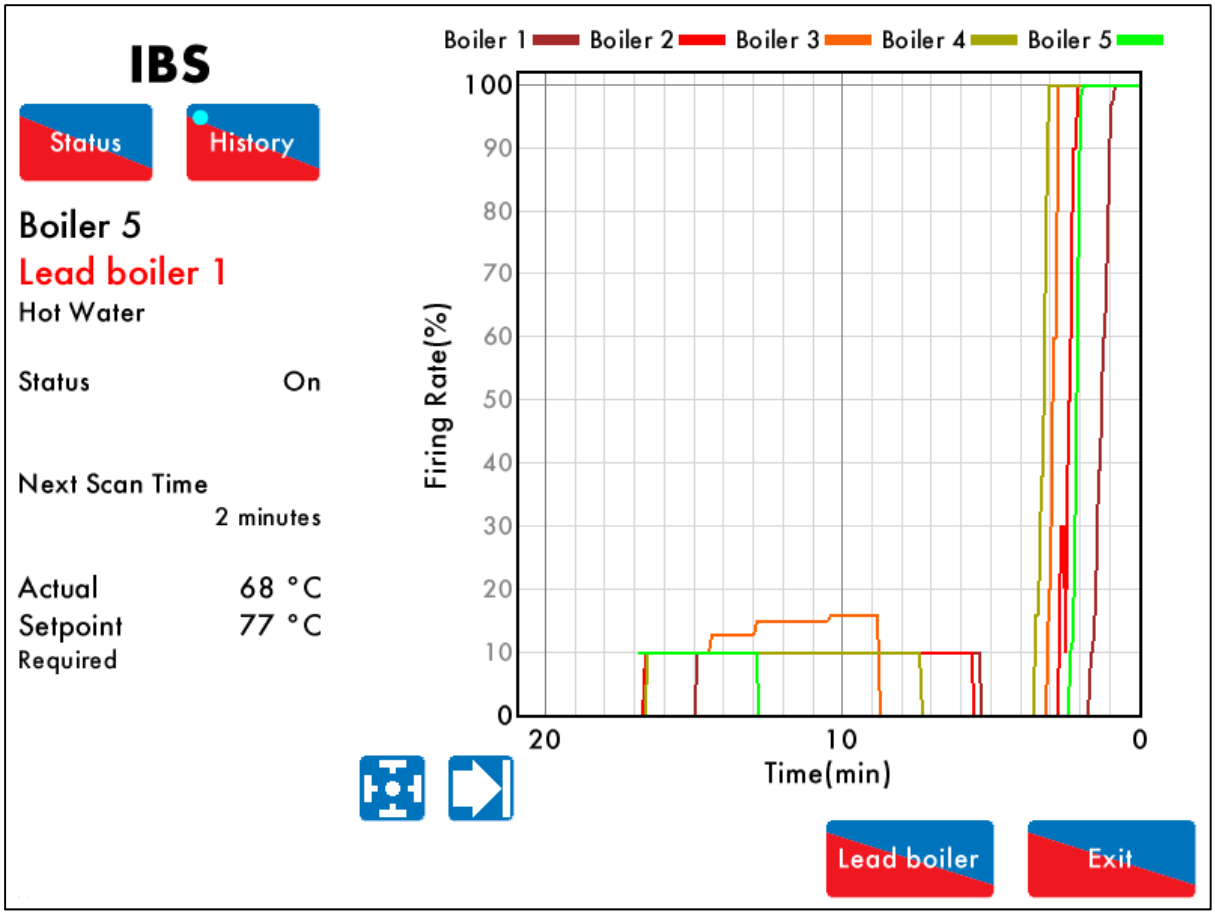


Figure 3.9.3.i IBS – History

Press 

in the IBS – Status screen (Figure 3.9.1.i) to view IBS History screen in Figure 3.9.3.i. The firing rate histories for the MMs in the sequencing loop are displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.10 EGA Screen

3.10.1 EGA – Gas

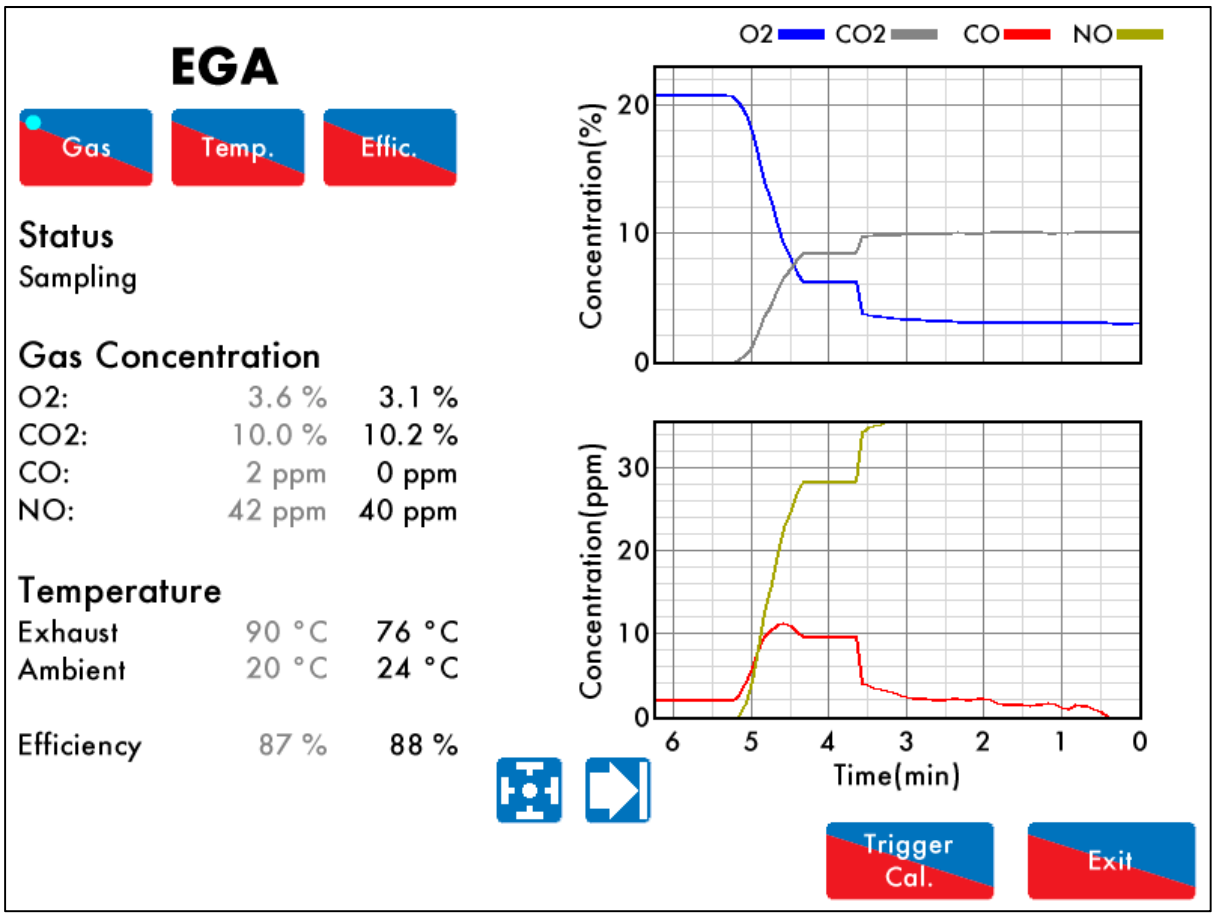


Figure 3.10.1.i EGA – Gas

Press the EGA box in the Home screen (Figure 3.1.i) to view the EGA Gas screen in Figure 3.10.1.i. The following information is displayed:

- EGA status
- Commissioned exhaust gases, temperature and efficiency values (in grey)
- Current exhaust gases, temperature and efficiency values (in black)

This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

Press 

to force the EGA into a calibration when it is next in a safe condition, such as not trimming and not calibration.

3.10.2 EGA – Temperature

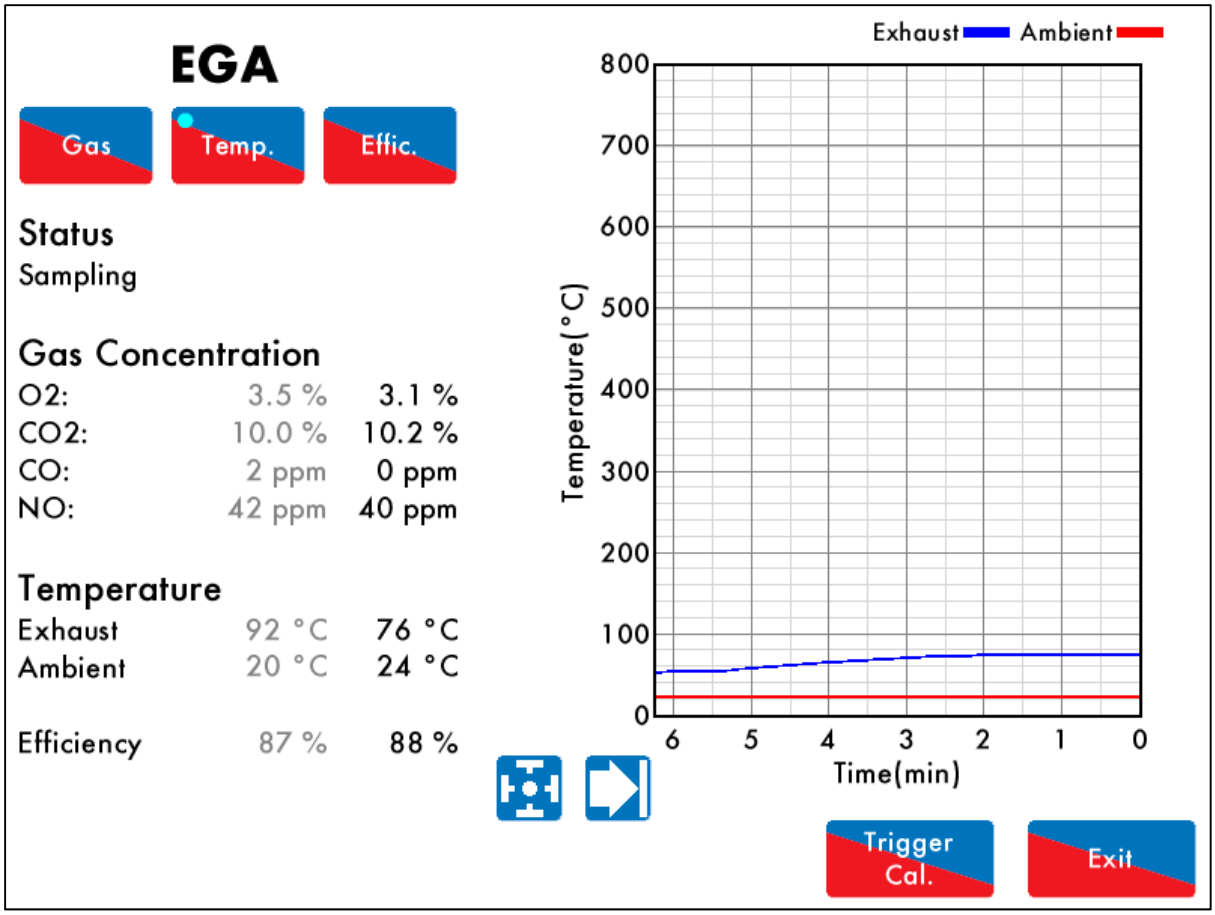


Figure 3.10.2.i EGA – Temperature

Press 

in the E.G.A Gas screen (Figure 3.10.1.i) to view EGA Temperature screen in Figure 3.10.2.i.The exhaust and ambient temperature histories are displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.10.3 EGA – Efficiency

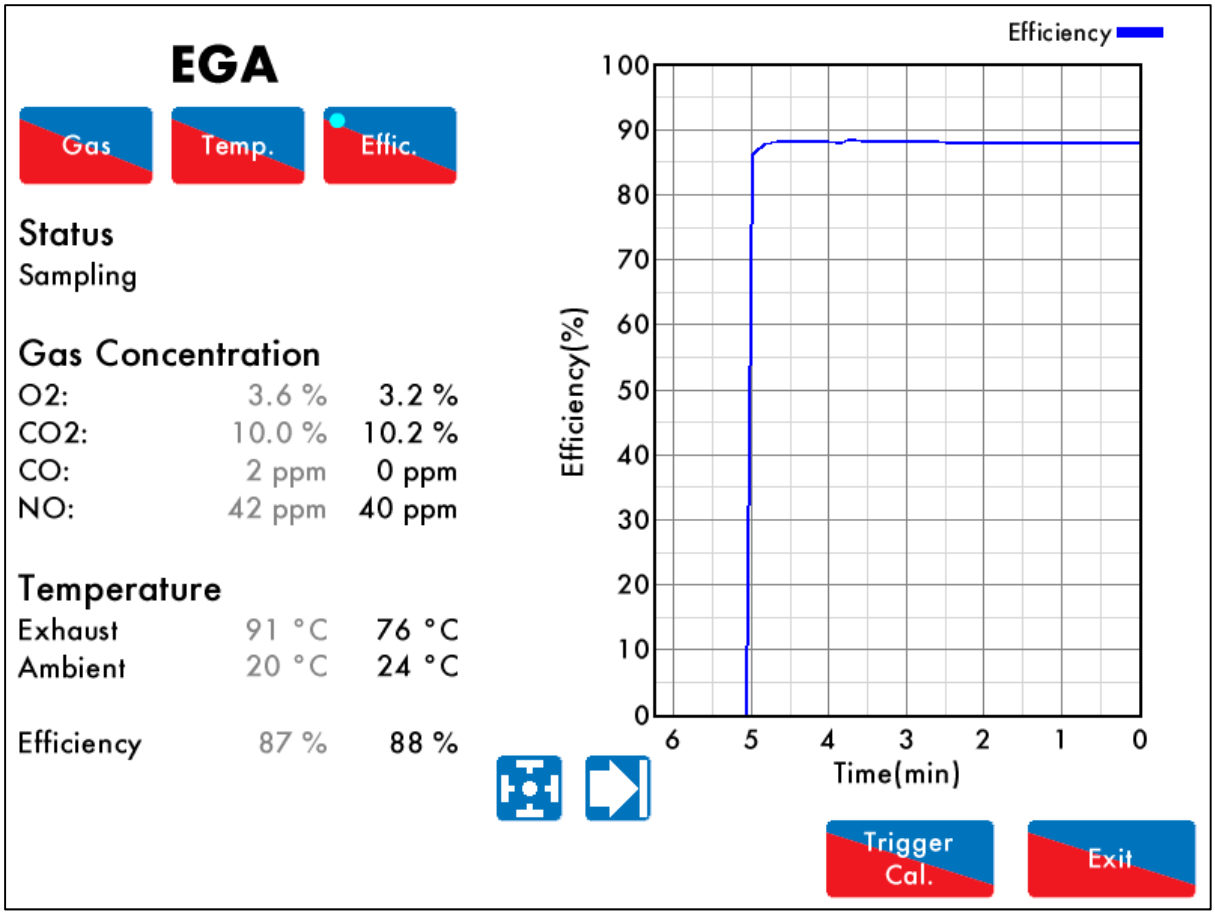


Figure 3.10.3.i EGA – Efficiency

Press 

in the EGA Gas Screen (Figure 3.10.1.i) to view the EGA Efficiency screen in Figure 3.10.2.i. The combustion efficiency history is displayed. This data is logged for 24 hours on the MM.

Use the  buttons to change the timescale of the data displayed, and press and drag on the axis to zoom in/ out of the graph.

This information is logged for 2 years on the DTI when connected with the MM.

Note: Power cycling the MM or changing fuel will reset this data log.

3.11 Outside Temperature Compensation Screen

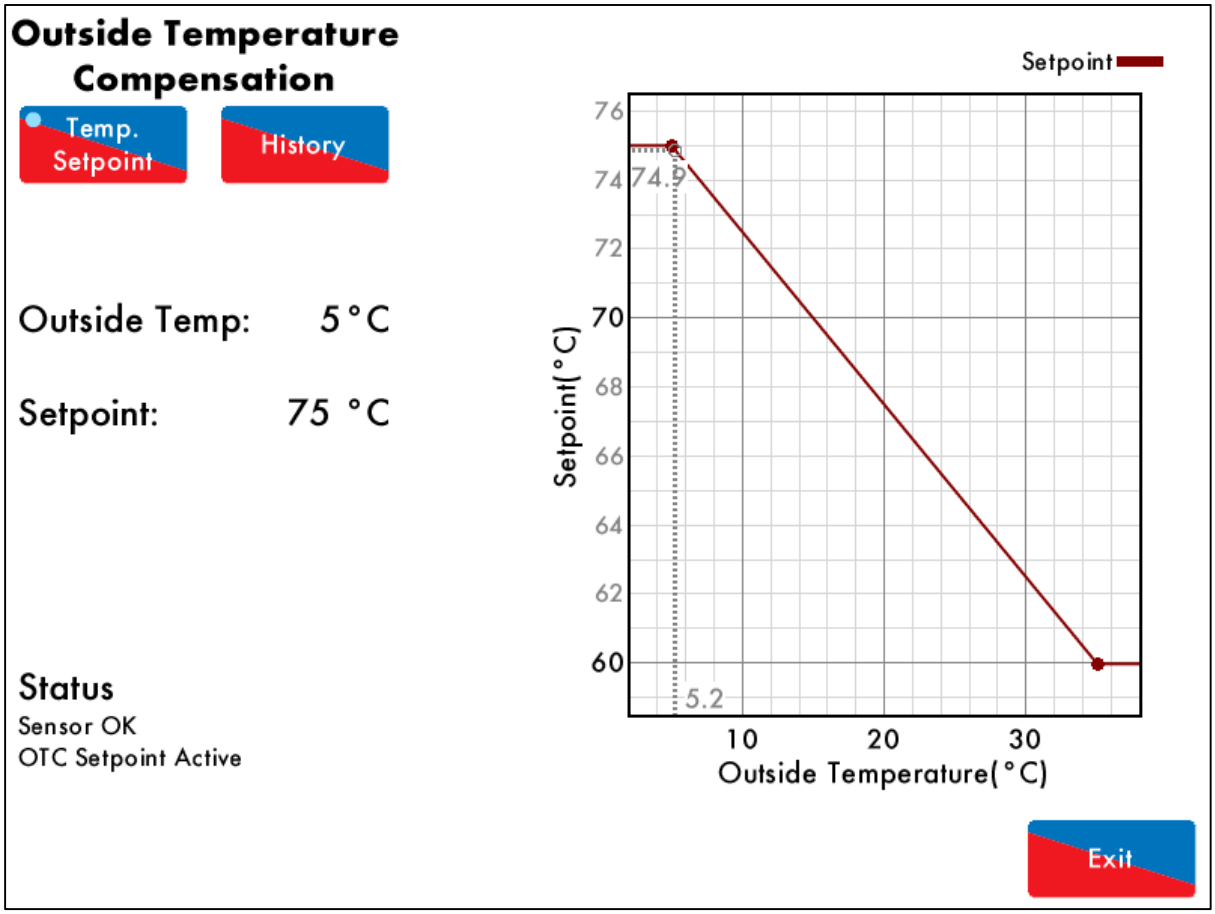


Figure 3.11.i OTC – Temperature, Setpoint

Press on the outside temperature sensor in the Home screen (Figure 3.1.i) to view the Outside Temperature Compensation screen in Figure 3.11.i. The following information is displayed:

- Current outside temperature
- Current required setpoint
- Status of the OTC sensor
- Status of the OTC required setpoint

Press 

in the Outside Temperature Compensation screen (Figure 3.11.1.i) to view the Outside Temperature Compensation History. The outside temperature and setpoint history are stored on the MM for 24 hours.

Note: Power cycling the MM or changing fuel will reset this data log.

3.12 System Configuration Screen

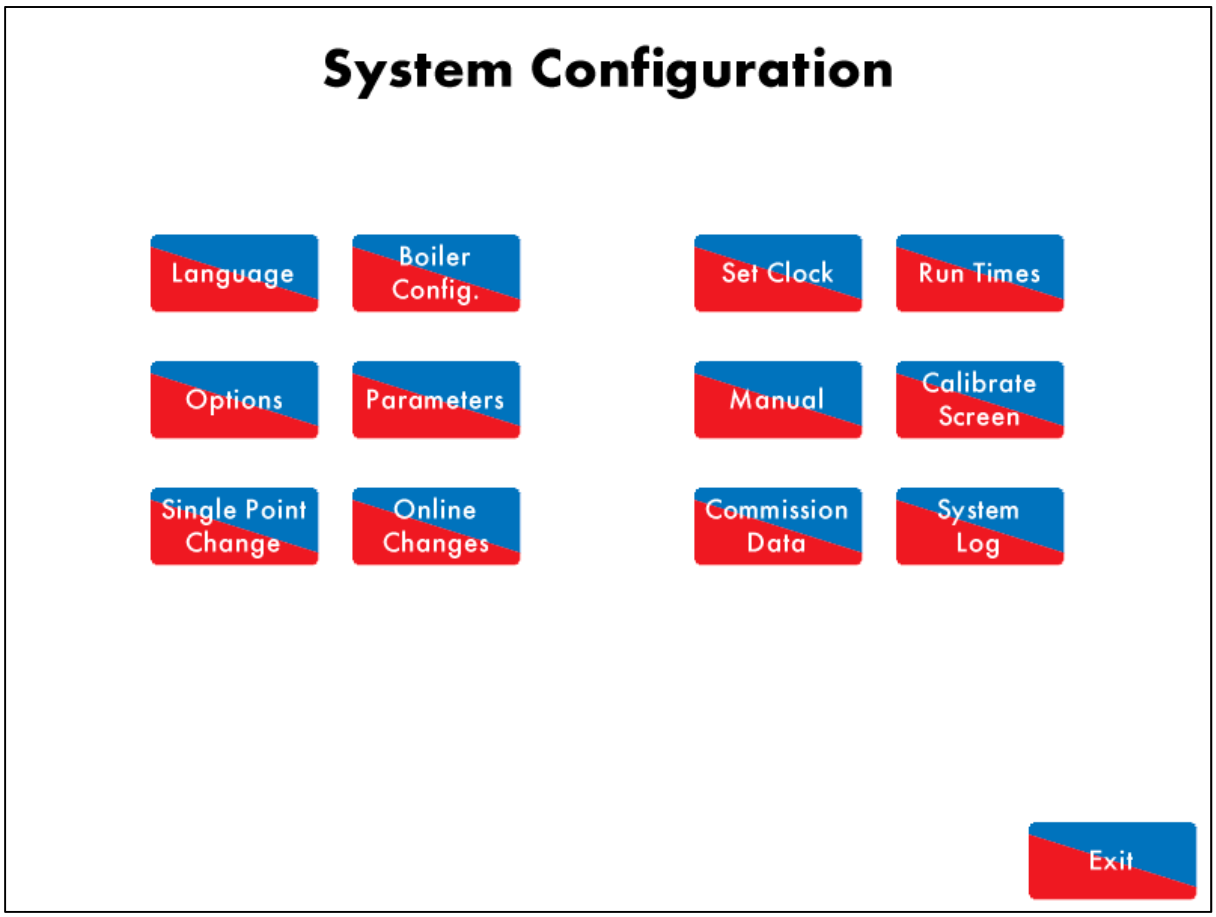


Figure 3.12.i System Configuration

Press 

in the Home screen (Figure 3.1.i) to view the System Configuration screen in Figure 3.12.i. In System Configuration, it is possible to view or make changes to the following:

- Language (password protected)
- Boiler configuration displayed (password protected)
- View all options/parameters
- Online changes (password protected)
- Single point change (password protected)
- Clock and run times (password protected)
- Manual
- Commission data
- System log
- Calibrate screen

3.12.1 Language

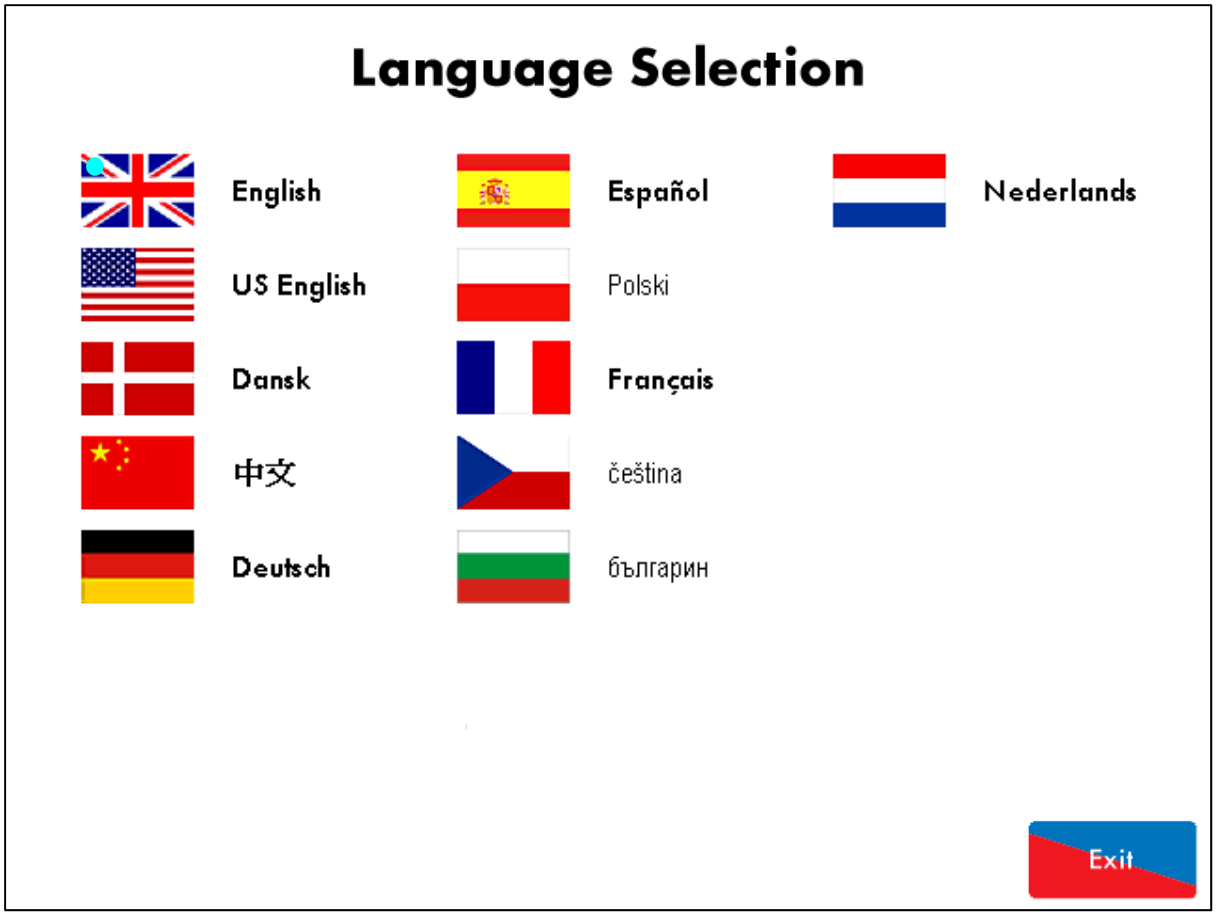


Figure 3.12.1.i Language

Press 

in the System Configuration screen (Figure 3.12.i) to view the Language screen in Figure 3.12.1.i. You will be prompted to enter a password. Select the language to be displayed and press 

.

Note: The SD card must contain the language file to view this.

Note: The Online Changes password is used to access the Language selection screen. Please contact your local Autoflame approved tech centre for this password.

3.12.2 Boiler Configuration Screen

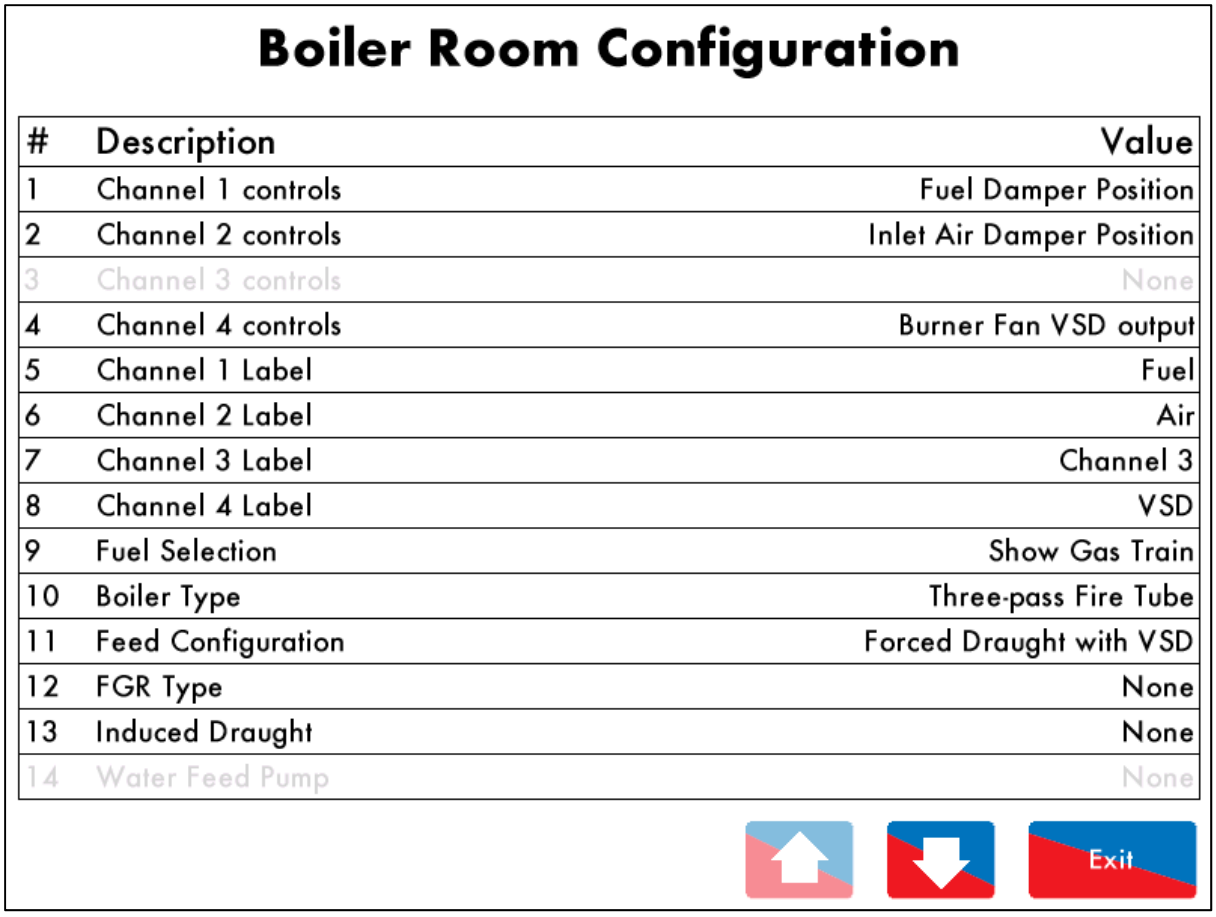


Figure 3.12.2.i Boiler Room Configuration

Press 

in the System Configuration screen (Figure 3.12.i) to view the Boiler Configuration screen in Figure 3.12.2.i. You will be prompted to enter the password. It is possible to set up the boiler display shown in the Home screen. Once the settings have been configured to show how the boiler is setup, press 

.

Note: The Online Changes password is used to access the Boiler Configuration selection screen. Please contact your local Autoflame approved tech centre for this password.

The table below shows the available Boiler Configuration settings.

Setting	Description	
1	Channel 1 Controls	
• Fuel damper position		
2	Channel 2 Controls	
• None	• Draught air damper position	
• Inlet air damper position	• Steam/air atomisation damper position	
• FGR air damper position	• Water inlet damper position	
3	Channel 3 Controls	
• None	• Draught air damper position	
• Inlet air damper position	• Steam/air atomisation damper position	
• Outlet air damper position	• Water inlet damper position	
• FGR air damper position		
4	Channel 4 controls	
• None	• Draught fan VSD output	
• Burner fan VSD output	• Water feed VSD output	
• FGR fan VSD output		
5	Channel 1 Label	
• Channel 1	• Steam	
• Fuel	• VSD	
• Gas	• Blower	
• Oil	• Sleeve	
• Air	• Head	
• FGR	• Inlet	
• P-Air (primary air)	• Outlet	
• S-Air (secondary air)	• Water	
• ID fan (induced draught)	• Gas 1	
• FD fan (forced draught)	• Gas 2	
6	Channel 2 Label	
• Channel 2	• Steam	
• Fuel	• VSD	
• Gas	• Blower	
• Oil	• Sleeve	
• Air	• Head	
• FGR	• Inlet	
• P-Air (primary air)	• Outlet	
• S-Air (secondary air)	• Water	
• ID fan (induced draught)	• Gas 1	
• FD fan (forced draught)		
7	Channel 3 Label	
• Channel 1	• Steam	
• Fuel	• VSD	
• Gas	• Blower	
• Oil	• Sleeve	
• Air	• Head	
• FGR	• Inlet	
• P-Air (primary air)	• Outlet	
• S-Air (secondary air)	• Water	
• ID fan (induced draught)	• Gas 1	
• FD fan (forced draught)	• Gas 2	

Setting	Description	
8	Channel 4 Label	
• Channel 1 • Fuel • Gas • Oil • Air • FGR • P-Air (primary air) • S-Air (secondary air) • ID fan (induced draught) • FD fan (forced draught)		• Steam • VSD • Blower • Sleeve • Head • Inlet • Outlet • Water • Gas 1 • Gas 2
9	Fuel Selection	
• Show gas train • Show oil train		• Show gas and oil • Show gas and oil close-coupled
10	Boiler Type	
• Water tube • Three-pass fire tube • Four-pass fire tube • Cast-sectional tube		• Horizontal coil tube • Vertical coil tube • Kiln
11	Feed Configuration	
• Forced draught • Forced draught VSD		• Rotary cup
12	FGR Type	
• None • Induced FGR with a motorised damper		• Forced FGR with VSD • Forced FGR with a motorised damper and VSD
13	Induced draught	
• None • Induced draught		• Induced draught with a VSD • Induce draught with motorised damper
15	Steam/Air Atomisation	
• None • Show steam/air train		• Show steam/air train with a servo
16	Two-Port Valve	
• None		• Show two-port valve
17	Combustion Head Type	
• Diffuser		• Mesh

3.12.3 Options

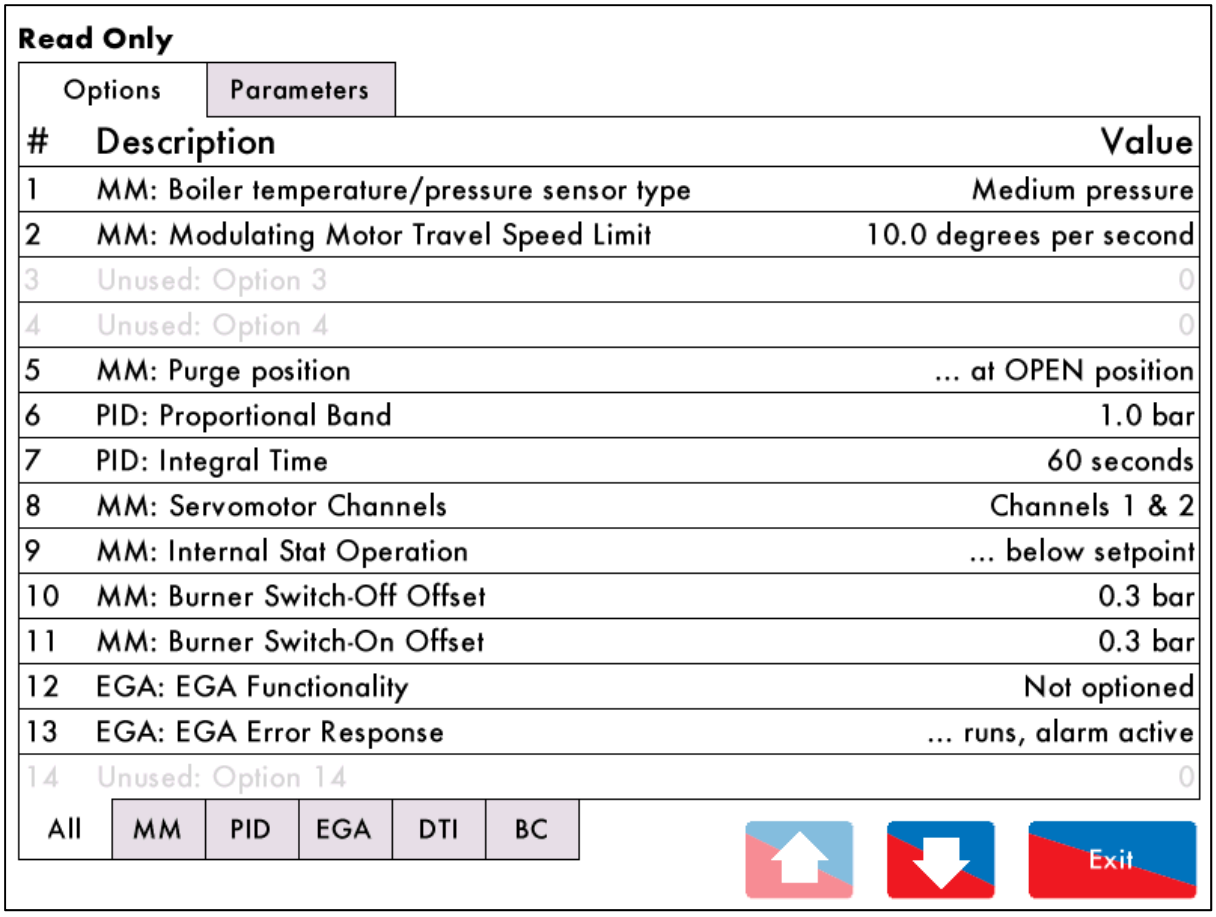


Figure 3.12.3.i Options

Presss 

in the System Configuration screen (3.12.i) to view Options screen in Figure 3.12.3.i. The Options screens display all the options and their settings, however no changes can be made to these settings. To make changes to the Options, please refer to section 3.12.5.

3.12.4 Parameters

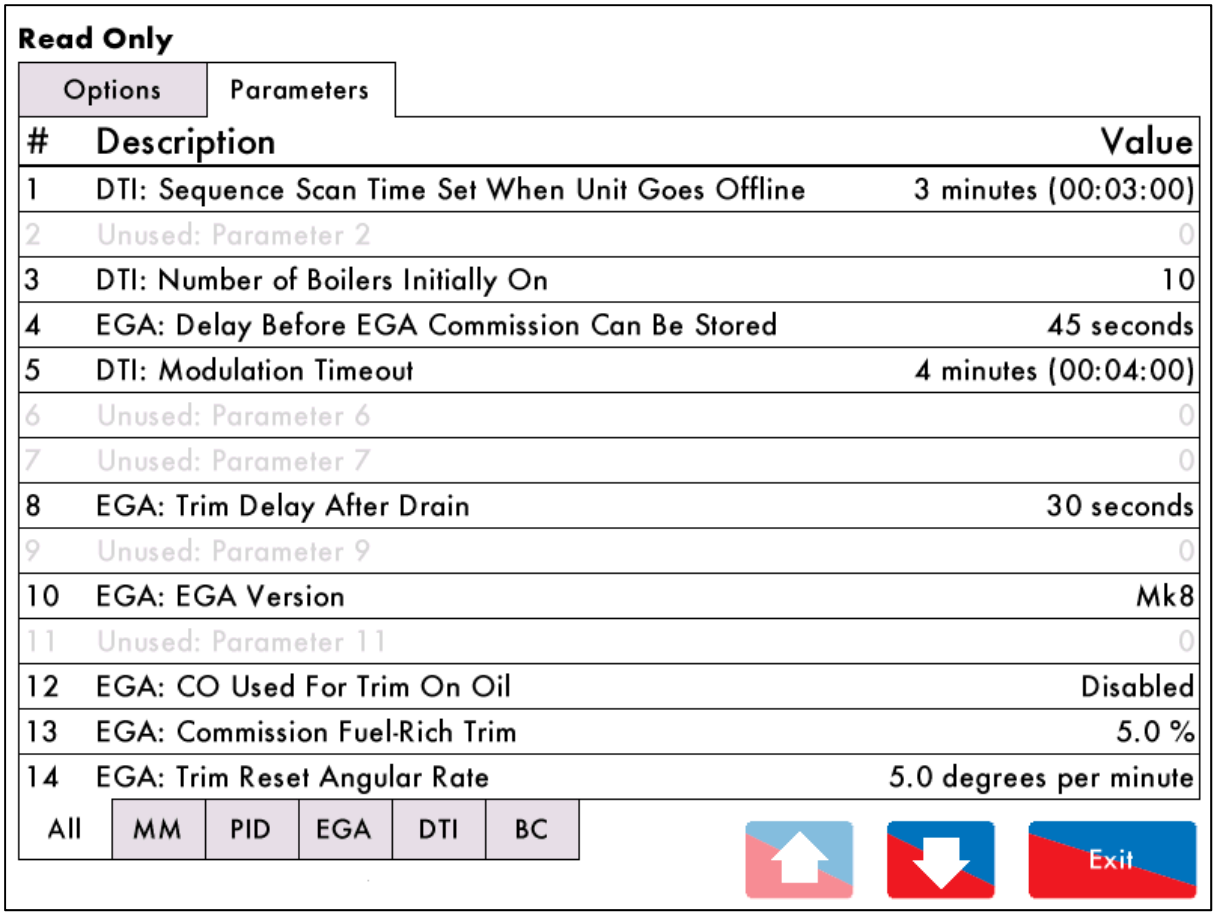


Figure 3.12.4.i Parameters

Press 

in the System Configuration screen (Figure 3.12.i) to view the Parameters screen in Figure 3.12.4.i. The Parameters screens display all the parameters and their settings. To make changes to these Parameters, refer to section 3.12.5.

3.12.5 Online Changes

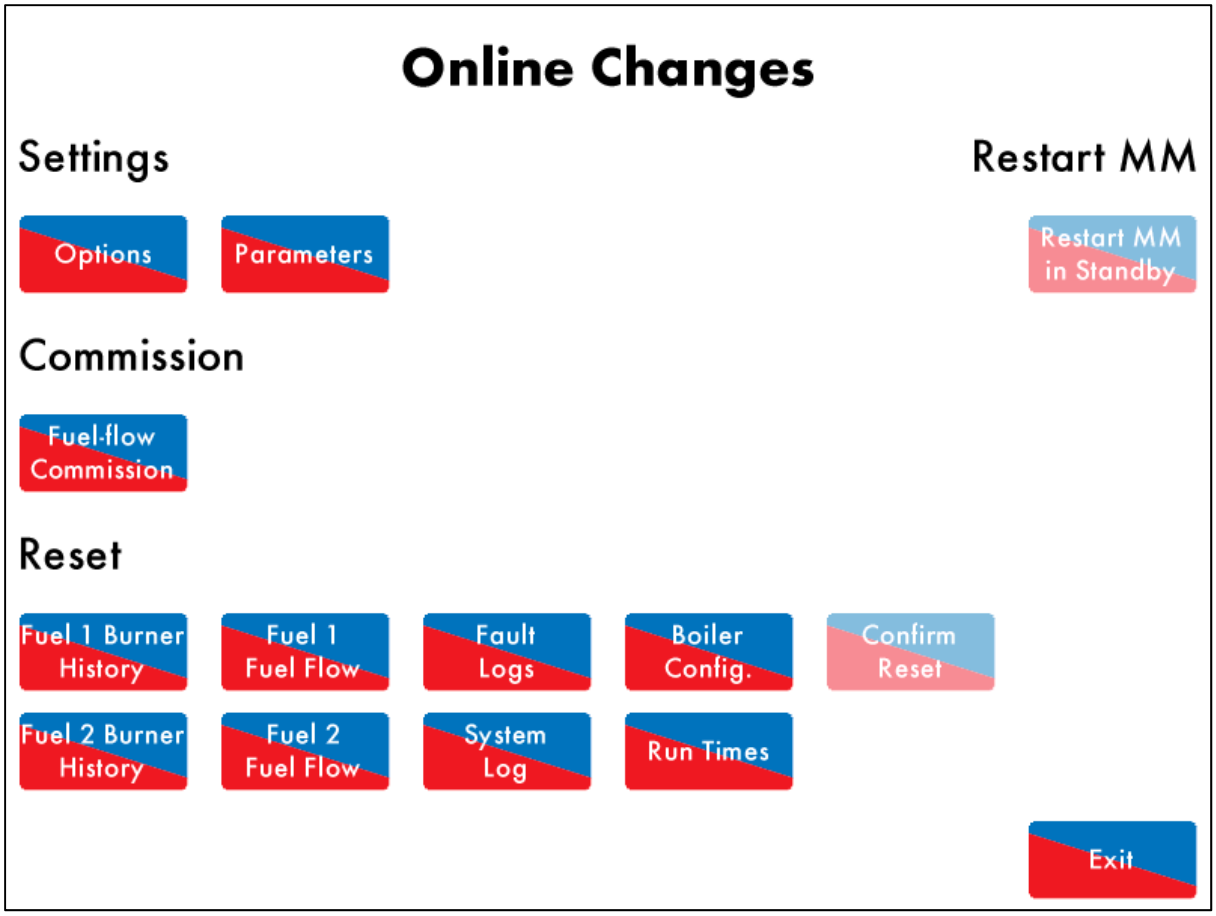


Figure 3.12.5.i Online Changes

Press Online Changes in the System Configuration screen (Figure 3.12.i) to view the Online Changes screen in Figure 3.12.5.i. You will be prompted to enter the password. It is possible to change the non-safety critical options/parameters by pressing Options or Parameters.

Press Fuel 1 Burner History to reset the Fuel 1 burner history and then press Confirm Reset. The fuel 1 and 2 burner and fuel flow history, fault logs, system log, boiler configuration and run times can all be reset.

If the MM is in standby mode, press Restart MM to restart the MM. This button will be greyed out as in Figure 3.12.5.i if the burner is on.

3.12.6 Set Clock

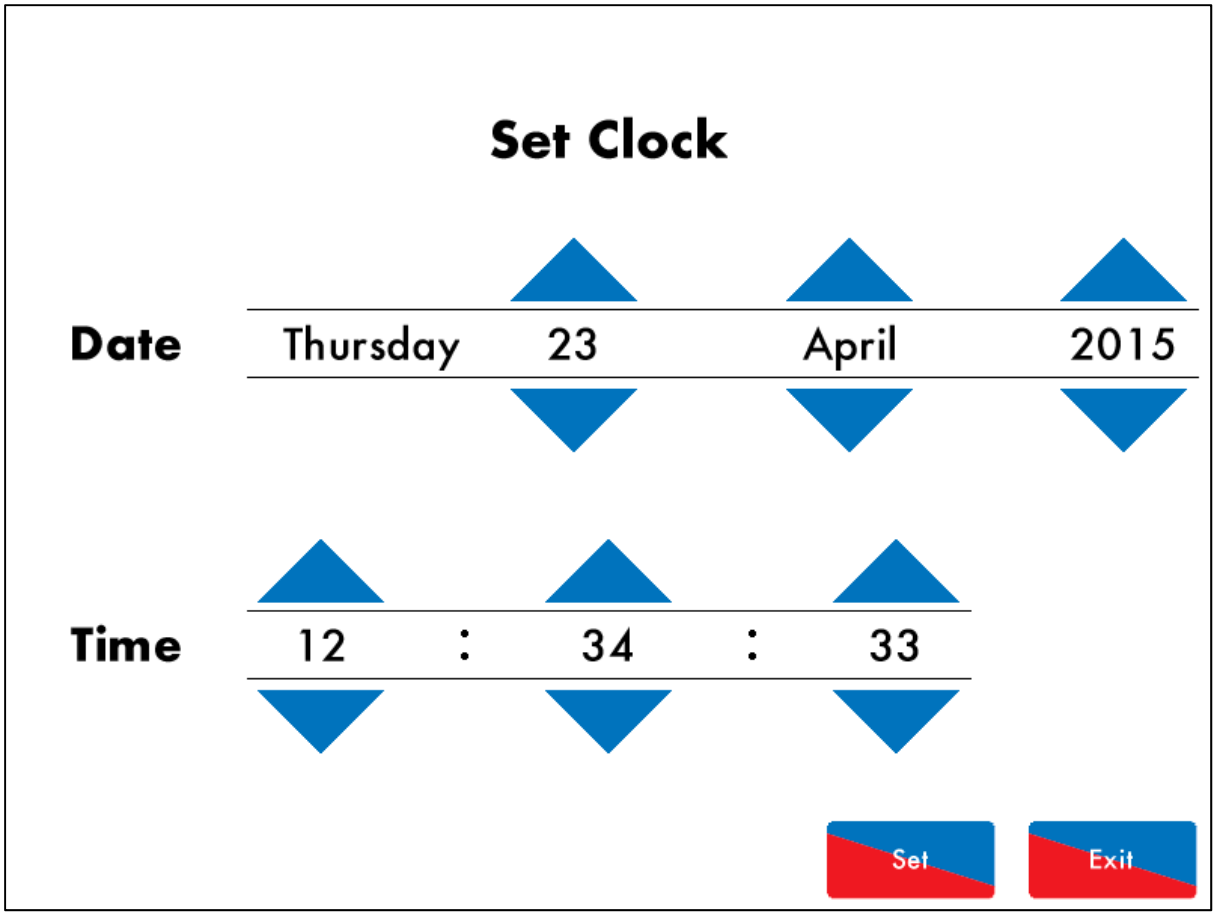


Figure 3.12.6.i Set Clock

Press 

in the System Configuration screen (Figure 3.12.i) to view the Set Clock screen in Figure 3.12.6.i. You will be prompted to enter the password (10, 10). Change the time and date using the  buttons. Press 

and then 

.

Note: If connected to a DTI the time and date will be set by this and not be user adjustable. Please refer to the DTI Set-Up Guide to change this time.

3.12.7 Run Times

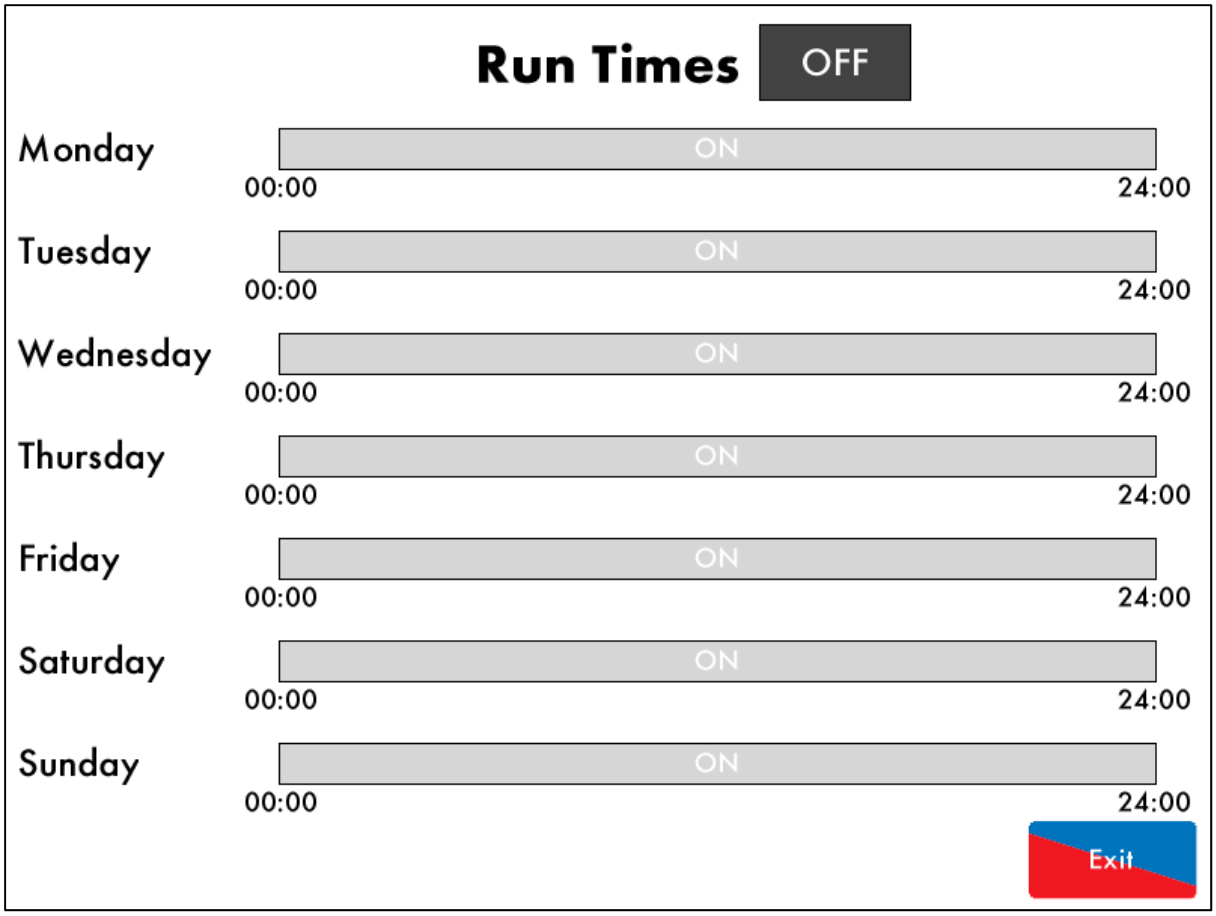


Figure 3.12.7.i Run Times – OFF

Press 

in the System Configuration screen (Figure 3.12.i) to view the Run Times screen in Figure 3.12.7.i. You will be prompted to enter a password (11, 11). Run Times sets when the MM is scheduled to be on and firing to the required setpoint, on and firing to the reduced setpoint or off.

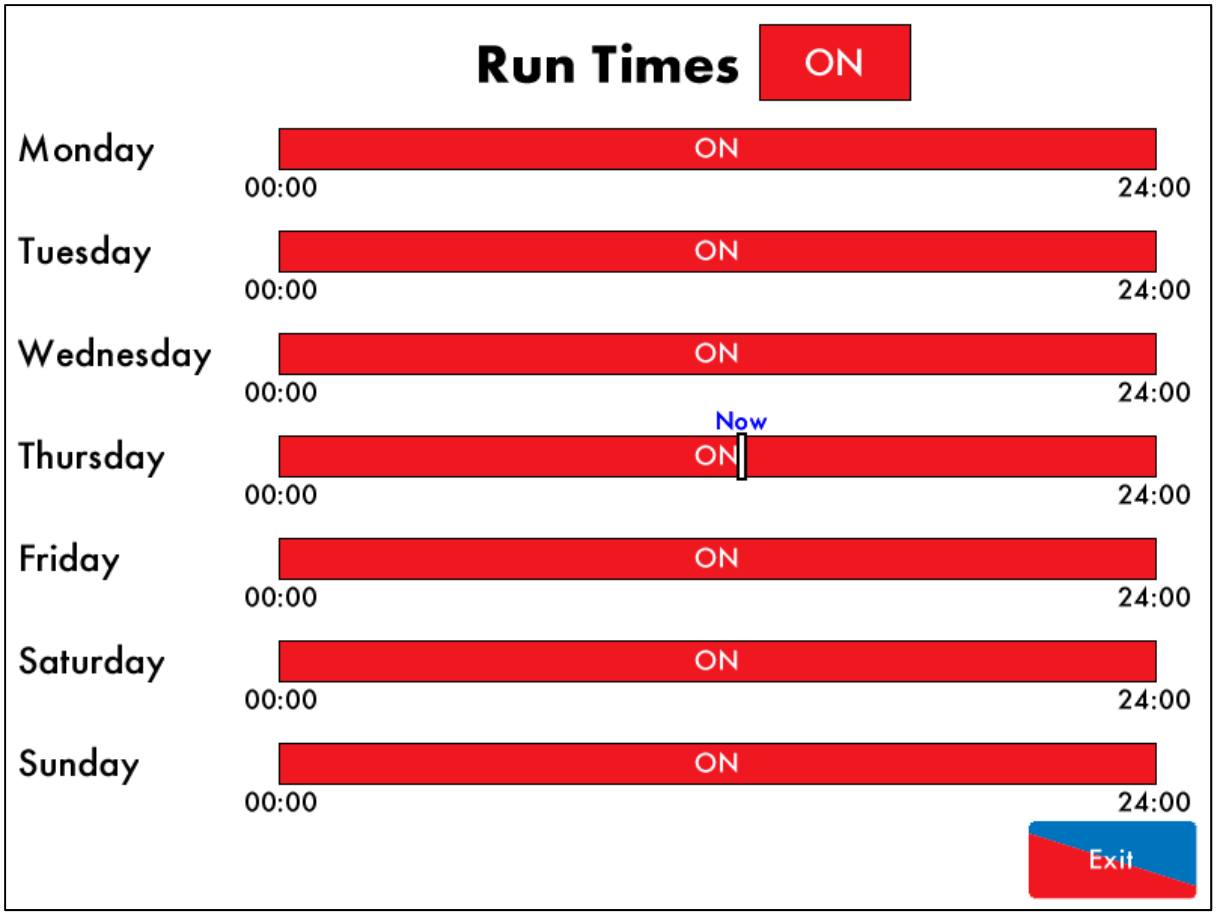


Figure 3.12.7.ii Run Times – ON

Press OFF in the Run Times screen (Figure 3.12.7.i) to view the Run Times On/Off screen in Figure 3.12.7.ii. Press ON in the Run Times – ON screen to disable the run times.

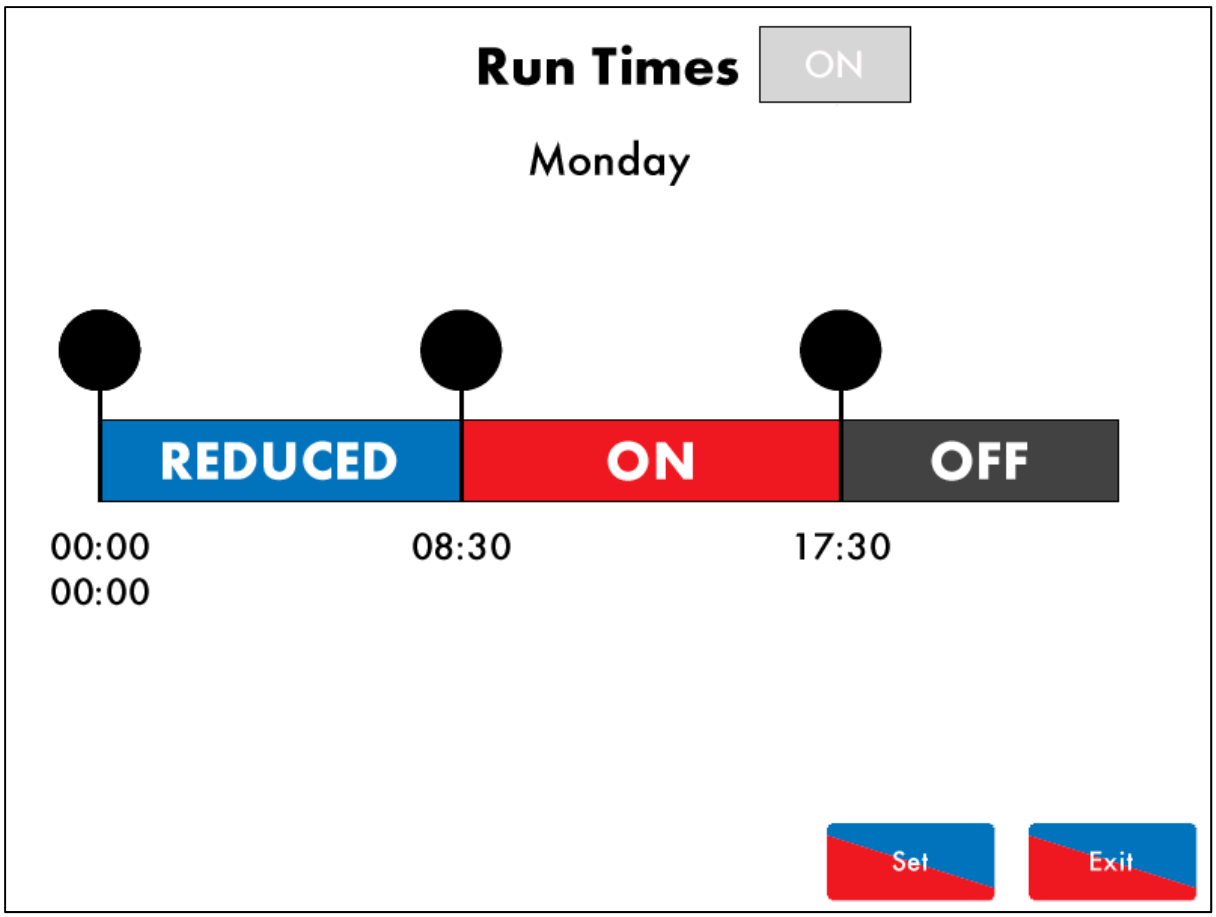


Figure 3.12.7.iii Run Times – Monday

To set the schedule, press on the bar for that day in the Run Times On/Off screen (Figure 3.12.7.ii) and drag the to set the intervals, and then press the bar to change the intervals to ON, OFF or REDUCED. Up to 4 time periods can be set.

Note: The MM will fire to the reduced setpoint set in the Status screen (Figure 3.2.1.i) when scheduled in the Run Times or if option/parameter 154 is set to 3 and an input is detected on Terminal 80.

3.12.8 Manual

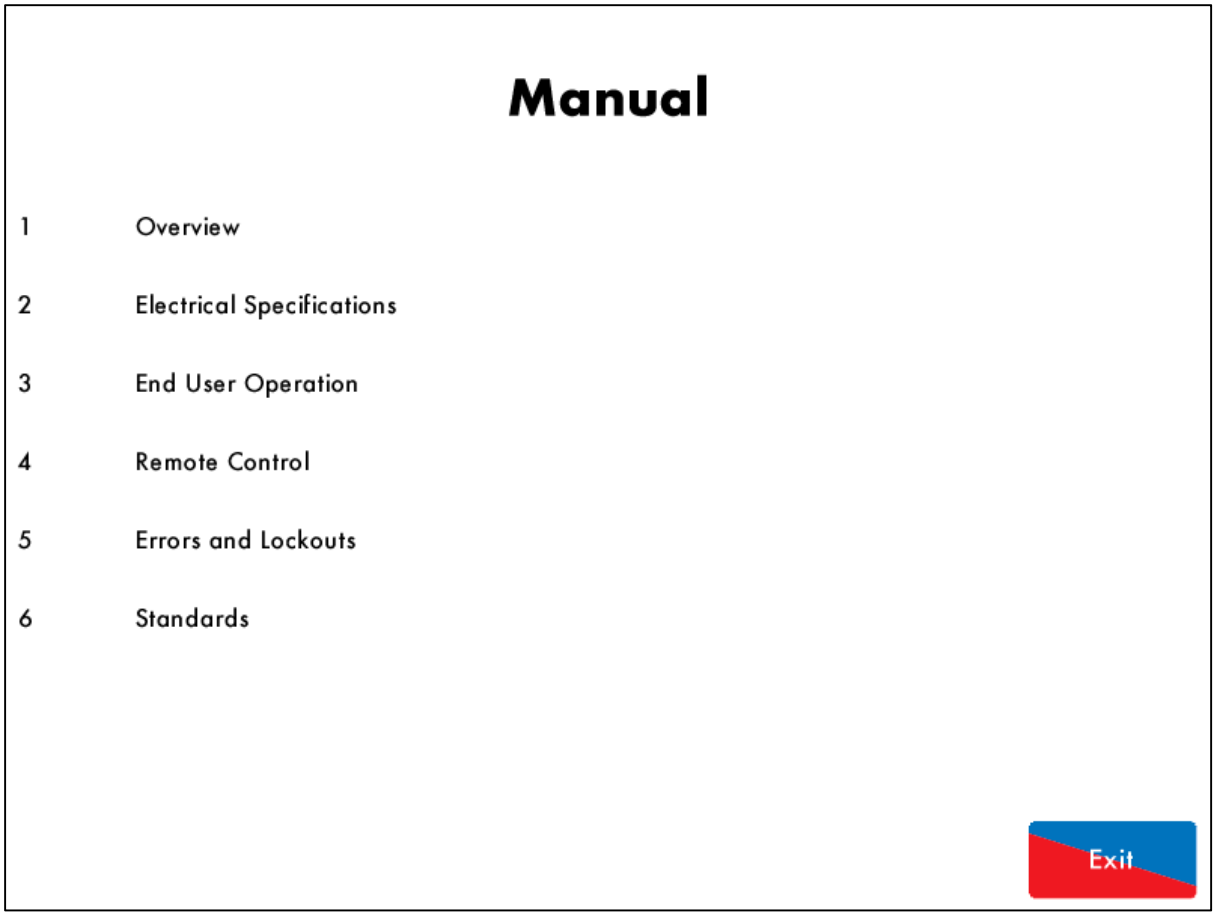


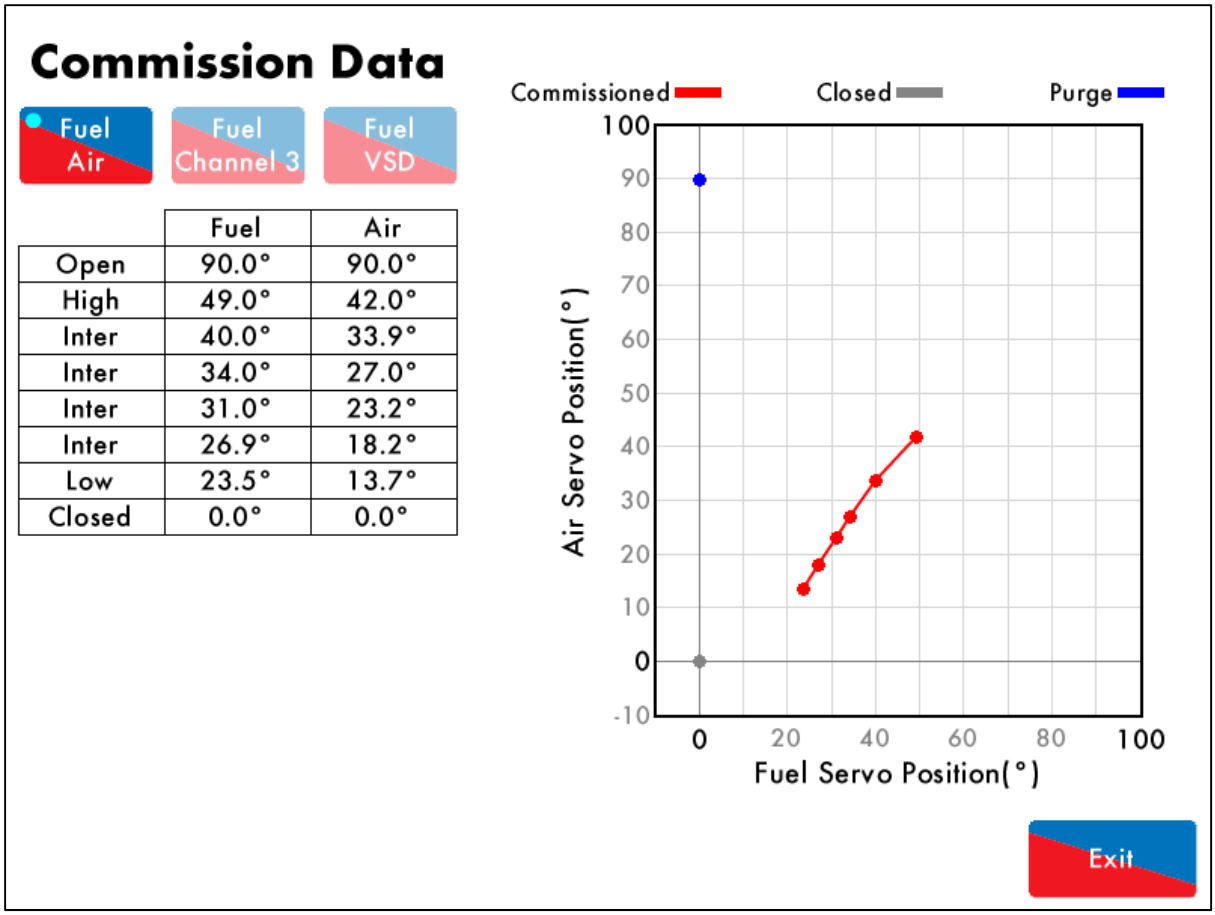
Figure 3.12.8.i Manual

Press 

in the System Configuration (3.12.i) to view the Manual screen in Figure 3.12.8.i. Press on the section headings to navigate to the sections.

Note: The SD card must contain the manual file to view this.

3.12.9 Commission Data



	Fuel	Air
Open	90.0°	90.0°
High	49.0°	42.0°
Inter	40.0°	33.9°
Inter	34.0°	27.0°
Inter	31.0°	23.2°
Inter	26.9°	18.2°
Low	23.5°	13.7°
Closed	0.0°	0.0°

Figure 3.12.9.i Commission Data

Press 

in the System Configuration screen (Figure 3.12.i) to view the Commission Data screen in Figure 3.12.9.i.

3.12.10 System Log

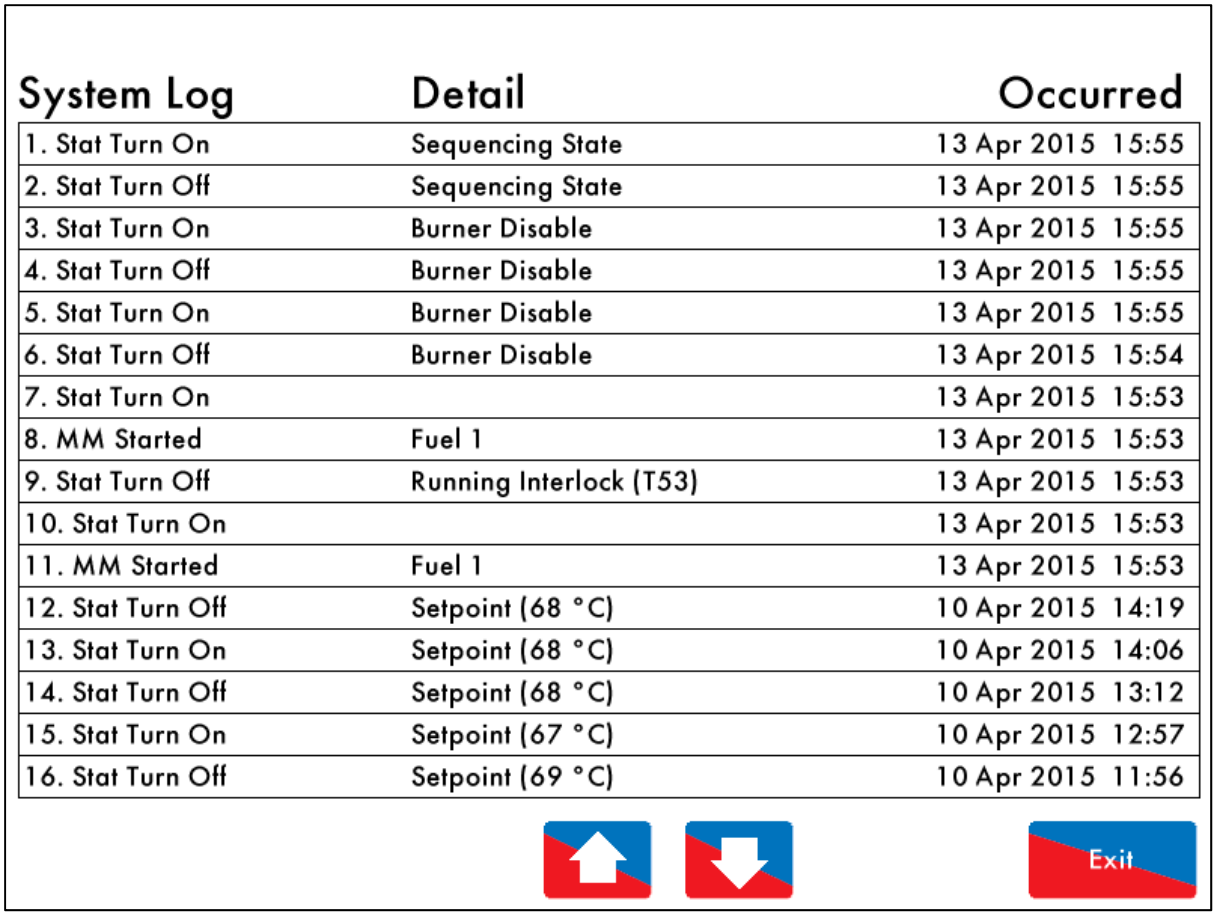


Figure 3.12.10.i System Log

Press 

in the System Configuration screen (Figure 3.12.i) to view the System Log screen in Figure 3.12.10.i. This data is stored on the MM and the SD card for 1000 entries.

4 BURNER START-UP SEQUENCE

The MM goes through a series of internal checks and flame safeguard checks before starting up the 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 they have occurred, and the phase in which it occurred. If any errors or lockouts occur, please contact Autoflame Engineering Ltd or your local Autoflame Technology Centre.

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

- Firing on gas
- 2 Valve proving system – no vent valve, single valve pilot
- Interrupted pilot
- UV scanner
- Air pressure sensor
- Gas pressure sensor – VPS and pressure limits checked
- VPS operates before start-up
- Pre-purge and post-purge
- No golden start
- No FGR start

4.1 Recycle

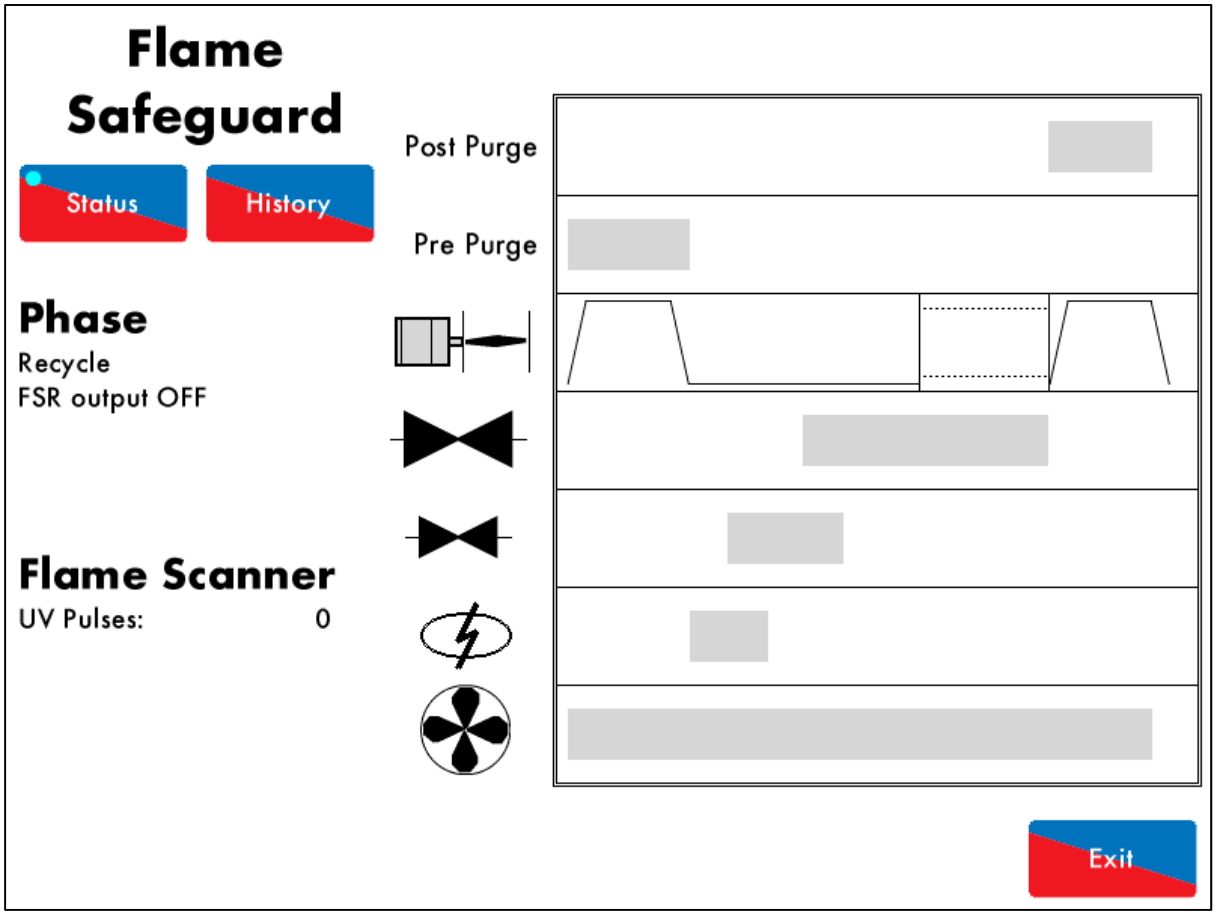


Figure 4.1.i Recycle

When the burner enters the Recycle phase shown in Figure 4.1.i, both the fuel valves and air damper go to their respective commissioned 'closed' positions, and the burner is not firing.

As the burner is off in Recycle, there should not be any flame detected. The UV scanner checks that there is no flame, and if a flame is detected, the lockout 'Simulated Flame' will occur. This could be a result of after burn and must be investigated. A post-purge could be necessary. See option/parameters 118 and 135.

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

4.2 Standby

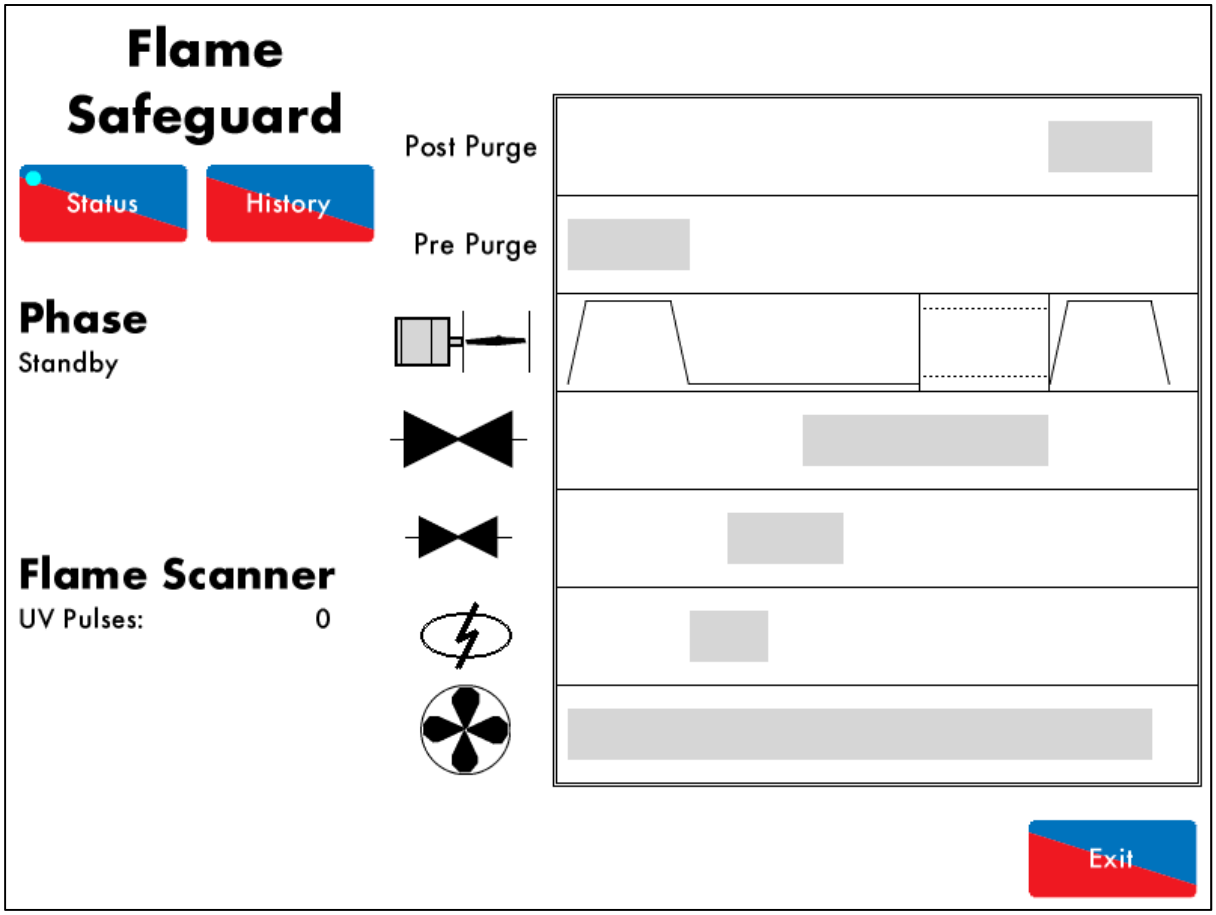


Figure 4.2.i Standby

The burner will go into Standby shown in Figure 4.2.i., before the safety checks begin to initiate the burner start-up sequence.

The MM will remain in this phase if it is waiting for a call to start via the internal stat, subject to the required setpoint and load demand. The external safety interlock circuit is tied into T53, this also must be ready for the burner to be switched on, to move to the next phase.

The MM will only 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.

The Standby phase is also part of the Intelligent Boiler Sequencing. The MM could be in Standby because it is a lag boiler and not required to contribute to the system. See options 16, 41, 42, 53 and 54.

The MM will remain in Standby if the burner has been disabled, see section 3.1.3. The MM can also be disabled remotely, see section 5 Remote Control.

4.3 Internal Relay Tests

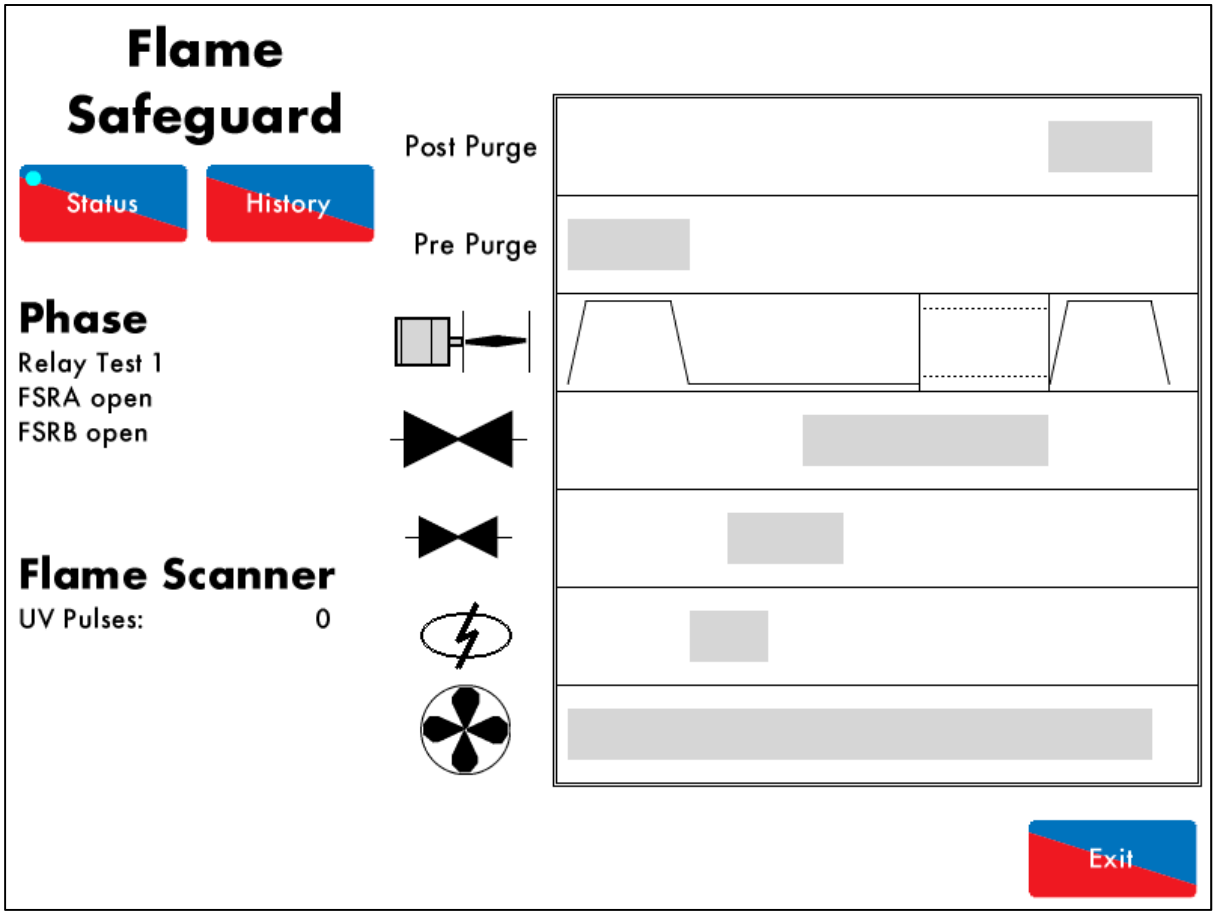


Figure 4.3.i Relay Test 1

During the Internal Relay Tests phase shown in Figure 4.3.i., the MM will check its internal flame safe relays 1 to 5. Should any lockouts occur now for the relay tests such as 'FSR Test 1A' this is an indication of an internal fault within the MM.

The MM will go through a series of 5 relay tests.

If voltage is detected on terminal 57 call for heat during these checks when there should not be, the lockout 'Fail Safe Relay Fault' will occur. Please check the 5A fuse.

4.4 CPI Input

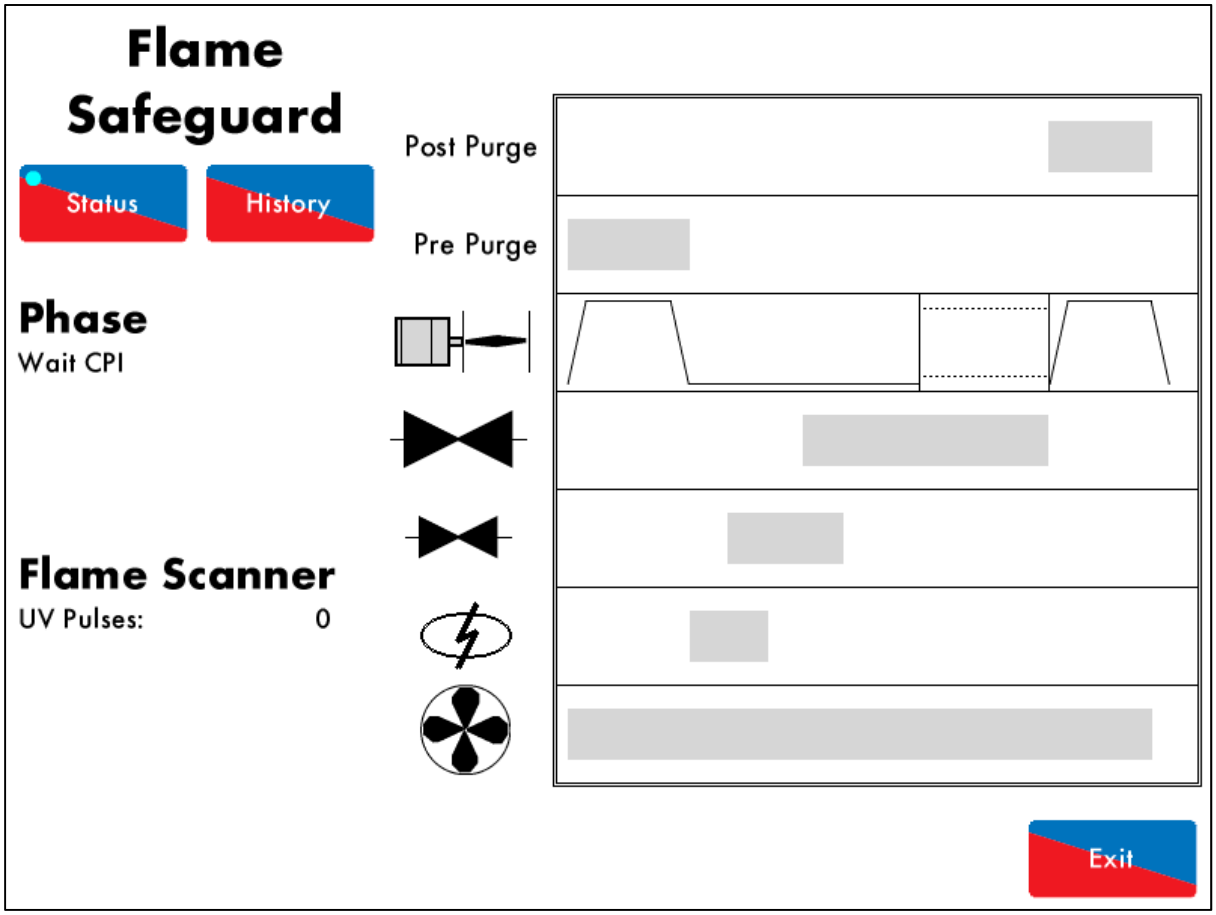


Figure 4.4.i CPI Input

In the Wait CPI phase shown in Figure 4.4.i, a check is made on terminal 55 for the proof of closure switch. If terminal 55 does not see an input within 5 seconds, the lockout 'No CPI Reset' will occur.

4.5 Valve Proving

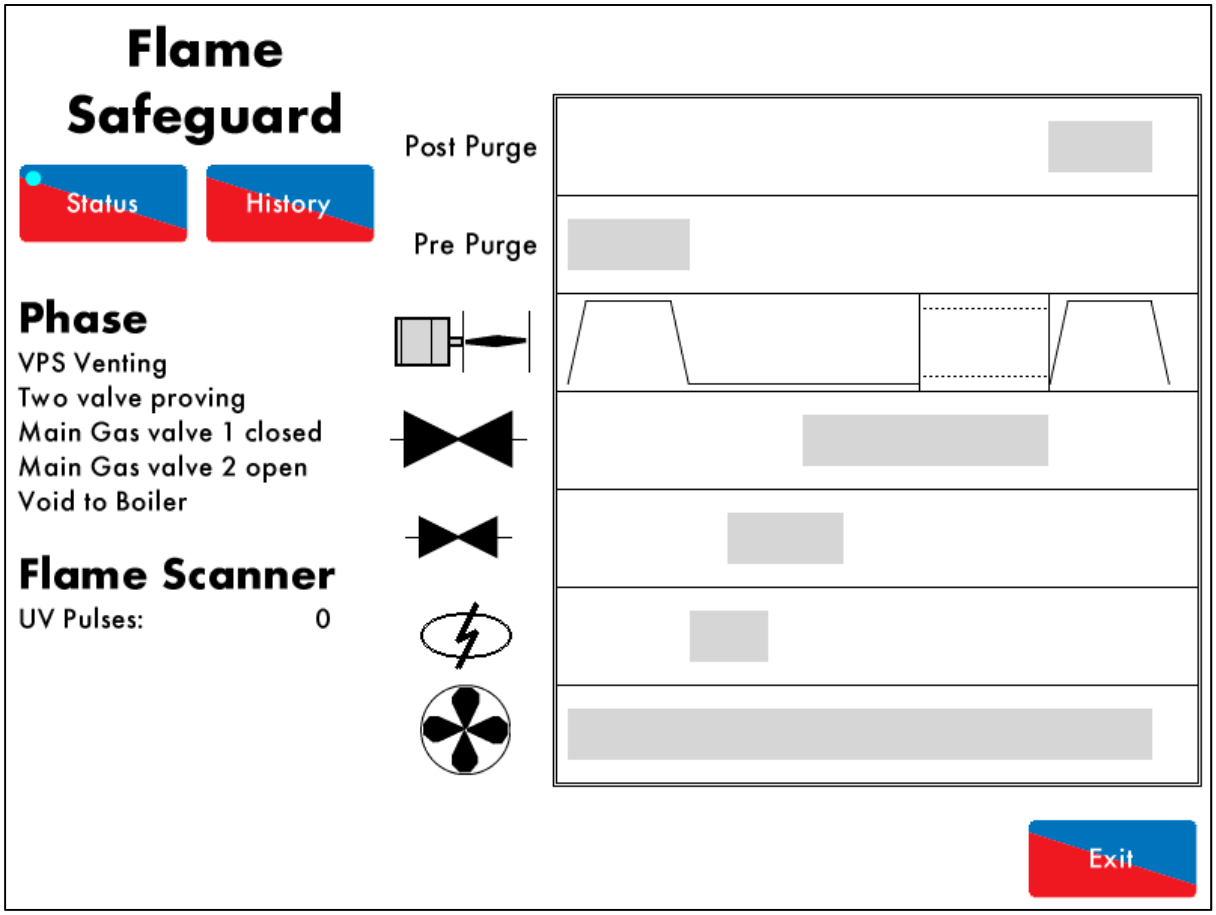


Figure 4.5.i VPS Venting

In this example, the MM has no vent valve and has single valve pilot optioned. 2 Valve proving is used to check the integrity of the gas for any leaks. See option/parameter 130.

During the VPS Venting phase shown in Figure 4.5.i., the main gas valve 1 is checked. The main gas valve 1 output is off (closed), and the main gas valve 2 output is on (opened), so that the void between the main gas valves can vent to atmosphere. The gas pressure sensor is now zeroed. If the gas pressure sensor cannot be zeroed, the lockout 'VPS air zeroing fail' will occur, since the gas pressure has been detected when venting to atmosphere. This could indicate that there is a fault with the main gas valve 1 or 2.

If no voltage is detected when the burner main gas valve 2 output T61should be on (and vice versa), the lockout 'Main Gas 2 Output Fault' will occur.

Note: If two valve proving has been optioned with single valve pilot, then the pilot valve is used for this VPS venting phase.

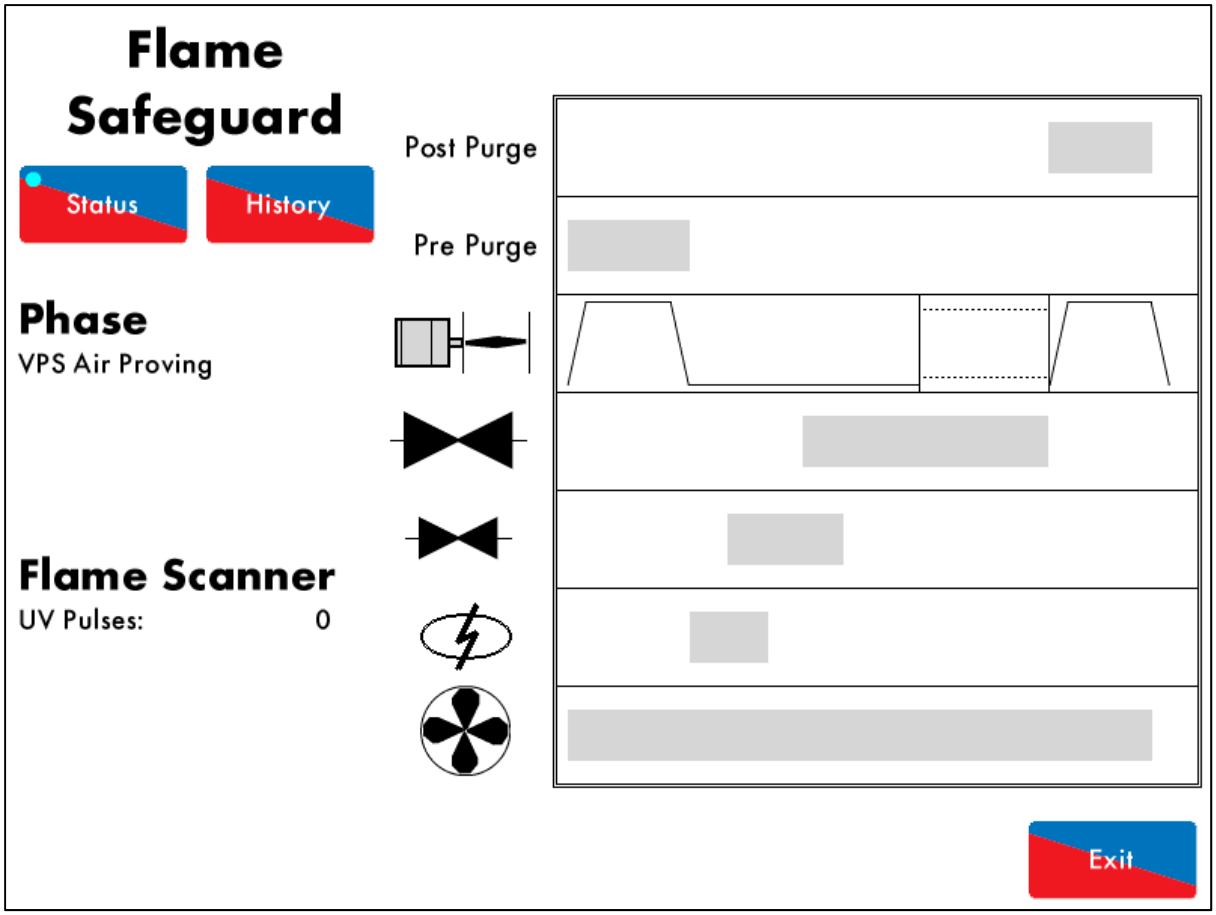


Figure 4.5.ii VPS Air Proving

In the VPS Air Proving phase shown in Figure 4.5.ii, the main gas valve 2 output is off (closed) and the main gas valve 1 output is off (closed), to check for a pressure increase.

After the valves close, there is a 1.5 second delay before pressure reading is taken. If a pressure increase is detected then the lockout 'VPS Air Proving Fail' occurs as air has been let in between the main gas valve 1 and 2, indicated that main gas valve 1 has failed.

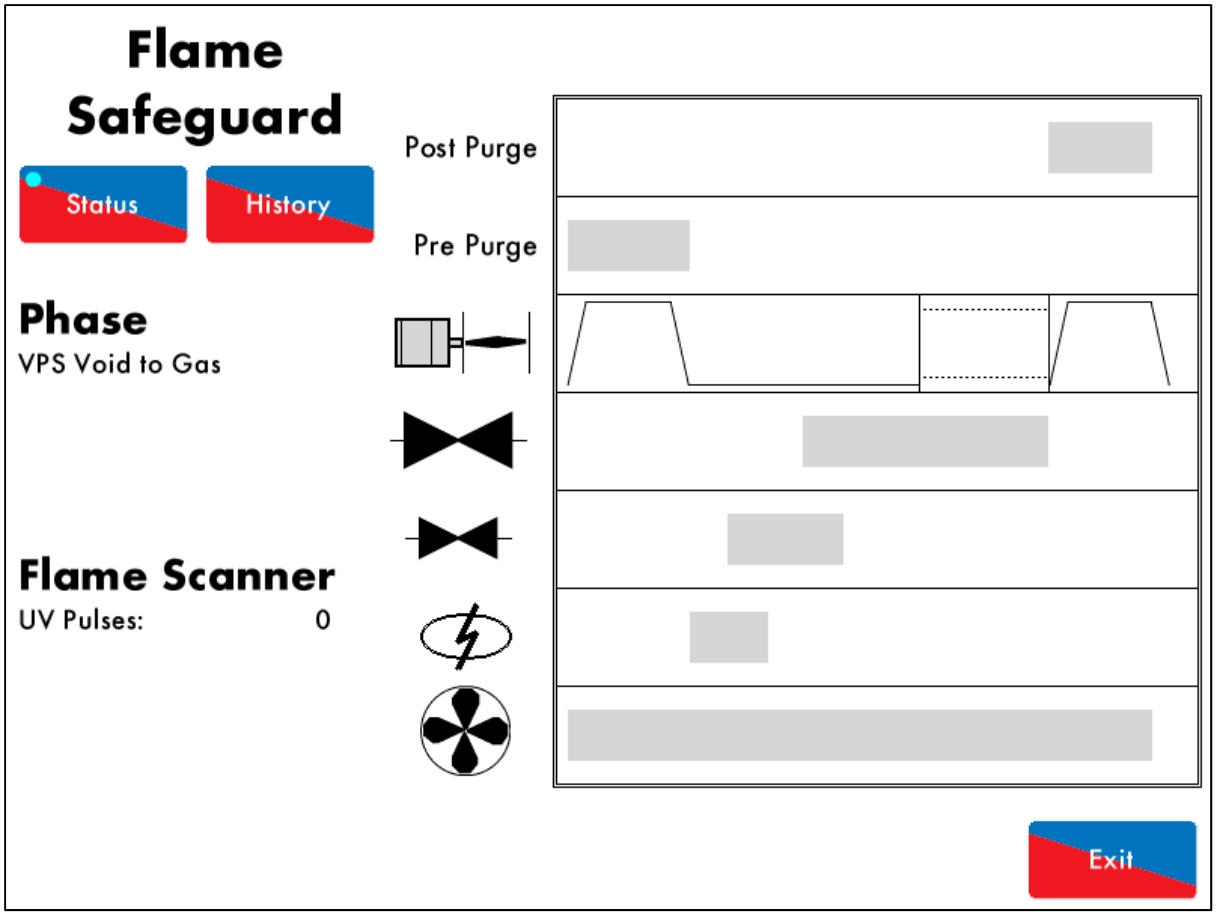


Figure 4.5.iii VPS Void to Gas

In the VPS Void to Gas phase shown in Figure 4.5.iii, the main gas valve 1 output is on (open), and the main gas valve 2 is output off (closed) – gas is let through to fill the void.

If the measured static line pressure is below the offset lower limit set in option/parameter 138, then a 'gas pressure low limit' lockout will occur.

If no voltage is detected when the burner main gas valve 1 output T60 should be on (and vice versa), the lockout 'Main Gas 1 Output Fault' will occur.

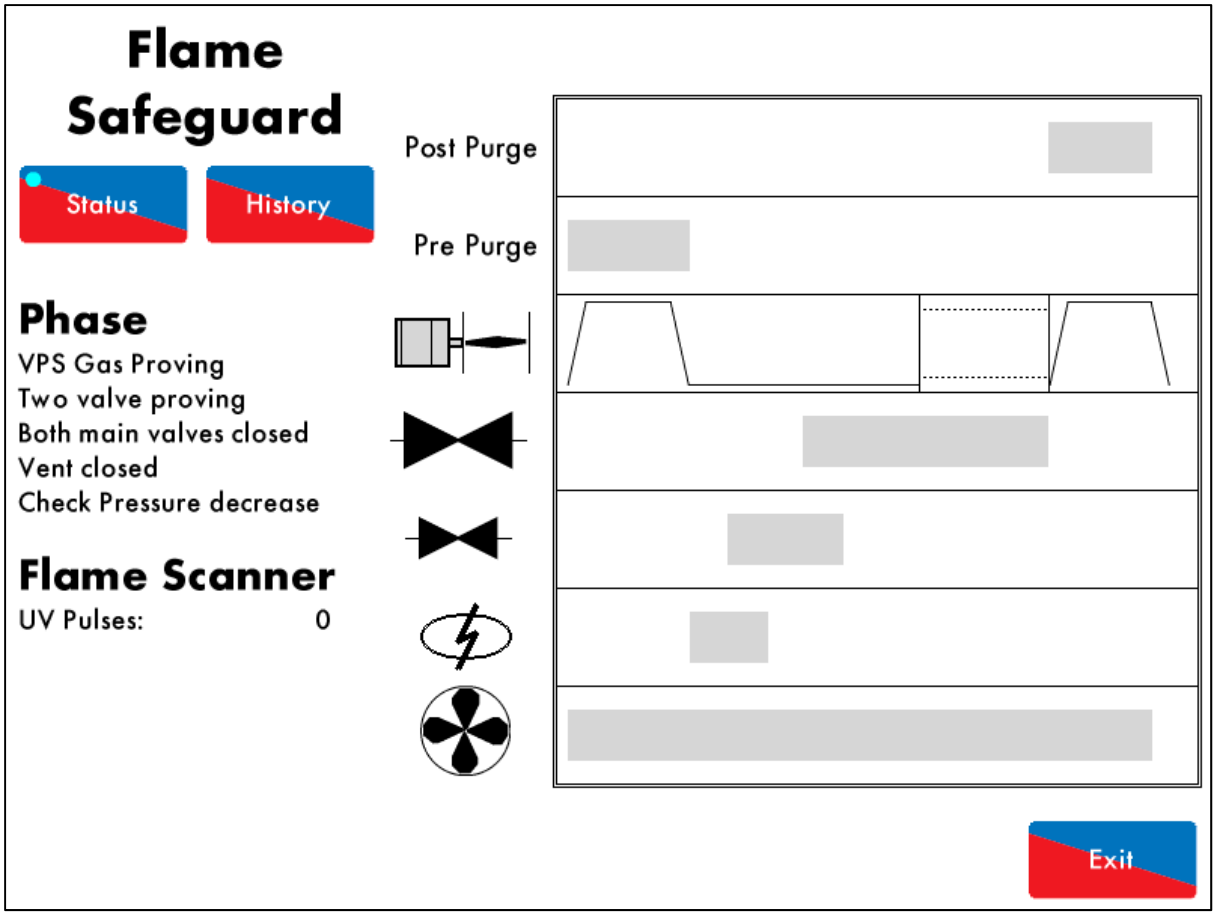


Figure 4.5.iv VPS Gas Proving

In the VPS Gas Proving phase shown in Figure 4.5.iv, the outputs of main gas valve 1 and 2 are both off (closed), to check for any gas leaks in the void between the main valves.

After the valves close, there is 1.5 second delay before the initial gas pressure reading is taken. The reading taken after this delay must be at least 80% of this measured static line pressure. If there is a decrease in the gas pressure, there could be a leak of pressure out and the lockout 'VPS Gas Proving Fail Low' will occur. This indicates that there could be a fault with main gas valve 2. See option/parameter 133.

If the lockout 'VPS Gas Input Too High' occurs, this indicates that there an increase in pressure has been detected. Check the main gas valve 1, and ensure the valve opening times are set correctly, see option/ parameter 134.

If the measured static line pressure is below offset limit

4.6 Zero Air Sensor

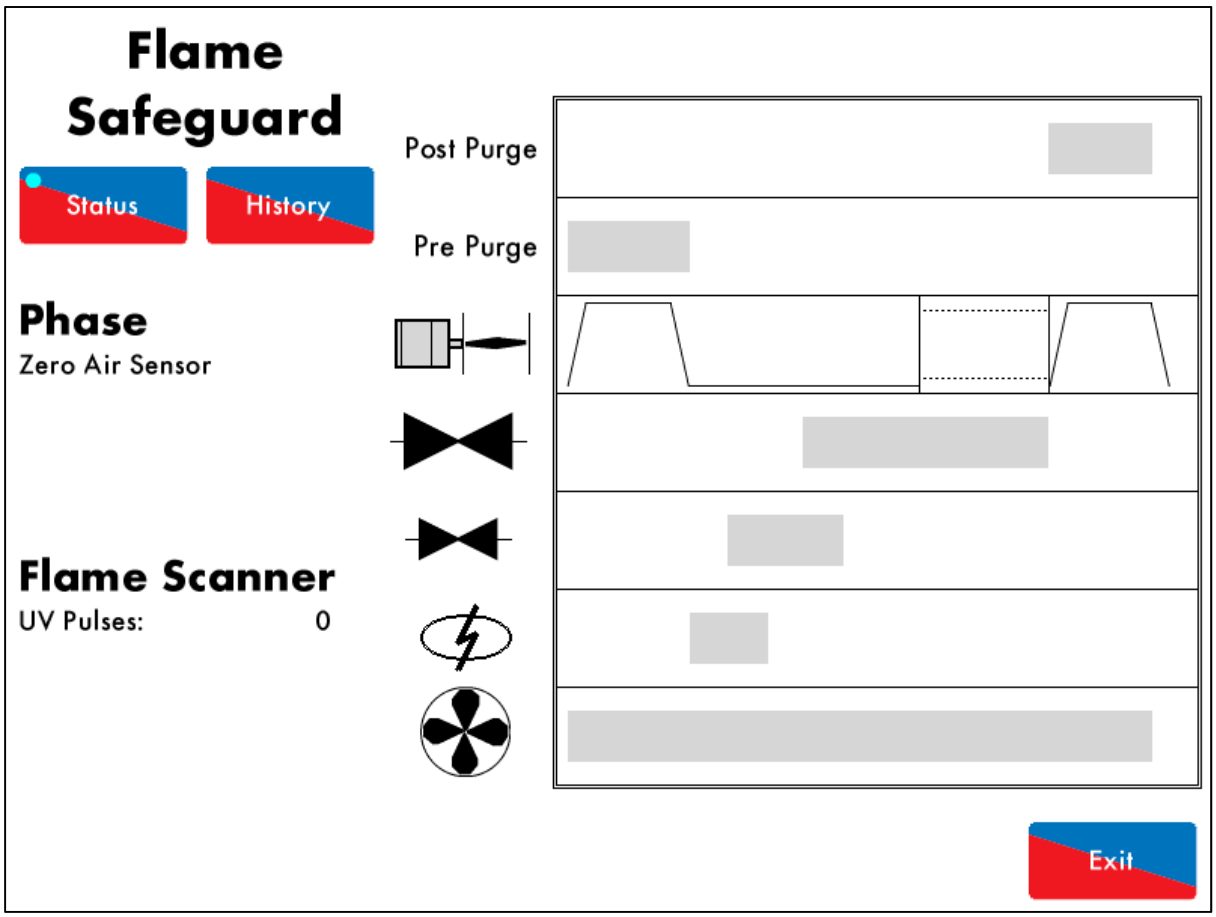


Figure 4.6.i Zero Air Sensor

Once the VPS checks are competed, the air pressure is checked before the burner motor starts up in the Zero Air Sensor screen shown in Figure 4.6.i. The air pressure sensor will look for zero air pressure. If the air pressure sensor cannot be zeroed, because there is 5mbar difference from the air pressure sensor's zero value, then the lockout 'Air Sensor Zero' will occur.

If an air switch is used on T54, the MM will go to the Wait for Air Switch phase. If a reset of voltage is not seen and the MM is in this phase more than 2minutes, the lockout 'Wait Air Switch Timeout' will occur.

If both an air pressure sensor and air switch are optioned, then both must read low before the 'Wait for Air Switch' phase can be passed, see option/parameter 148.

4.7 Purge

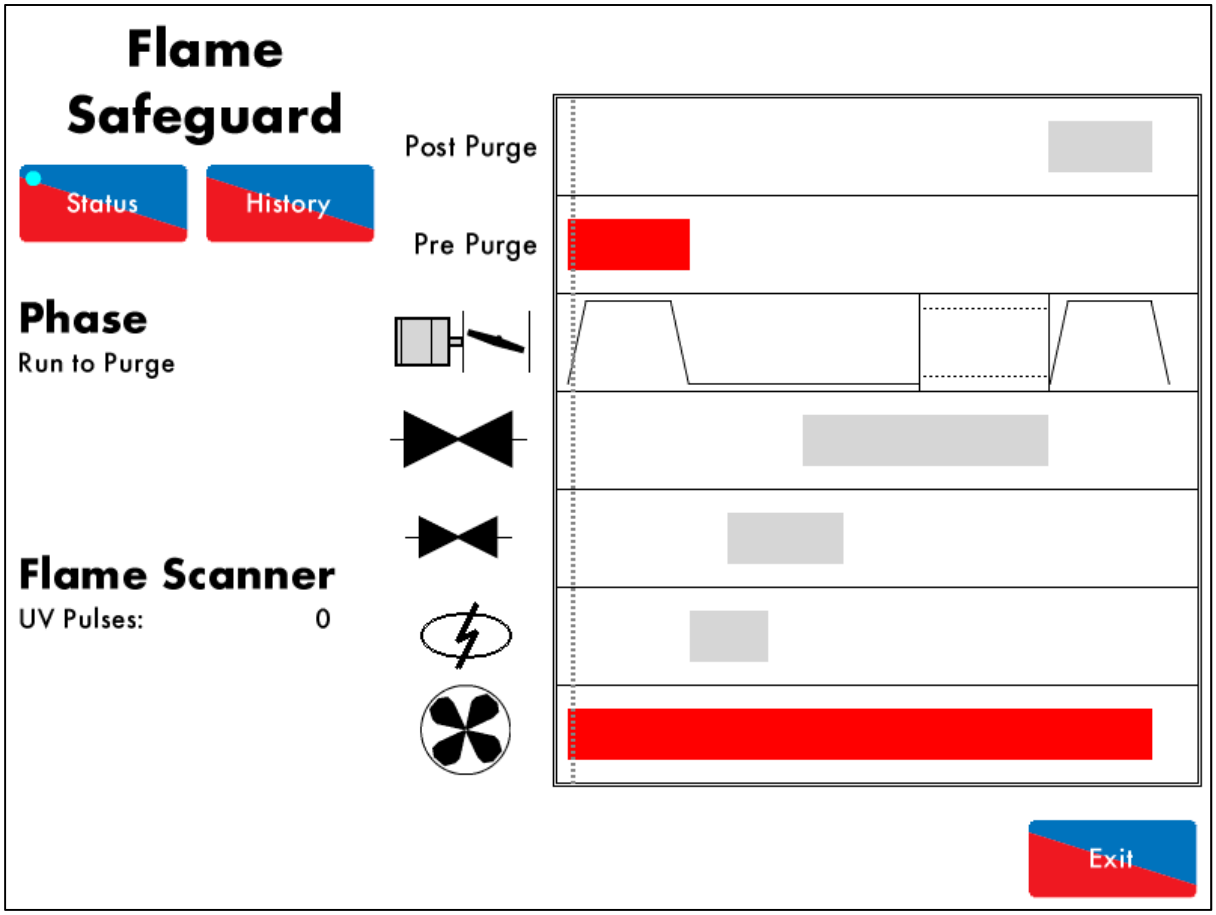


Figure 4.7.i Run to Purge

Once all the internal relay and VPS checks have been made, the channels move to their commissioned purge positions in the Run to Purge phase shown in Figure 4.7.i. The burner motor output is switched on. If a VSD is fitted and the feedback does not match the commissioned signal, the MM will sit at Run to Purge indefinitely without a lockout.

If no voltage is detected when the burner motor output T58 should be on (and vice versa), the lockout 'Motor Output Fault' will occur.

Note: A delay to purge input can be used on terminal 80; a timeout can also be optioned for this input. See option/parameters 154 and 57.

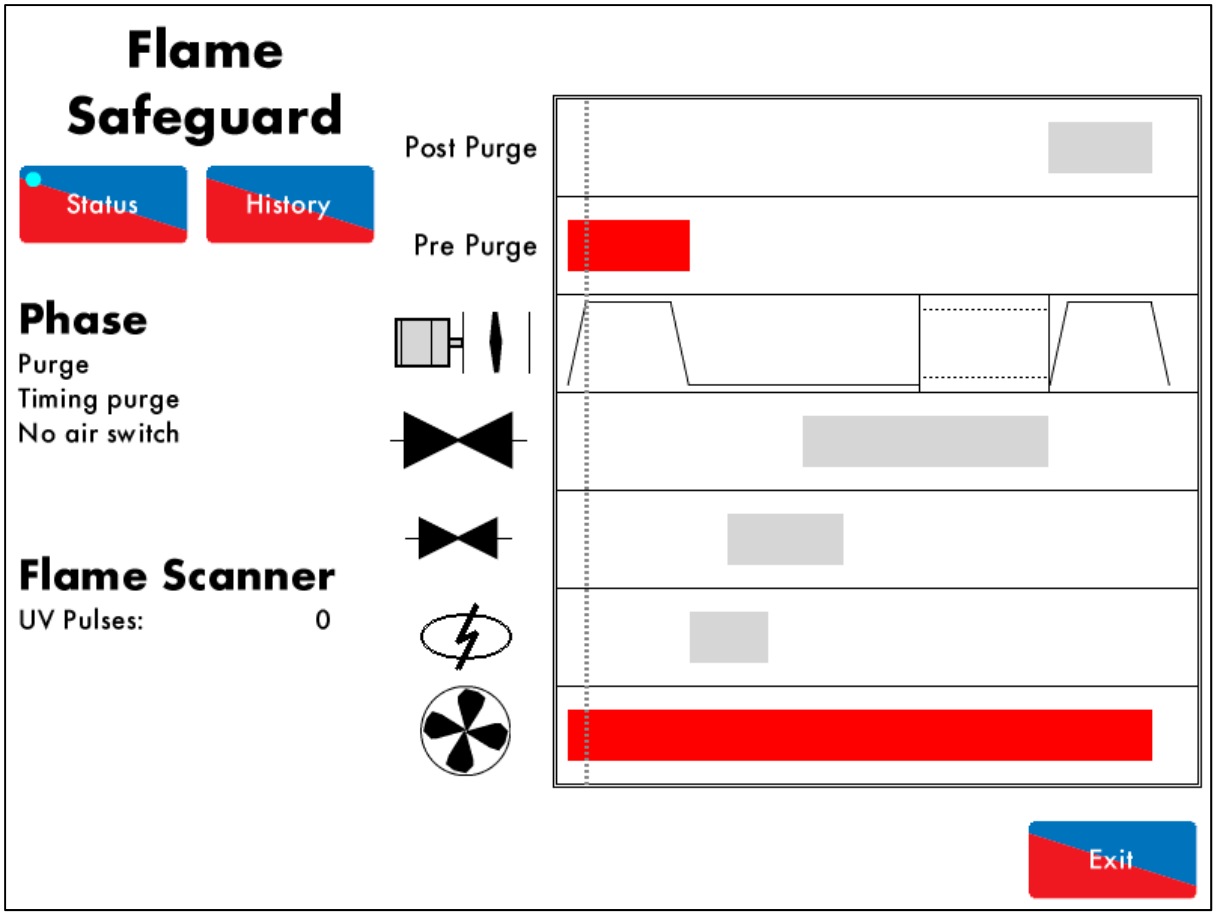


Figure 4.7.ii Purge No Air Switch

The Purge No Air Switch phase shown in Figure 4.7.ii allows a delay before the air switch/air pressure sensor is checked. See option/parameter 121.

Note: A purge position interlock can be connected to terminal 81; this input must made in order for the system to begin the purge phase, see option/parameter 155.

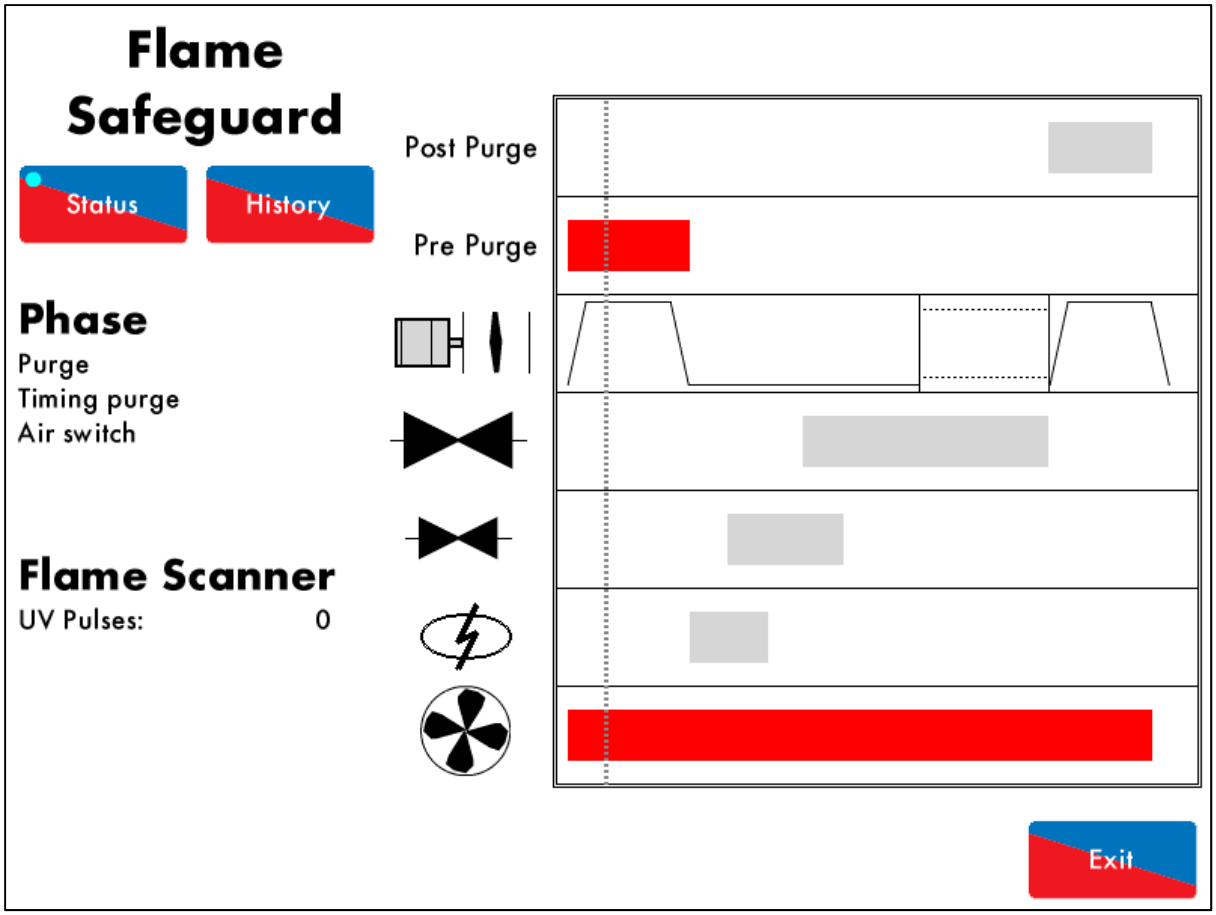


Figure 4.7.iii Purge Air Switch

Once the 'delay from start of the purge before the air switch is checked' has elapsed, the air pressure sensor checks for a minimum air pressure in the Purge Air Switch phase shown in Figure 4.7.iii. If the air pressure sensor does not detect sufficient air, then the lockout 'No Air Proving' will occur. See option/ parameters 141 and 149.

If using an air switch, line voltage must be present on T54 throughout the purge cycle and maintained until the burner enters the Recycle phase on Shut Down. See option/ parameter 145.

Purging the burner/boiler forces fresh air to flow through the combustion chamber; this clears out any fuel remnants or residual combustion gases. See option/parameter 112.

Note: A purge pressure proving input can be used on terminal 81 with an optional timeout; this input is checked after the no air switch delay, see option/parameters 155 and 158.

4.8 Ignition

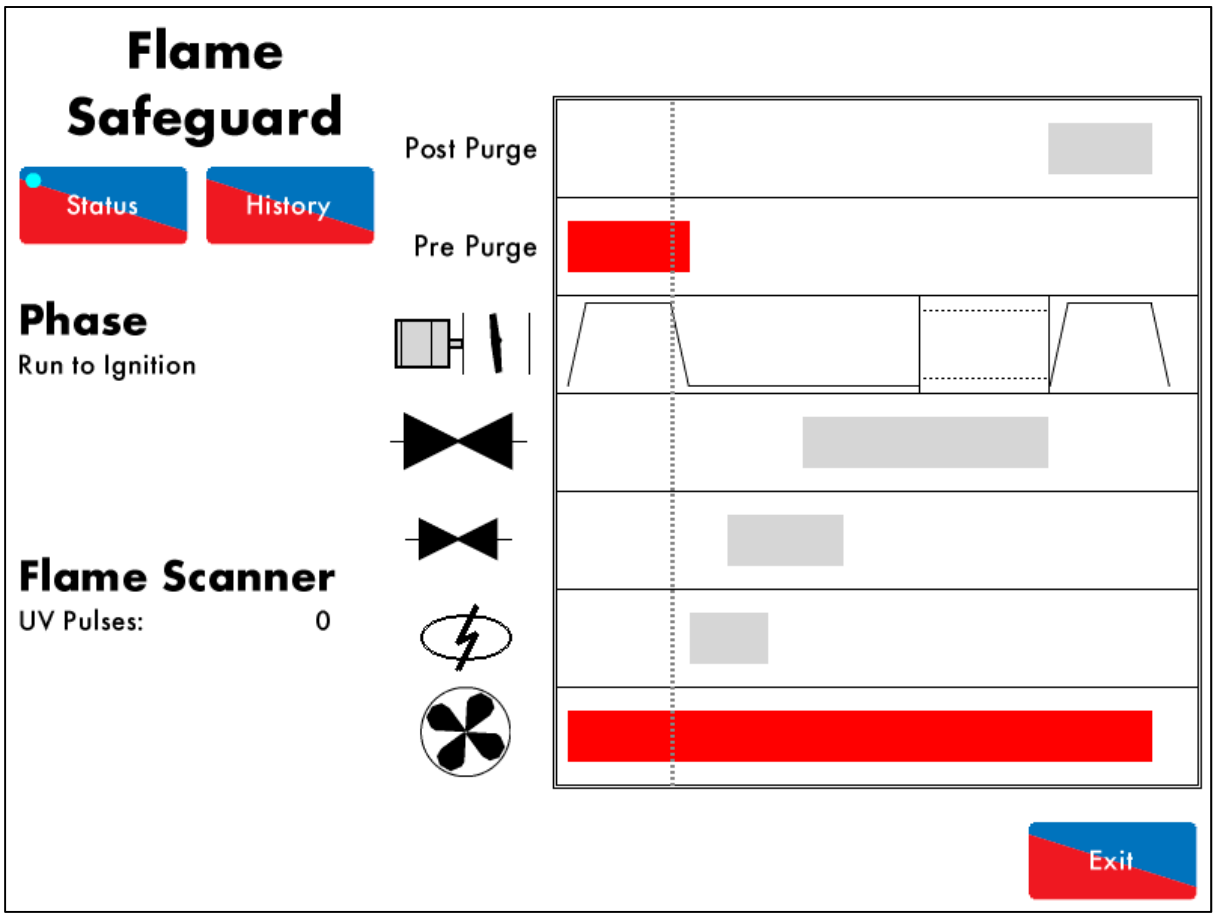


Figure 4.8.i Run to Ignition

In the Run to Ignition phase shown in Figure 4.8.i, the channels will move to their commissioned start positions. If a VSD is fitted and the feedback does not match the commissioned signal, the MM will sit at Run to Ignition indefinitely without a lockout.

Note: If the system has been commissioned with FGR start, then the MM will run to the FGR start positions her, unless Golden start is commissioned and the MM will run to the Golden start position.

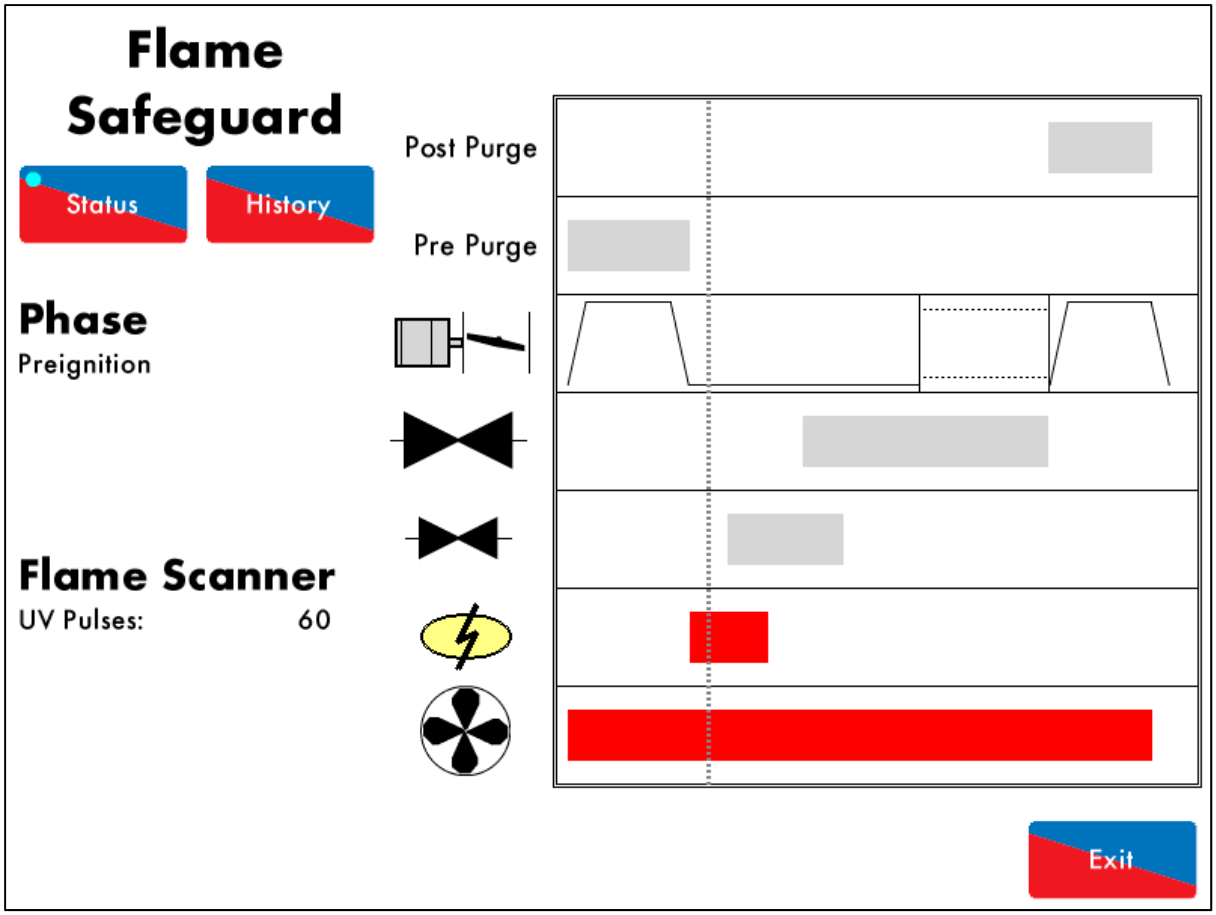


Figure 4.8.ii Pre-ignition

The ignition transformer output is switched on in the Pre-ignition phase shown in Figure 4.8.ii, before the pilot gas valve is switched on (open). See option/parameter 113.

If no voltage is detected when the ignition output T63 should be on (and vice versa), the lockout 'Ignition Output Fault' will occur.

If the gas valves proof of closure switch output T55 is opened during ignition, the lockout 'CPI Input Wrong State' will occur.

4.9 Pilot

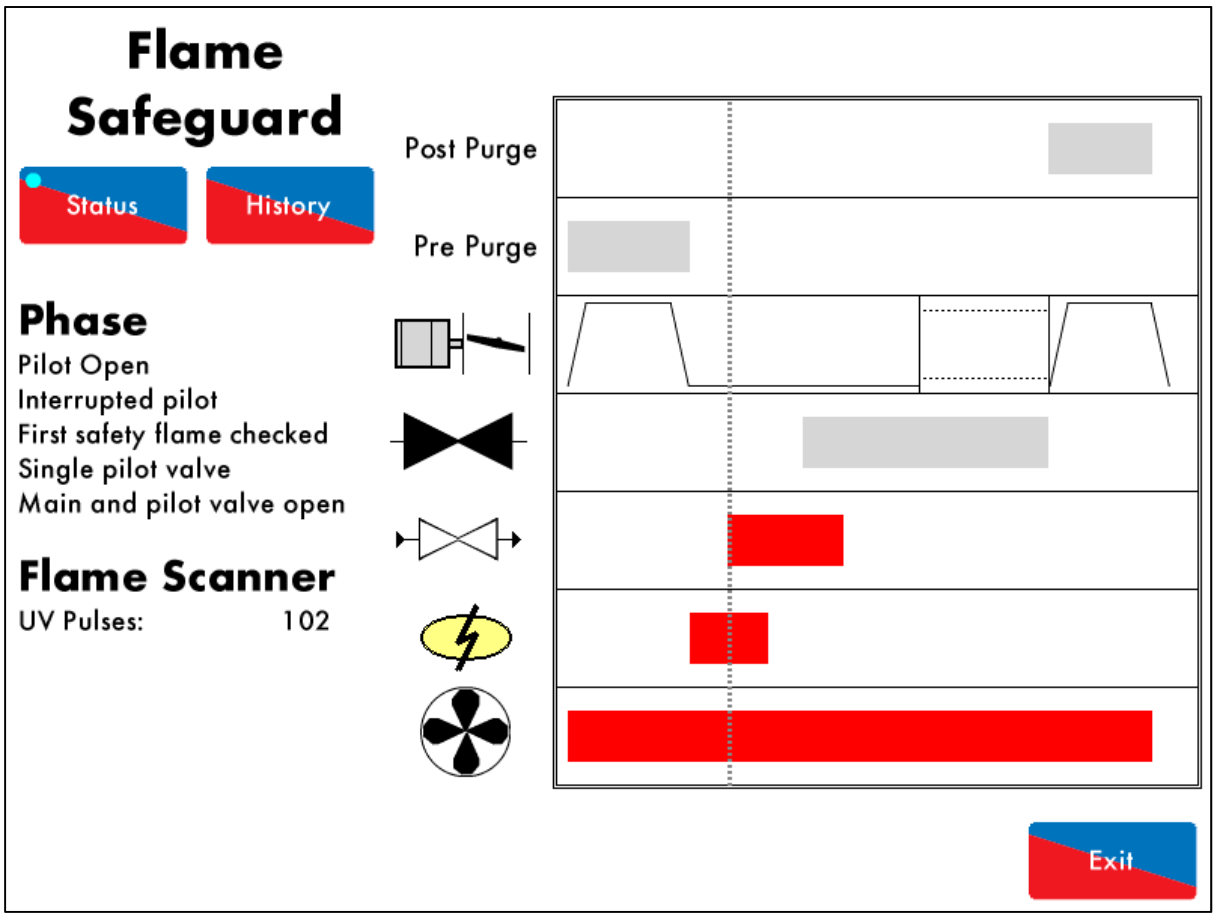


Figure 4.9.i Pilot Open

The pilot gas valve is switched on (open) in the Pilot Open phase shown in Figure 4.9.i. The 1st safety time is the period when the pilot valve is open before the flame is checked. See option/parameter 114.

If no voltage is detected when the pilot valve output T59 should be on (and vice versa), the fault 'Start Gas Output Fault' will occur.

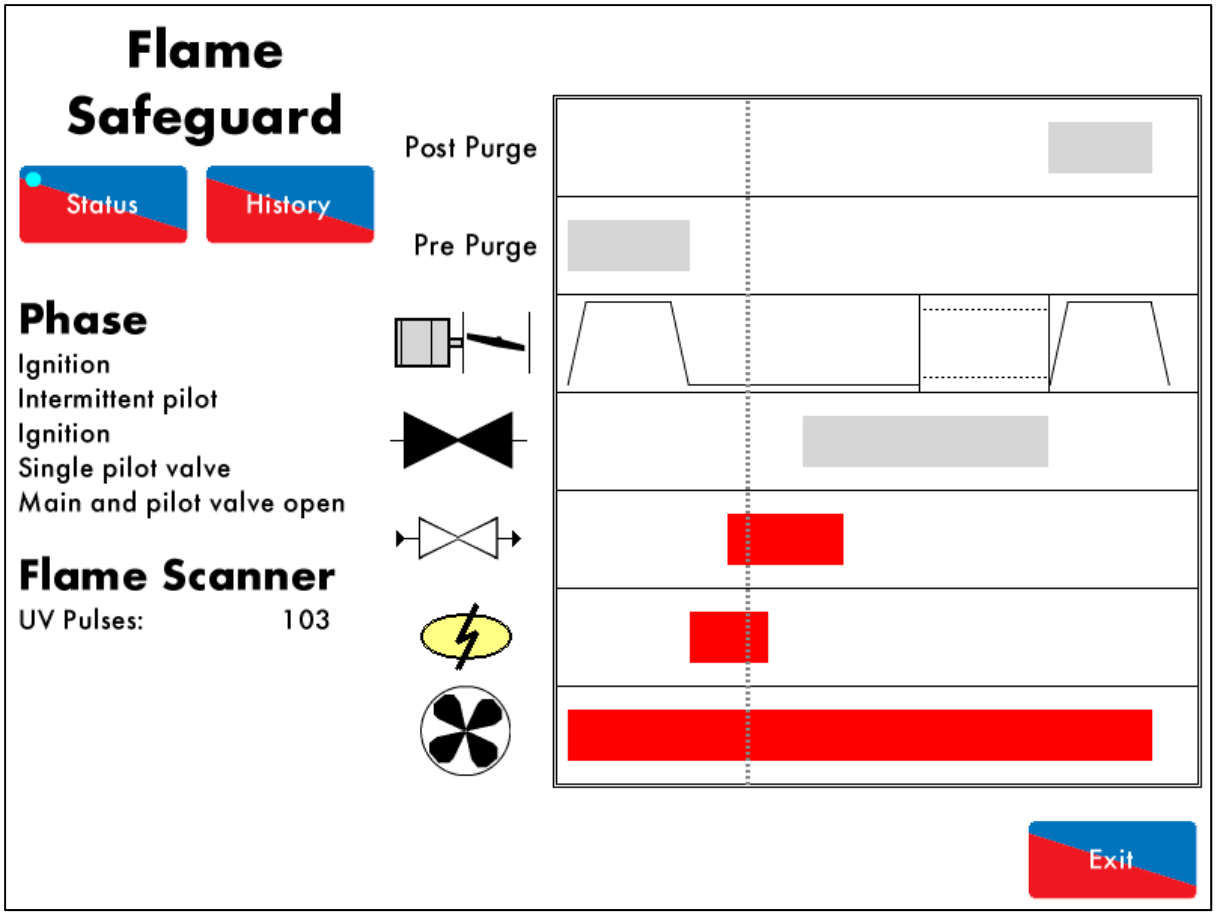


Figure 4.9.ii Ignition

At the end of the 1st safety time period, the pilot flame is checked by the UV scanner in the Single Valve Pilot Ignition shown in Figure 4.9.ii. If the pilot goes out, the lockout 'No Flame Signal' will occur.

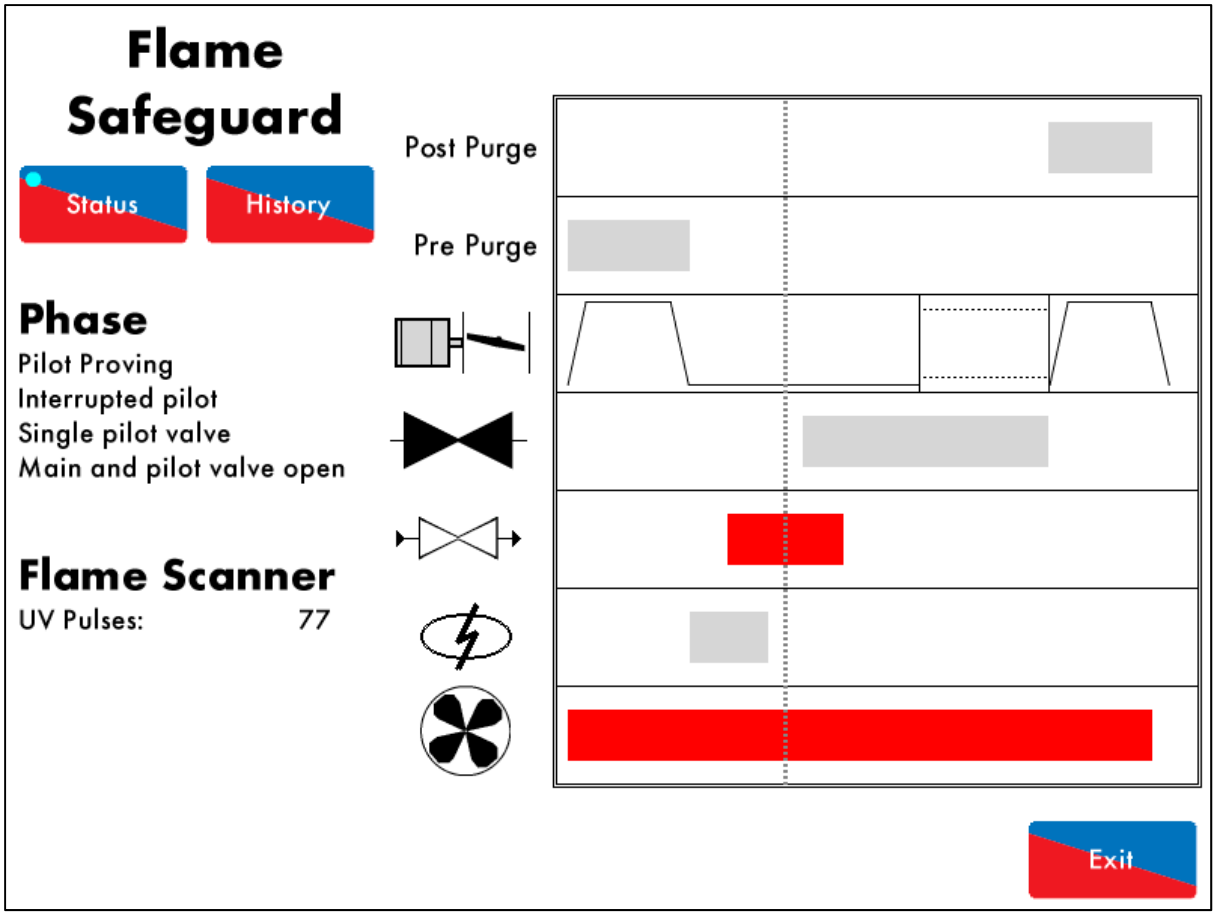


Figure 4.9.iii Pilot Proving

The ignition transformer output is switched off after the pilot ignition, in the Pilot Proving phase shown in Figure 4.9.iii. This proving period gives the pilot flame a chance to stabilise. The flame is checked to ensure the pilot is strong. If the pilot goes out, the lockout 'No Flame Signal' will occur. See option/parameters 115 and 120.

4.10 Proving

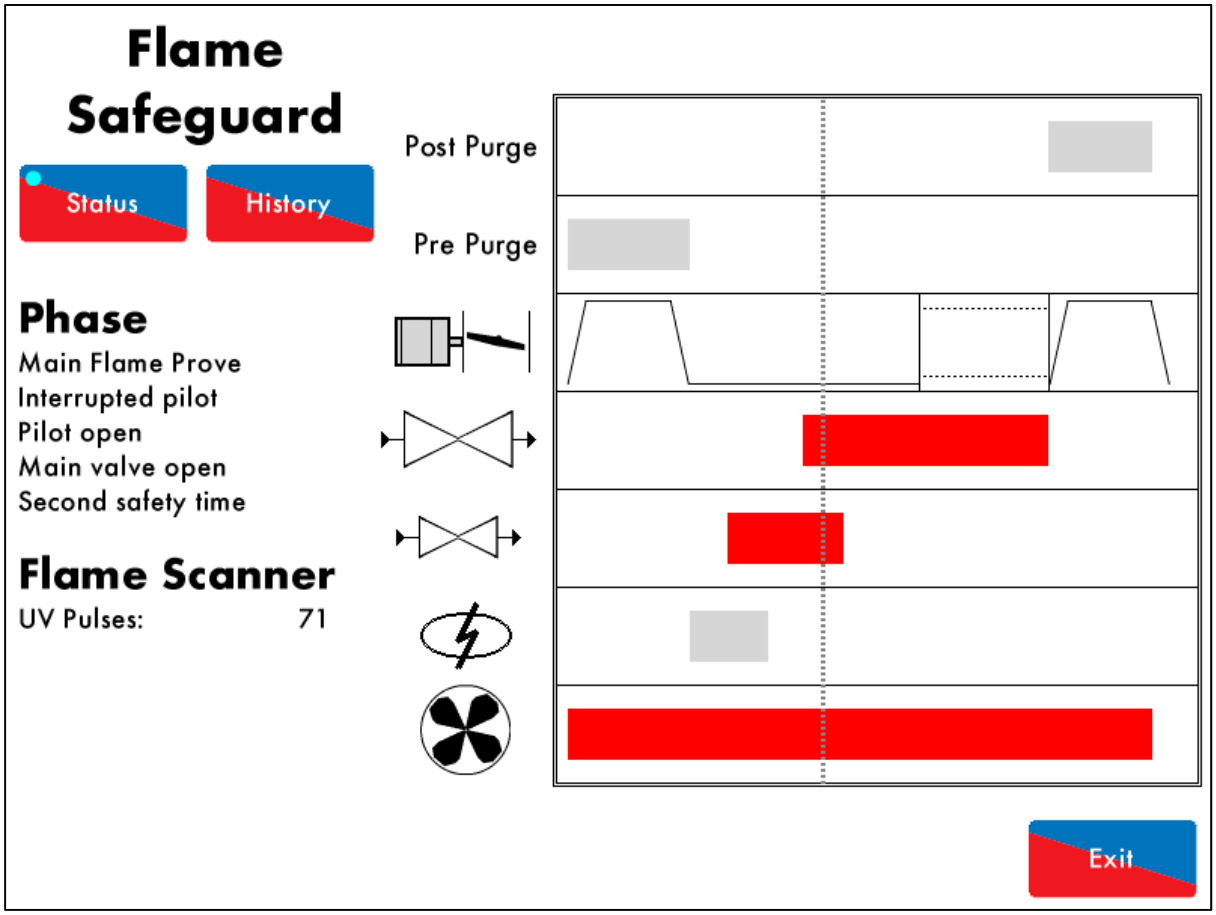


Figure 4.10.i Main Flame Prove Second Safety Time

The 2nd safety time begins, where the flame is not checked in the Interrupted Pilot 2nd Safety phase shown in Figure 4.10.i.

The 2nd safety time is the period where the pilot/main valves overlap. The outputs of the main gas valves 1 and 2 are switched on (opened), while the pilot valve output is maintained on (opened). This 2nd safety time allows the main flame to light prior to the pilot valve output being switched off (closed). See option/parameter 116. If the flame is not strong enough, the lockout 'No Flame Signal' will occur.

If no voltage is detected when the burner main gas valve 1 output T60 should be on (and vice versa), the lockout 'Main Gas 1 Output Fault' will occur.

If no voltage is detected when the burner main gas valve 2 output T61should be on (and vice versa), the lockout 'Main Gas 2 Output Fault' will occur.

The CPI/POC input T55 is now no longer checked through the firing cycle.

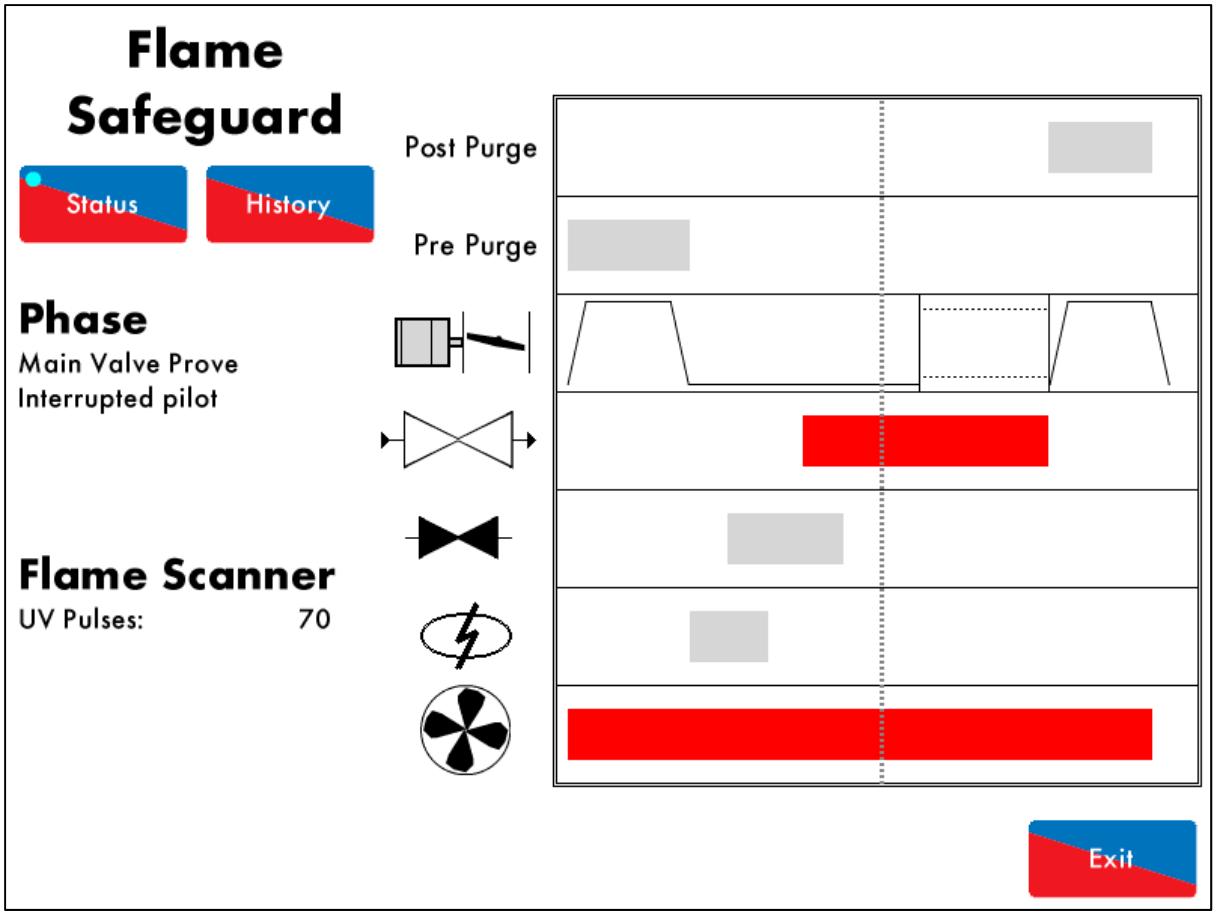


Figure 4.10.ii Main Flame Prove

In the Interrupted Pilot Main Prove phase shown in Figure 4.10.ii, the pilot gas valve output is switched off (closed). There is a time delay to allow the main flame to stabilise before the burner proceeds to normal modulation as set. If the main flame fails now, the lockout 'No Flame Signal' will occur. See option/ parameter 117.

After the second safety time, the gas pressure limits are checked in the main flame proving phase, see option/parameters 136 and 137.

4.11 Firing

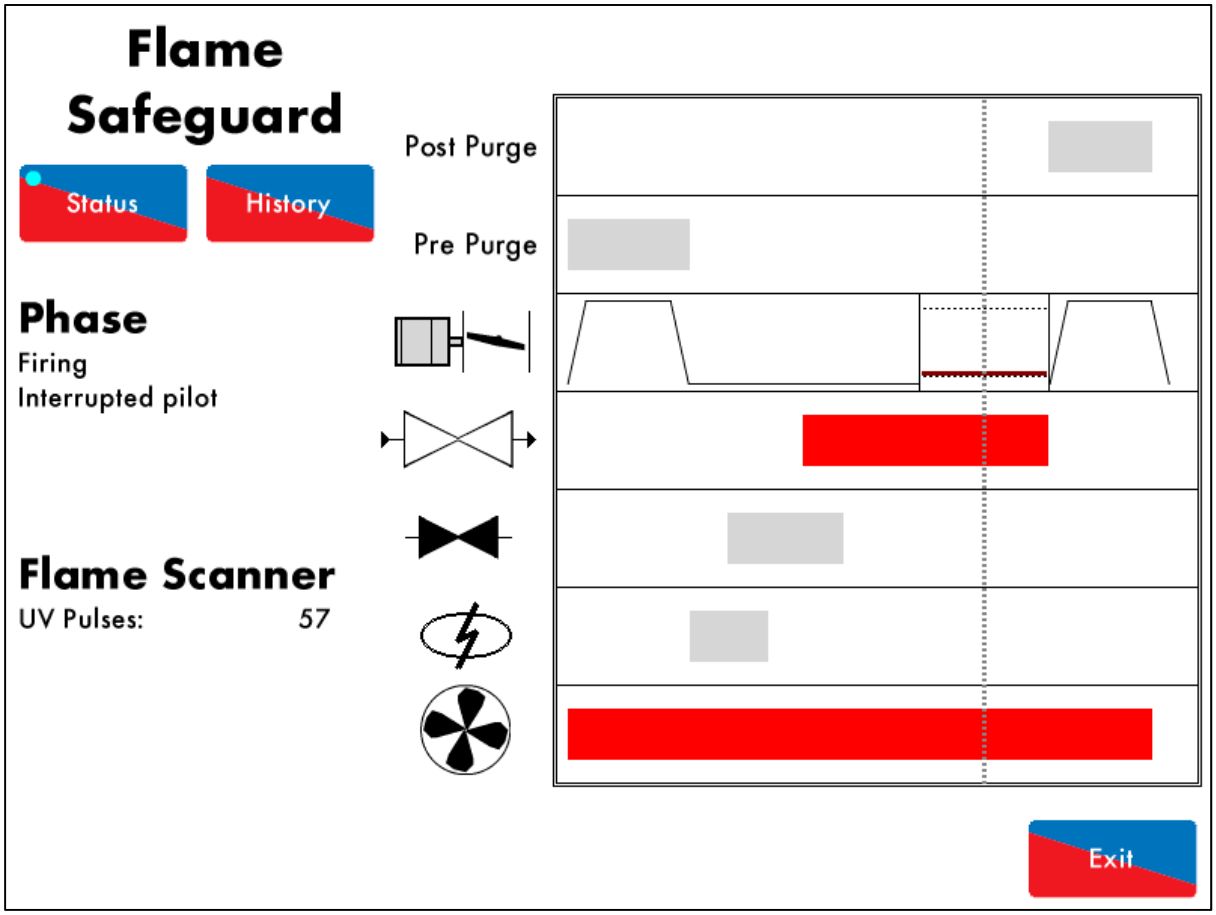


Figure 4.11.i Firing

The burner has now completed the start-up sequence and fires normally according to its set operation in the Firing phase shown in Figure 4.11.i. If using internal PID, the burner will modulate its firing rate up and down based on how far away its actual temperature/ pressure is from meeting the required temperature/ pressure.

The gas and air pressure limits are continually monitored in this example. If the gas pressure exceeds the upper limit or is below the lower limit, the lockouts 'Gas Pressure High' or 'Gas Pressure Low' will occur, respectively. If the air pressure is outside of the limits, the lockout 'Air Pressure Out of Window' will occur. See option/parameters 136, 137 and 147.

4.12 Post Purge

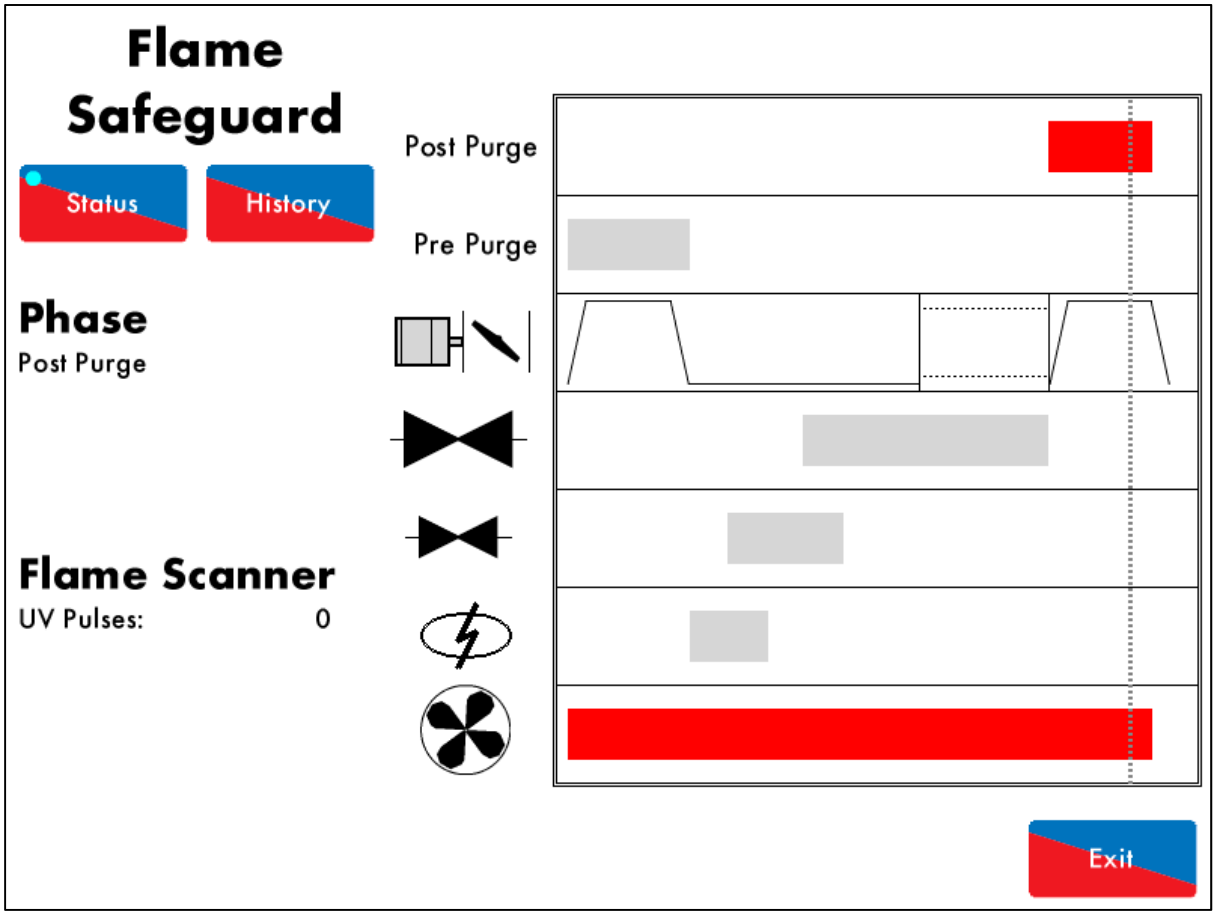


Figure 4.12.i Post Purge

The Post-Purge phase shown in Figure 4.12.i is optioned in this example. When T53 is switched off and the burner is off, the MM will purge fresh air through the burner/boiler, when the burner shuts down in normal conditions (internal/external stat). The outputs of the main gas valves 1 and 2, and the pilot valve are switched off (closed). See option/parameters 118 and 135.

The post purge timer begins once the channels have moved to their post purge positions and the purge interlock has been made on terminal 81 if optioned. This does not apply to NFPA post purge.

After Post-Purge, the MM will go back to the Recycle phase, the burner start-up sequence will continue as required.

Note: If NFPA Post-Purge is selected, then the burner will also perform a Post-Purge in the event of a lockout/error at any time after the Ignition phase, and the purge interlock on terminal 81 is not checked, if optioned.

5 REMOTE CONTROL

5.1 Modbus Settings

To access data remotely from the Mini Mk8 MM, this can be done either by connecting a Mk7 DTI, or by using direct Modbus. Direct Modbus cannot be used with sequencing or Mk7 DTI.

There are a limited number of Modbus addresses available in the Mini Mk8 MM, which can be accessed directly without the need for a DTI.

When using Modbus direct, e.g. connecting to Building Management System from the MM without a DTI, then neither Autoflame Intelligent Boiler Sequencing nor the DTI can be used.

The MM communicates using an RS485 data link from terminals 27 (-ve) and 28 (+ve). Beldon 9501 data cable is recommended.

Up to 10 MMs can be linked to together and connected to a Building Management System via terminals 27 and 28. Each Mini Mk8 MM will need to be set with an individual Modbus device ID by setting option 104.

The maximum block of addresses the Mini Mk8 MM can read and write to is 127, as per Modbus having a built-in limit of 255 byte packets.

If the MM does not receive any Modbus commands for 60 seconds, the Modbus goes 'offline.' You can keep the Modbus 'online' with a simple instruction, such as polling or setting a single value to that individual MM. If the Modbus is 'offline' then remote setpoint and firing rate set via Modbus will be disabled. The only exception is the enable/disable burner which changes the enable/disable button on the MM on the home screen, as this change will last until the Modbus state is changed again or the enable/disable button is pressed again.

If the MM is powered off or the communications is lost, the Modbus address values from the unit will not be true.

Please see next page for Modbus addresses.

5.2 Configuration

Option	Description	Setting
100	Sequencing/DTI or Modbus function	1
101	Modbus baud rate	As required
102	Modbus parity setting	As required
103	Modbus stop bits setting	As required
104	Modbus device ID	As required
105	Binary format	As required

The following terminals are used for direct Modbus.

Terminal	Description
27	RS485 -
28	RS485 +
S	Screen

5.3 Modbus Addresses

There are 4 types of Modbus addresses:

0x Read/Write digital outputs – off/on commands

1x Read digital inputs – off/on signals/indications

These are binary values and have a 0/1 value indicating an off/on or no/yes value.

3x Read analogue inputs – variable data in

4x Read/Write analogue outputs – variable adjustments

These are multiple integer values and can have a value of 0 to 65534 and do not contain decimal points i.e. channel 1position Modbus value is 900 which is equivalent to 90.0°

Address	Description	Type
00001	Enable/Disable MM	Read/write digital
	• 0 = Burner is enabled, 1 = Burner is disabled • Value changes state of enable/disable button on MM home screen; changes are kept if MM loses comms with Modbus device sending commands	
10217	EGA Trim Optioned	Read digital
	• 0 = Trim not optioned, 1 = Trim optioned • Returns value 0 when option 12 is set for monitoring only.	
10218	EGA is Trimming	Read digital
	• 0 = EGA not trimming, 1 = EGA is trimming • Returns value 0 is actual temperature/pressure is below trim threshold	
10219	EGA Cooler Ready	Read digital
	• 0 = Cooler is ready, 1 = Cooler is not ready • Returns value 0 if EGA is an error state	
10220	EGA Ambient Temp OK	Read digital
	• 0 = Temperature OK, 1 = Temperature not OK	
10221	EGA NO_2 On	Read digital
	• 0 = NO_2 cell not optioned, 1 = NO_2 cell optioned • See option 36, valid for Mk7 EGA only	
10222	EGA SO_2 On	Read digital
	• 0 = SO_2 cell not optioned, 1 = SO_2 cell optioned • See option 36, valid for Mk7 EGA only	
10224	EGA OK to Sample	Read digital
	• 0 = EGA is not sampling, 1 = EGA is sampling	
10233	Hand Mode	Read digital
	• 0 = MM not in hand mode, 1 = MM in hand mode	
10234	Low Flame Hold	Read digital
	• 0 = MM not in low flame hold, 1 = MM in low flame hold	
10242	Disabled Status	Read digital
	• 0 = Burner enabled, 1 = Burner disabled • Returns state of enable/disable button on MM home screen and same value as address 00001	
30101	Load Index	Read analogue
	• Firing rate %	

Address	Description	Type
30102	Firing Status	Read analogue
	• 0 = Non-modulating, 1 = Modulating • Returns value 0 single point change, fuel flow metering and commissioning	
30104	Burner Rating	Read analogue
	• MW x 10 • Metric units determined from fuel flow metering	
30105	Actual Value	Read analogue
	• Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 • Imperial: temperature °F, pressure PSI, low pressure PSI x 10	
30106	Required Value	Read analogue
	• Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 • Imperial: temperature °F, pressure PSI, low pressure PSI x 10	
30107	Selected Fuel	Read analogue
	• 0 = Fuel 1, 1 = Fuel 2	
30109	Channel 1 Position	Read analogue
	• Degrees x 10 • Range is -6.0° to 96.0°	
30110	Channel 2 Position	Read analogue
	• Degrees x 10 • Range is -6.0° to 96.0°	
30111	Channel 3 Position	Read analogue
	• Degrees x 10 • Range is -6.0° to 96.0°	
30113	MM Error Number	Read analogue
	• 0 = System is does not have an error, N = error number, check error codes	
30115	EGA Current O_2 Value	Read analogue
	• % x 10	
30116	EGA Current CO_2 Value	Read analogue
	• % x 10	
30117	EGA Current CO Value	Read analogue
	• ppm x 10	
30118	EGA Current Exhaust Gas Temperature	Read analogue
	• Metric: temperature x 10 °C • Imperial: temperature x 10 °F	
30119	EGA Current Efficiency Value	Read analogue
	• % x 10	
30120	EGA Current NO Value	Read analogue
	• ppm x 10	
30121	EGA Current SO_2 Value	Read analogue
	• ppm x 10	
30122	EGA Commissioned O_2 Value	Read analogue
	• % x 10	
30123	EGA Commissioned CO_2 Value	Read analogue
	• % x 10	
30124	EGA Commissioned CO Value	Read analogue
	• ppm x 10	

Address	Description	Type
30125	EGA Commissioned Exhaust Gas Temperature	Read analogue
	• Metric: temperature x 10 °C • Imperial: temperature x 10 °F	
30126	EGA Commissioned Efficiency Value	Read analogue
	• % x 10	
30127	EGA Commissioned NO Value	Read analogue
	• ppm x 10	
30128	EGA Commissioned SO_2 Value	Read analogue
	• ppm x 10	
30129	EGA Error Code	Read analogue
	• 0 = EGA does not have a fault, N = EGA error	
30130	Minimum Remote Setpoint	Read analogue
	• Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 • Imperial: temperature °F, pressure PSI, low pressure PSI x 10	
30131	Maximum Remote Setpoint	Read analogue
	• Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 • Imperial: temperature °F, pressure PSI, low pressure PSI x 10	
30132	Current Flow Thousands	Read analogue
	• Metric kW, imperial MMBTU/hr x 1000 • Remainder after whole number of MW or MMBTU/hr x 1000 taken away. E.g. 1.5MW gives 500 value and 15.1MMBTU/hr gives 100 value	
30133	Current Flow Millions	Read analogue
	• Metric MW, imperial MMBTU/hr • Whole number of MW or MMBTU/hr. E.g. 1.5MW gives 1 value and 15.1MMBTU/hr gives 15 value	
30134	Fuel 1 Flow Total Thousands	Read analogue
	• Metric kW/hr, imperial MMBTU/hr • Remainder after whole number of MW/hr or MMBTU x 1000 taken away, x 1000. E.g. 1.5MW/hr gives 500 value and 15.1MMBTU gives 100 value	
30135	Fuel 1 Flow Total Millions	Read analogue
	• Metric MW/h, imperial MMBTU • Whole number of MW/hr or MMBTU. E.g. 1.5MW/hr gives 1 value and 15.1MMBTU gives 15 value	
30136	Fuel 1 Flow Total Billions	Read analogue
	• Metric GW/hr, imperial MMBTU / 1000 • Whole number of GW/hr or MMMBTU E.g. 1.5MW/hr gives 0 value and 15.1MMBTU gives 0 value	
30137	Fuel 2 Flow Total Thousands	Read analogue
	• Metric kW/hr, imperial MMBTU/hr • Remainder after whole number of MW/hr or MMBTU x 1000 taken away, x 1000. E.g. 1.5MW/hr gives 500 value and 15.1MMBTU gives 100 value	
30138	Fuel 2 Flow Total Millions	Read analogue
	• Metric MW/h, imperial MMBTU • Whole number of MW/hr or MMBTU. E.g. 1.5MW/hr gives 1 value and 15.1MMBTU gives 15 value	

Address	Description	Type
30139	Fuel 2 Flow Total Billions	Read analogue
• Metric GW/hr, imperial MMBTU / 1000 • Whole number of GW/hr or MMMBTU E.g. 1.5MW/hr gives 0 value and 15.1MMBTU gives 0 value		
30140	Fuel 3 Flow Total Thousands	Read analogue
• Metric kW/hr, imperial MMBTU/hr • Remainder after whole number of MW/hr or MMBTU x 1000 taken away, x 1000. E.g. 1.5MW/hr gives 500 value and 15.1MMBTU gives 100 value		
30141	Fuel 3 Flow Total Millions	Read analogue
• Metric MW/h, imperial MMBTU • Whole number of MW/hr or MMBTU. E.g. 1.5MW/hr gives 1 value and 15.1MMBTU gives 15 value		
30142	Fuel 3 Flow Total Billions	Read analogue
• Metric GW/hr, imperial MMBTU / 1000 • Whole number of GW/hr or MMMBTU E.g. 1.5MW/hr gives 0 value and 15.1MMBTU gives 0 value		
30143	EGA Current Ambient Temperature	Read analogue
• Metric: temperature x 10 °C • Imperial: temperature x 10 °F		
30144	EGA Current Delta Temperature	Read analogue
• Metric: temperature x 10 °C • Imperial: temperature x 10 °F		
30145	EGA Commissioned Ambient Temperature	Read analogue
• Metric: temperature x 10 °C • Imperial: temperature x 10 °F		
30146	EGA Commissioned Delta Temperature	Read analogue
• Metric: temperature x 10 °C • Imperial: temperature x 10 °F		
30147	UV Counts	Read analogue
• Returns value displayed on MM		
30148	IR Counts	Read analogue
• Returns value displayed on MM		
30149	Ionisation Counts	Read analogue
• Returns value display on MM		
30150	EGA Current NO_2 Value	Read analogue
• ppm x 10		
30151	EGA Commissioned NO_2 Value	Read analogue
• ppm x 10		
30804	Channel 4 VSD Output	Read analogue
• mA x 10 or V x 10		
30805	Channel 4 VSD Input	Read analogue
• mA x 10 or V x 10		
30830	Lockout Number	Read analogue
• 0 = System is not in lockout, N = lockout number		
30831	Fuel 1 Type	Read analogue
• 0 = Gas, 1 = Oil • Option/ parameter 150 value		

Address	Description	Type
30832	Fuel 2 Type	Read analogue
	• 0 = Gas, 1 = Oil • Option/parameter 151 value	
30839	Fuel 1 Hours Run	Read analogue
	• Completed hours	
30840	Fuel 2 Hours Run	Read analogue
	• Completed hours	
30843	Fuel 1 Start-ups	Read analogue
	• Start-ups	
30844	Fuel 2 Start-ups	Read analogue
	• Start-ups	
30849	Current Gas Pressure	Read analogue
	• mbar x 10, "wg x 10, PSI x 100 • parameter 41 value	
40001	Remote Required Setpoint	Read/write analogue
	• Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 • Imperial: temperature °F, pressure PSI, low pressure PSI x 10 • After 1 minute of no Modbus communications to the unit, the M.M. will ignore this required value and use the required setpoint set on the M.M.'s status screen.	
40121	Remote Firing Rate	Read/write analogue
	• % • 40131 must be set to 1 to change the firing rate remotely	
40131	Remote Firing Rate Enable	Read/write analogue
	• 0 = Remote firing rate disabled, 1 = remote firing rate enabled	

6 ERRORS AND LOCKOUTS

6.1 Errors

Errors occur when the MM detects an internal fault, component out of range, internal check failure or power supply issue. To clear an error, the MM must be restarted.

Error	Message	Description
1	Channel 1 Positioning Error	Servomotor is outside of the commissioned range
• Check wiring on terminals 40 – 47 • Check signal cable from the MM to the servomotor is screened at one end • Check potentiometer is zeroed correctly • Go into Commissioning mode, check the servomotor position and ensure that closed is at 0.0°		
2	Channel 2 Positioning Error	Servomotor is outside of the commissioned range
• Check wiring on terminals 40 – 47 • Check signal cable from the MM to the servomotor is screened at one end • Check potentiometer is zeroed correctly • Go into Commissioning mode, check the servomotor position and ensure that closed is at 0.0°		
3	Channel 3 Positioning Error	Servomotor is outside of the commissioned range
• Check wiring on terminals 40 – 47 • Check signal cable from the MM to the servomotor is screened at one end • Check potentiometer is zeroed correctly • Go into Commissioning mode, check the servomotor position and ensure that closed is at 0.0°		
5	Channel 1 Gain Error	Servomotor position measurement hardware error
• Check wiring and voltages on terminals 40 – 47 and 70 – 75		
6	Channel 2 Gain Error	Servomotor position measurement hardware error
• Check wiring and voltages on terminals 40 – 47 and 70 – 75		
7	Channel 3 Gain Error	Servomotor position measurement hardware error
• Check wiring and voltages on terminals 40 – 47 and 70 – 75		
9	Channel 1 Movement Error	Servomotor moves when not expected and vice versa
• Check wiring and voltages on terminals 70 – 75 • Check servomotors drive in correct direction • Check valve is not stuck		
10	Channel 2 Movement Error	Servomotor moves when not expected and vice versa
• Check wiring and voltages on terminals 70 – 75 • Check servomotors drive in correct direction • Check damper is not stuck		
11	Channel 3 Movement Error	Servomotor moves when not expected and vice versa
• Check wiring and voltages on terminals 70 – 75 • Check servomotors drive in correct direction • Check valve is not stuck		
13	Analogue Power Supply Error	ADC measured 12V supply out of range
• Check wiring for shorts on terminals 41, 47 and 39		
14	Digital Power Supply Error	ADC measured 3.3V supply out of range
• Check for noise on the mains input, wiring and voltages on all terminals		
15	EEPROM Error	Fault communicating with the on board EEPROM
• Contact Autoflame approved local Tech Centre		

Error	Message	Description
16	ADC Error	Internal fault
• Contact Autoflame approved local Tech Centre		
17	Watchdog Timeout	Internal fault
• Contact Autoflame approved local Tech Centre		
18	Processor Clock Error	Internal fault
• Contact Autoflame approved local Tech Centre		
19	System Error	Internal fault
• Contact Autoflame approved local Tech Centre		
20	Flash Data Error	Internal fault
• Re-install software SD card		
21	Processor Temperature Error	Internal fault
• Check ambient temperature of unit does not exceed maximum recommended temperature		
22	Burner Control Comms Error	Internal fault
• Contact Autoflame approved local Tech Centre		
23	Burner Control Reset	Internal fault
• Contact Autoflame approved local Tech Centre		
24	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
25	Zero-Crossing Detection Error	Internal fault
• Check mains supply going to unit is within acceptable voltage range		
26	Mains Input Detection Error	Fuel mains input stuck reading low
• Check wiring and voltages on mains voltage terminals 53 – 90		
27	Load Sensor Error	Voltage from load sensor is outside of expected range
• Check load sensor wiring and ensure that the return voltage/resistance is less than 1V/ 1kΩ		
28	VSD Error	Feedback incorrect
• Check VSD feedback against commissioned VSD and ensure the feedback is stable		
29	VSD No Commission Feedback	No VSD feedback detected during commissioning
• Re-commission with VSD feedback connected • Check wiring on terminals 1 – 3 and 10 – 12		
30	Missing Commissioning Data	Internal fault
• Check there is commissioning data for all options servomotors/VSD		
31	FAR Execution Speed	Internal fault
• Contact Autoflame approved local Tech Centre		
32	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
33	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
34	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
35	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
36	VSD Sampling Error	VSD feedback current/ voltage too high
• Check wiring on terminals 1 – 3 and 10 – 12		

Error	Message	Description
38	Air Pressure Commission Fault	No air pressure trim data for a point with EGA trim
• Check EGA trim and air pressure trim in fuel-air curve		
39	Gas Pressure VPS Commission Fault	Commissioned gas pressure during VPS is below option/ parameter 133 threshold
• Check option/ parameter 133 and check gas pressure • Re-commission gas pressure sensor		
40	Gas Pressure Run Commission Fault	Commissioned gas pressure during Golden/ FGR start or main curve is below option/ parameter 136 threshold
• Check option/ parameter 136 and check gas pressure • Re-commission gas pressure sensor		
41	Air Pressure Commission Fault	Commissioned air pressure during Golden/ FGR start or main curve is too low
• Check option/parameters 147 and 149 • Re-commission air pressure sensor		
42	Air Pressure Zeroing Fault	Commissioned air zero pressure is more than 5mbar from sensor's zero value
• Check air pressure sensor value during VPS		

6.2 Burner Lockouts

Lockouts occur when the MM detects a fault with the burner operation such as VPS, gas/air pressure sensor and flame scanners. The lockout must be cleared and investigated on the MM.

Lockout	Message	Description
1	CPI Input Wrong State	Proof of closure switch opened during ignition sequence
• Check wiring on terminal 55 • Check proof of closure switches		
2	No Air Proving	No air pressure during start/ firing
• Check wiring on terminal 54 • Check air pressure switch • Check air pressure sensor • Check air pressures during running		
3	Ignition Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 63		
4	Motor Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 58		
5	Start Gas Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 59		
6	Main Gas 1 Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 60		
7	Main Gas 2 Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 61		
8	Vent Valve Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 62		
9	Failsafe Relay (Check 5AT)	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 57 • Check 5A fuse		
10	Simulated Flame	Flame is present when it not should be
• Isolate gas/ oil immediately • Call a certified Commissioning Engineer to investigate • If this lockout occurs during shutdown a post-purge may be required for after burn		
11	VPS Valve 1 Proving Fail	Leak detected during 'air proving' part of VPS
• Check 1st main gas valve • Call a certified Commissioning Engineer to investigate		
12	VPS Valve 2 Proving Fail	Leak detected during 'gas proving' part of VPS
• Check option/parameter 133 • Check 2nd main gas valve and vent valve • Check pilot valve if using single valve pilot • Isolate gas and call a certified Commissioning Engineer to investigate		
13	No Flame Signal	No flame detected during ignition/ firing
• Visually check flame • Check the flame scanner • Call a certified Commissioning Engineer to investigate		
14	Shutter Fault	UV signal detected during shutter operation on self-check
• Check wiring on terminals 21 and 22 • Check UV scanner type and check option/ parameter 110 is set accordingly		

Lockout	Message	Description
15	NO CPI Reset	Proof of closure switch not made after valves closed
• Check wiring on terminal 55 • Check proof of closure switches		
17	Gas Pressure Low	Gas pressure low limit exceeded while firing (gas sensor)
• Check gas pressure • Check option/ parameter 136		
18	Gas Pressure High	Gas pressure high limit exceeded while firing (gas sensor)
• Check gas pressure • Check option/ parameter 137		
19	RAM Test Failed	Hardware fault
• Contact Autoflame approved local Tech Centre		
20	PROM Test Failed	Hardware fault
• Contact Autoflame approved local Tech Centre		
21	FSR Test 1A	Internal relay test failed
• Check wiring and voltages on terminals 50 – 64		
22	FSR Test 2A	Internal relay test failed
• Check wiring and voltages on terminals 50 – 64		
23	FSR Test 1B	Internal relay test failed
• Check wiring and voltages on terminals 50 – 64		
24	FSR Test 2B	Internal relay test failed
• Check wiring and voltages on terminals 50 – 64		
26	Watchdog Fail 2B	Internal check failed
• Contact Autoflame approved local tech centre		
28	Watchdog Fail 2D	Internal check failed
• Contact Autoflame approved local tech centre		
29	Input Fault	Power supply fault
• Check mains voltage to the MM		
32	Gas Pressure Low Limit	Gas pressure lower than commissioned VPS value
• Check gas pressure • Check option/parameters 136 and 138		
33	VPS Pressure Zeroing	Gas pressure sensor cannot be zeroed at VPS venting
• Check gas pressure is within zero range (see MM Application Possibilities) • Check vent valve		
39	Freeze Timeout	MM kept in Phase Hold for more than 10minutes
• MM kept in Phase Hold during commissioning for more than 10 minutes		
44	Proving Circuit Fail T80	Loss of input on terminal 80 when delay to purge is enabled
• MM must be an input at all time from position to purge to post purge. • Check wiring on terminal 80.		
45	No Proving Circuit Set T80	Delay to purge timeout has elapsed
• Check option/parameter 157, and wiring on terminal 80.		
46	Purge Pressure Proving Timeout	Purge pressure proving timeout has elapsed
• Check option/parameters 155 and 158, and wiring on terminal 81.		
47	Ion. Internal Failsafe Fault	Internal check failed for flame rod
• Check wiring on terminal 64		

Lockout	Message	Description
48	Ion. Positive Peak Failsafe Fault	Signal check failed for flame rod
• Check wiring on terminal 64		
49	Ion. Negative Peak Failsafe Fault	Signal check failed for flame rod
• Check wiring on terminal 64		
50	Simulated Flame	Flame detected when there should not be (secondary test for ionisation)
• Visually check flame and check flame rod • Call a certified Commissioning Engineer to investigate		
51	No Flame Signal	No flame detected when there should be (secondary test for ionisation)
• Visually check flame and check flame rod • Call a certified Commissioning Engineer to investigate		
52	High IR Ambient	Flame detected when there should not be
• Visually check flame and check IR scanner • Call a certified Commissioning Engineer to investigate		
53	IR Comms Lost	Loss of comms with IR scanner
• Check wiring and screen on terminals 29, 30, 48 and 49 • Check that the IR scanner is not removed from the magnetic ring socket		
62	UV Signal Too High	Internal check failed for UV
• Check wiring on terminals 21, 22, 50 and 51		
63	Purge Limit Switch	Interlock not made on terminal 81
• Check option/ parameter 155 • Check wiring on terminal 81		
64	Start Limit Switch	Interlock not made on terminal 80
• Check option/ parameter 154 • Check wiring on terminal 80		
65	FSR A	Internal check failed
• Check wiring and voltages on terminals 50 – 64		
66	FSR B	Internal check failed
• Check wiring and voltages on terminals 50 – 64		
67	Gas Sensors Comms	Signal lost from gas pressure sensor
• Check wiring and screen on terminals 29, 30, 48 and 49		
68	Gas Sensor Type	Wrong gas pressure sensor detected
• Check option/parameters 128 and 156		
69	Gas Sensor Fault	Internal pressure sensor fault
• Contact Autoflame approved local tech centre		
70	UV Pot Fault	Hardware fault
• Contact Autoflame approved local tech centre		
71	Air Sensor Comms	Signal lost from air pressure sensor
• Check wiring and screen on terminals 29, 30, 48 and 49		
72	Air Sensor Type	Wrong air pressure sensor detected
• Check option/parameter 148		
73	Air Sensor Fault	Internal pressure sensor fault
• Contact Autoflame approved local tech centre		

Lockout	Message	Description
74	Air Sensor Zero	Air pressure is more than 5mbar from sensor's zero value
• Check air pressure sensor value during VPS		
75	Air Sensor Signal High	Air pressure reading is above 400mbar
• Contact Autoflame approved local tech centre		
76	Air Sensor Error Window	Air pressure outside of these limits for 3 seconds
• Check air pressure • Check option/parameter 147		
77	Wait Air Switch Timeout	Voltage has not been reset for 2minutes
• Check air pressure sensor value during VPS • Check voltage has been reset on terminal 54 within 2minutes before run to purge • Check wiring and voltage on terminal 54		
78	Gas Proving Fail High	Gas pressure too high during VPS
• Isolate gas • Check 1st main valve and vent valve • Check option/ parameters 133 and 134 • Call a certified Commissioning Engineer to investigate		
79	FSR Test 1C	Hardware fault
• Contact Autoflame approved local tech centre		
80	Timeout on Reaching Purge	Time set in option/parameter 124 has elapsed
• Check option/parameter 124		
82	Purge Pressure Proving Input	Input on T81 read high during relay test phases
• Input has been made before the blower starts; it should only be made continuously during purge. • Check wiring on terminal 81.		
198	BC Input Short	Internal fault
• Contact Autoflame approved local tech centre		
199	Lockout 199	Internal fault
• Contact Autoflame approved local tech centre		
200	Lockout Cleared	Lockout has been cleared
• MM status after lockout has been reset (Modbus)		
201	Powerup CPU Test Fail	Internal check failed
• Contact Autoflame approved local tech centre		
202	Powerup EEPROM Test Fail	Internal check failed
• Contact Autoflame approved local tech centre		

6.3 EGA Errors

The table below shows the EGA errors on the Mini Mk8 MM. Option 13 sets the way the MM responds to an EGA error.

EGA Error	Description
1	EGA Internal Error
• Check EGA for fault.	
2	No Communications
• Check parameter 10 is set to correct EGA version. • Check EGA operating mode is selected as 'EGA with MM.' • Check wiring between EGA and MM (terminals 25 and 26 on MM).	
3	O_2 Upper Limit
• Current O_2 value is above upper offset limit of commissioned value.* • Check exhaust gas readings and option 19.	
4	O_2 Absolute Limit
• Current O_2 value is below absolute limit.* • Check exhaust gas readings and option 25.	
5	O_2 Lower Limit
• Current O_2 value is below lower offset limit of commissioned value.* • Check exhaust gas readings and option 22.	
6	CO_2 Upper Limit
• Current CO_2 value is above upper offset limit of commissioned value.* • Check exhaust gas readings and option 20.	
7	CO_2 Absolute Limit
• Current CO_2 value is above absolute limit.* • Check exhaust gas readings and option 26.	
8	CO_2 Lower Limit
• Current CO_2 value is below lower offset limit of commissioned value.* • Check exhaust gas readings and option 23.	
9	CO Upper Limit
• Current CO value is above upper offset limit of commissioned value.* • Check exhaust gas readings and option 21.	
10	CO Absolute Limit
• Current CO value is above absolute limit.* • Check exhaust gas readings and option 27.	
11	NO Upper Limit
• Current NO value is above upper offset limit of commissioned value.* • Check exhaust gas readings and parameter 94.	
12	Exhaust Temperature Upper Limit
• Current exhaust temperature is above upper offset limit of commissioned value.* • Check exhaust gas readings and parameter 96.	
13	Exhaust Temperature Absolute Limit
• Current exhaust temperature is above absolute limit.* • Check exhaust gas readings and parameter 97.	

*When option 12 is set to 3 for trim and combustion limits, the combustion limits are evaluated once per trim cycle. A combustion limit error will occur if the current exhaust value has crossed the combustion limit for the number of trim cycles set in parameter 17 (the default value is 3 cycles).

6.4 Troubleshooting and Further Information

6.4.1 UV Shutter Faults

UV shutter fault– there are two LED's on the back of the self-check UV. The red LED indicates the presence of a flame; the yellow LED indicates shutter operation. The red LED will flicker in the presence of UV light. Every 60 seconds the yellow LED will come on, indicating that the shutter is closing. The red LED should then extinguish briefly. If this is not happening check the wiring to self-check UV sensor:

Green wire = Terminal 22
Yellow wire = Terminal 21
Blue wire = Terminal 50
Red wire = Terminal 51

6.4.2 UV Problems

If the red LED's fail to illuminate but the burner operates, it is likely that the 2 wires are crossed. This must be corrected. Once corrected a full flame signal strength will be displayed/registered.

The Autoflame UV software utilises early spark termination within the internal flame safeguard control. Therefore, detection of the ignition spark is allowed. During start-up the ignition is de-energised and the pilot flame must be proven without the spark before the main fuel valves are open (safety shut off). Due to the above statement it is not necessary to have a sight tube on the UV for pick-up. This, in fact, will drastically reduce the flame pick-up.

If insufficient UV is detected, it is advised to use a swivel mount assembly (UVM60003/UVM60004) in order to obtain maximum pick-up. This will allow the commissioning engineer to reliably sight the UV for optimum performance and trouble free operation.

Note: Under no circumstances is a non-Autoflame UV scanner permitted to be used. This is in breach of all codes and approvals associated with the Autoflame combustion management system. This may lead to serious equipment damage, critical injury or death.

If a non-Autoflame scanner is required then please contact Autoflame directly for technical support. For more information on UV scanners, please refer to MM Flame Safeguard and Operation.

6.4.3 Snubbers

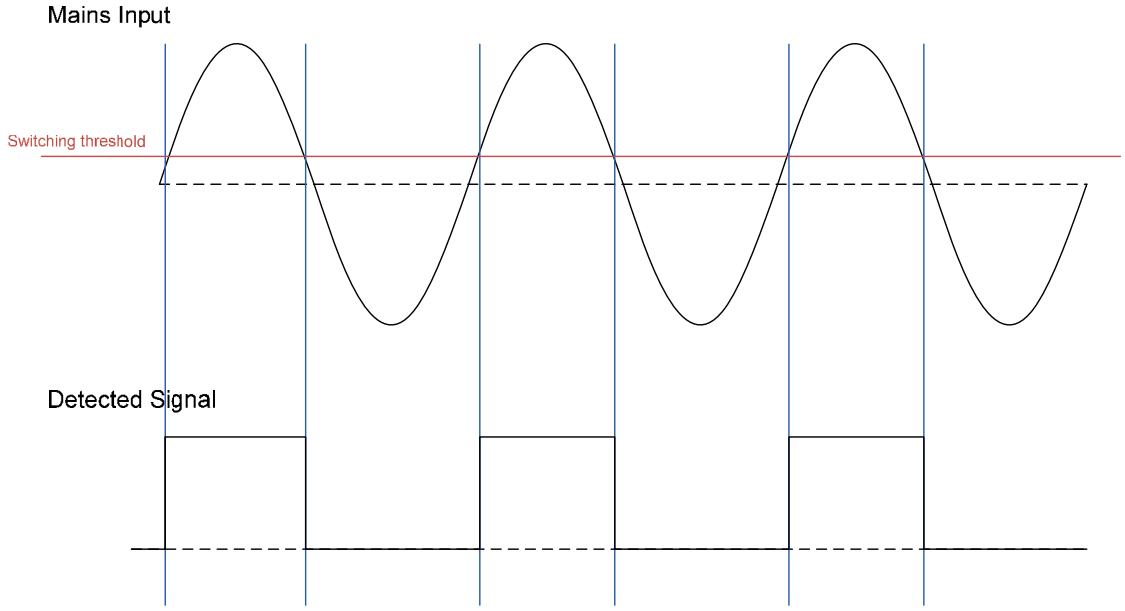
The Autoflame system has internal components which protects itself against voltage/current spikes and electrical interference. In some installations this internal protection is not enough, especially when the main fuel valve Terminals 60 and 61 have been connected to older gas valves and voltage/current spikes have occurred when the valves have been switched on or off. This can cause internal damage to the MM Snubbers can be used on these old gas valves to protect the MM from these spikes; they should be fitted across the power terminals of the gas valves. Please contact Autoflame Sales for more information.

6.4.4 Channel Positioning Error

The 'Channel Positioning' MM Error is caused by incorrect wiring and incorrect servomotor position. In addition to checking the wiring, and zeroing the potentiometer, please also check that the correct voltage is supplied to the servomotors, which should be ±10% of the required voltage, and the unit is earthed properly. This can cause hunting issues if not at the required voltage or incorrect earthing.

6.4.5 Input Fault

The 'Input Fault' MM Error relates to a fault with the power supply going to the MM The MM verifies the power supply going to the unit; the mains inputs are sampled to check the DC voltage. The diagram below illustrates the AC voltage that comes in through the power supply with the detected signal (digital input).



The MM checks the ON state of the digital signal in the mains input; the ON state of the digital input should be 50%. This means that the digital input should be in the ON state for a half-wave of the AC signal. The OFF state is safe. If the MM sees the digital input being ON for more than 75% across a sample period, then it will get stuck in an unsafe state. This will cause an Input Fault lockout to occur.

If this lockout persists, the mains input should be checked. To troubleshoot this issue, please check for any DC voltage in the mains voltage and contact your local power supplier.

6.4.7 Setting Conflicts

Some of the option/parameter values may require another option/parameter to be set, as described in the table below. The MM will be forced into Commission mode.

Setting Conflict Message
(1) (45) External modulation cannot be used with external load sensor.
• External modulation and external load sensor are connected to the same terminals, so they cannot be used together. • Check options 1 and 45.
(1) (P53, P54, P55, P56) External load sensor incorrectly configured
• The external load sensor must be set with the minimum and maximum values and voltages. • Check option 1 and parameters 53 – 56.
(1) (81, 83) OTC setpoints too high for optioned load sensor
• If minimum and maximum setpoints OTC setpoints must be set within the possible range of the optioned load detector. • Check option 1, 81 and 83.
(4) (8) Servo channel 2 configured as air but not enabled
• If the air servomotor is enabled, then channel 2 must also be enabled. • Check options 4 and 8.
(4) (12) Trim requires the use of a servo as the air channel
• If the air channel is controlled by a VSD and no air servomotor, then trim function cannot be used. • Check options 4 and 12.
(4) (90) VSD Channel 4 configured as air but not enabled.
• If the air is controlled by the VSD on channel 4, then this VSD must be enabled. • Check options 4 and 90.
(30) (31) Invalid remote sepoint configuration
• The Minimum Remote Setpoint (DTI/Modbus/External) cannot be set higher than the Maximum Remote Setpoint (DTI/Modbus/External) and vice versa. • Check options 30 and 31.
(45) (16) External modulation cannot be used with sequencing
• External modulation cannot be used on any MMs in sequencing. • Check options 16 and 45
(81, 82, 83, 84) OTC Configuration invalid
• Setpoints at minimum and maximum outside temperatures cannot be set the same. • Minimum and maximum outside temperatures cannot be set the same. • Check options 81, 82, 83 and 84
(111) (122) Flame scanner changeover cannot be optioned with no pilot
• If no pilot is set, then flame scanner changeover cannot be used. • Check option/parameters 111 and 122.
(111) (130) Single valve pilot cannot be optioned with no pilot
• If no pilot is set, then gas valve configuration cannot be set for single valve pilot. • Check option/parameters 111 and 130.
(116) Fuel 1 2nd Safety time too high for Gas
• If fuel 1 is gas, the maximum allowed 2nd safety time is 10 seconds. • Check option/parameters 116 and 150.
(118) (135) NFPA Post Purge must be at least 15 seconds
• If NFPA Post Purge is enabled, then this time must be set to a minimum of 15 seconds. • Check option/parameters 118 and 135

Setting Conflict Message
(118) (141) (149) Purge air pres. threshold cannot be higher when post purge is optioned
• If post purge is enabled, then the purge air pressure threshold cannot be set higher than the running air pressure threshold. • Check option/parameters 118, 141 and 149.
(123) Fuel 2 2nd Safety time too high for Gas
• If fuel 2 is gas, the maximum allowed 2nd safety time is 10 seconds. • Check option/parameters 123 and 151.
(125, 126) (128) Pressure limits does not operate using digital input.
• Gas pressure upper/lower limits can only be used with a gas pressure sensor. • Check option/parameters 125, 126 and 128.
(125, 126) (129) (135) Post VPS cannot be optioned with NFPA Post Purge
• If NFPA post purge is enabled for gas, VPS can only be set for operating before burner start-up. • Check option/parameters 125, 126, 129 and 135.
(125) (150) Gas pressure sensor cannot be optioned when fuel type is oil (fuel 1)
• Valve proving and gas pressure limits can only be used for gas • Check option/parameters 125 and 150
(126) (151) Valve proving cannot be optioned when fuel type is oil (fuel 2)
• Valve proving and gas pressure limits can only be used for gas • Check option/parameters 126 and 151
(128) (156) T82 is no set as VPS input
• If valve proving is optioned and configured as a digital VPS input from, T82 must be configured as the input for a VPS input gas pressure switch. • Check option/parameters 128 and 156.
(P85) (16) Modulation exerciser cannot be used with sequencing
• Modulation exerciser should be used for test purposes and cannot be used with sequencing. • Check option 16 and parameter 85.
(P89) (16) Stat exerciser cannot be used with sequencing
• Stat exerciser should be used for test purposes and cannot be used with sequencing. • Check option 16 and parameter 89.
(P99) (P100) Graceful shutdown and assured low fire shut off not allowed
• If graceful shutdown is set, then assured low fire shut off cannot be used. • Check parameters 99 and 100.

6.4.8 Forced Commission

The MM will be forced into Commission mode if there is an setting conflict as in 6.4.6, and/or the following conditions occurs:

Forced Commission Message
Fuel not commissioned.
• Selected fuel must be commissioned.
Servo configuration does not match commissioning.
• The number of servomotors selected does not match the last commission settings. • Check option 8.
VSD configuration does not match commissioning.
• The settings for VSD channel 4 does not match the last commission settings. • Check options 90, 91 and 95.
Golden start optioned but not commissioned.
• Golden start has been optioned but not set in the last commission settings, see section 3.4.8. • Check option 29.
FGR optioned but not commissioned.
• FGR start has been optioned but not set in the last commission settings, see section 3.4.9. • Check options 48, 49 and 50.
EGA fuel/air-rich trim ranges changed.
• EGA trim range does not match last commission settings. • Check parameters 13 and 19.
BC Option/parameter mismatch.
• There is a mismatch in the BC option/parameters 110 – 160. • Check options 110 – 160 match to their corresponding parameter.
Invalid option value.
• An option value is outside the allowed range for the current software. • Check all options.
Invalid parameter value.
• A parameter value is outside the allowed range for the current software. • Check all parameters.
Options have been reset.
• Option settings have been reset due to data lost in an EEPROM error.
Parameters have been reset.
• Parameter settings have been reset due to data lost in an EEPROM error.
VPS sensor not commissioned.
• Gas pressure sensor has been enabled but not commissioned. Perform a gas pressure commission or a full re-commission.
Commissioned gas pressure during valve proving too low.
• Gas pressure stored during valve proving is less than option/parameter 133.
Commissioned running gas pressure too low.
• Gas pressure at one or more commissioned points is less than option/parameter 136.
APS sensor not commissioned.
• Air pressure has been enabled but not commissioned. Perform an air pressure commission or a full re-commission.
Commissioned air pressure too low.
• Air pressure at one or more commissioned points is less than option/parameters 147 and/or 149.

Forced Commission Message
VSD feedback variation too small
• VSD feedback variation is within optioned tolerance band meaning that a constant value can pass for any point on the curve. • Check option 99.
Air channel configuration does not match commissioning
• Air channel selected does not match the last commission settings. • Check option 4.
IR Upload was completed successfully, check configuration then restart.
• Check data has uploaded successfully before restarting in run mode.

7 STANDARDS

The Mini Mk8 MM has been tested and approved to the following standards:

UL 372, 5th Edition

C22.2 No. 199-M89

BS EN 298:2012

BS EN 12067-2:2004

BS EN 1643:2014

ISO 23552-1:2007

AGA AS 4625-2008

AGA AS 4630-2005

Notes

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