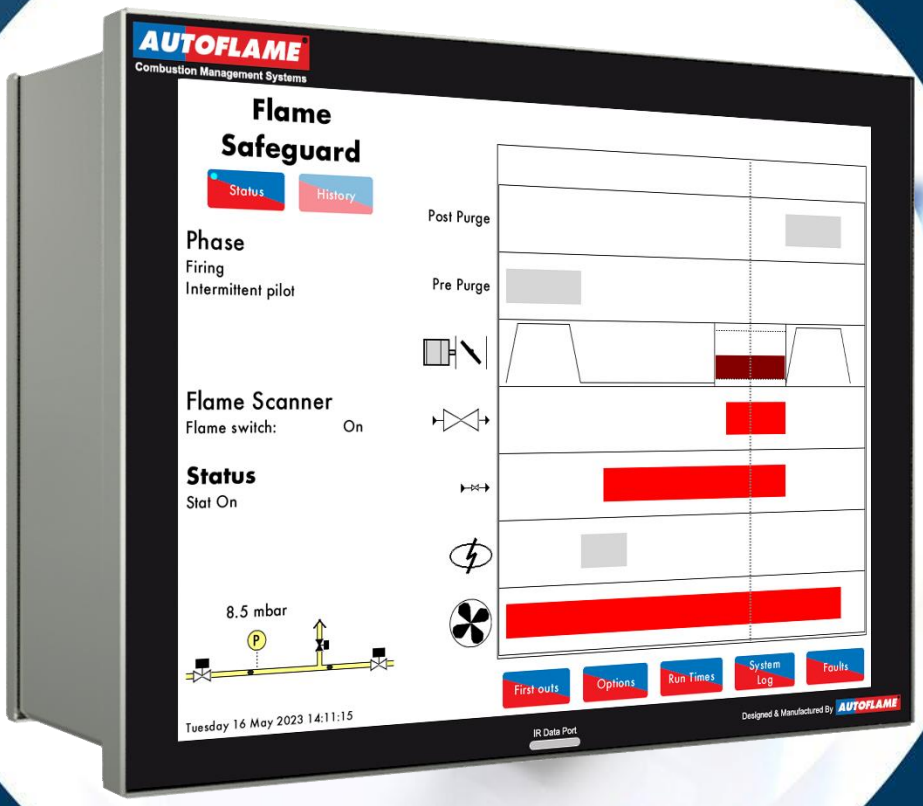
AUTOFLAME®
Combustion Management Systems



AUTOFLAME MK8 FLAME SAFEGUARD CONTROLLER MANUAL MM80001/FSG

08 FEB 2024

Autoflame Engineering Ltd.
Unit 1-2 Concorde Business Centre
Airport Industrial Estate
Wireless Road, Biggin Hill
Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Web: www.autoflame.com

AUTOFLAME MK8
FLAME SAFEGUARD
MANUAL
MM80001/FSG

08 FEB 2024

This manual and all the information contained herein is copyright of Autoflame Engineering Ltd. It may not be copied in the whole or part without the consent of the Managing Director.

Autoflame Engineering Ltd's policy is one of continuous improvement in both design and manufacture. We therefore reserve the right to amend specifications and/or data without prior notice. All details contained in this manual are correct at the time of going to print.

Important Notes

A knowledge of combustion related procedures and commissioning is essential before embarking work on any of the MM / EGA systems. This is for safety reasons and effective use of the MM / EGA 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 herein.

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

- 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 AUTOFLAME FLAME SAFEGUARD OVERVIEW, SPECIFICATIONS AND WIRING 13
1.1 Autoflame Flame Safeguard Overview 13
1.1.1 Autoflame Flame Safeguard Main Features 14
1.1.2 Fixing Holes and Dimensions 15
1.2 Installation 16
1.2.1. Humidity 16
1.2.2. Vibration 16
1.2.3. Weather 16
1.2.4. Environmental Classification 17
1.3 Wiring 18
1.3.1 Servo Motor Control Schematic Main Board 19
1.3.2 On/Off Burner Control Schematic 20
1.3.3 Expansion Board 21
1.3.4 Fuse Ratings 22
1.4 Electrical Specifications 23
1.4.1 Classifications 23
1.4.2 Inputs and Outputs 23
1.4.3 Internal Hardware Status Monitoring 23
1.4.4 Input Checks 23
1.4.5 Expansion Board Inputs and Outputs 24
1.4.6 Cable Specifications 25
1.4.7 Terminals Description 26
1.4.8 Expansion Board Terminals Description 28
1.5 Relay Box 29
1.5.1 Relay Box Terminal Description 29
1.6 Converting a Flame Safeguard unit to an Autoflame Flame Safeguard 31
1.6.1 Converting Honeywell Flame Safeguard Units 31
1.6.2 Converting Fireye Flame Safeguard Units 33
1.7 Standards 34
2 OPTIONS AND PARAMETERS 35
2.1 Options 35
2.2 Parameters 59
2.3 Language 69
2.4 Set Clock 70
3 CONFIGURING THE AUTOFLAME FLAME SAFEGUARD UNIT 71
3.1 Overview 71
3.1.1 Single Servo Burner Set up 72
3.1.2 On/Off Burner Set up 72
3.1.3 Wiring Checks 72
3.2 Installation Checks 73
3.2.1 Configuration Checks 73
3.2.2 Operational Checks 73
3.2.3 Installation Precautions 73
3.2.4 Maintenance and Servicing 73
4 GENERAL FEATURES 74
4.1 No Pre-Purge 74
4.2 Autoflame Flame Safeguard Flame Detection Using Flame Switch 75
4.3 Terminals 80 and 81 Functions 76

4.3.1 T80 Functions 76
4.3.2 T81 Functions 76
4.4 Valve Proving with Autoflame Gas Sensor 77
5 EXPANSION FEATURES 78
6 DIRECT MODBUS 79
6.1 Overview 79
6.2 Direct Modbus Expansion Options 80
6.3 Setup and Configuration 81
6.4 Modbus Addresses 82
6.4.1 Modbus Address for MM Status (30102) 91
7 FIRST OUTS 92
7.1 Overview of First Outs 92
7.2 First Outs Expansion Options 92
7.3 First Outs Configuration 93
7.3.1 Enabling First Outs 93
7.3.2 Accessing First Outs 93
7.3.3 First Out Function 94
7.3.4 Edit First Out Label 95
7.3.5 First Outs Interlock 96
8 OPERATION 98
8.1 Home Screen 98
8.1.1 Flame Safeguard - History 99
8.1.2 Options 100
8.1.3 Parameters 101
8.1.4 Expansion 102
8.1.5 Run Times 103
8.1.6 System Log 106
8.1.7 First Outs 107
8.1.8 Faults 108
9 BURNER START-UP SEQUENCE 109
9.1 Recycle 110
9.2 Standby 111
9.3 Internal Relay Tests 112
9.4 CPI Input 113
9.5 Valve Proving 114
9.6 Wait for Air Switch 118
9.7 Purge 119
9.8 Ignition 122
9.9 Pilot 124
9.10 Proving 127
9.11 Firing 128
9.12 Post Purge 129
10 UNLOCKING THE AUTOFLAME FLAME SAFEGUARD UNIT TO A MK8 MM 130
10.1 Fully Unlocking the Autoflame Flame Safeguard Controller 130
11 ERRORS AND LOCKOUTS 133
11.1 Errors 133
11.2 Lockouts 137
11.3 Alarms and Warnings 142
11.4 Settings Conflicts 150

VERY IMPORTANT SAFETY NOTES



Please fully read and understand the following notes before commencing with any work related to the Mk8 MM Flame Safeguard Controller. Failing to do so can result in serious injury or even death, and can cause serious equipment and substantial property damage.

Any person working on a boiler must be adequately trained and have a thorough understanding and appreciation of the boiler plant.

It is the responsibility of the technician working on the plant to ensure that the system operation meets all local codes and regulations.

Options, Parameters and Expansion Options must only be changed by an Autoflame-trained and certified technician who has thorough understanding of the Autoflame combustion control systems and boiler/combustion control in general. Any person changing these settings without undergoing the necessary training and gaining an understanding of the boiler plant may place themselves and others in a potentially dangerous situation or cause permanent equipment damage.

Modification to the Autoflame system settings should only ever be carried out by qualified combustion engineers. Changes to the Autoflame control system setuphas the potential to make the controller operate in an unstable and potentially unsafe manner.

Commissioning or burner start-up must only be carried out by a an Autoflame- trained and certified technician.

The commissioning procedure as described must be strictly adhered to. Anybody commissioning an Autoflame system must be trained in operating combustion equipment safely.

Autoflame products must only be installed, set up, commissioned and adjusted by an Autoflame certified technician.

The fundamental idea of the system is to set a fuel valve position and then set a corresponding air damper position. Care must be taken when adjusting the fuel and air positions so as not to create any unstable or hazardous combustion conditions, e.g. moving the fuel valve to the open position without increasing the air damper position. Improper use may result in property damage, serious physical injury or death.

Electrical connections are live, make sure to fully and safely isolate the mains power before carrying out any work related to the wiring connections, failure to do so may result in serious physical injury or death.

If you are unclear about anything related to the Autoflame system, please contact Autoflame for technical advice.

1 AUTOFLAME FLAME SAFEGUARD OVERVIEW, SPECIFICATIONS AND WIRING

1.1 Autoflame Flame Safeguard Overview

The Autoflame Flame Safeguard unit or MM80001/FSG is a version of the Micro-Modulating system that provides an easily programmable and flexible means of providing the flame safeguard aspects of controlling a boiler/burner.

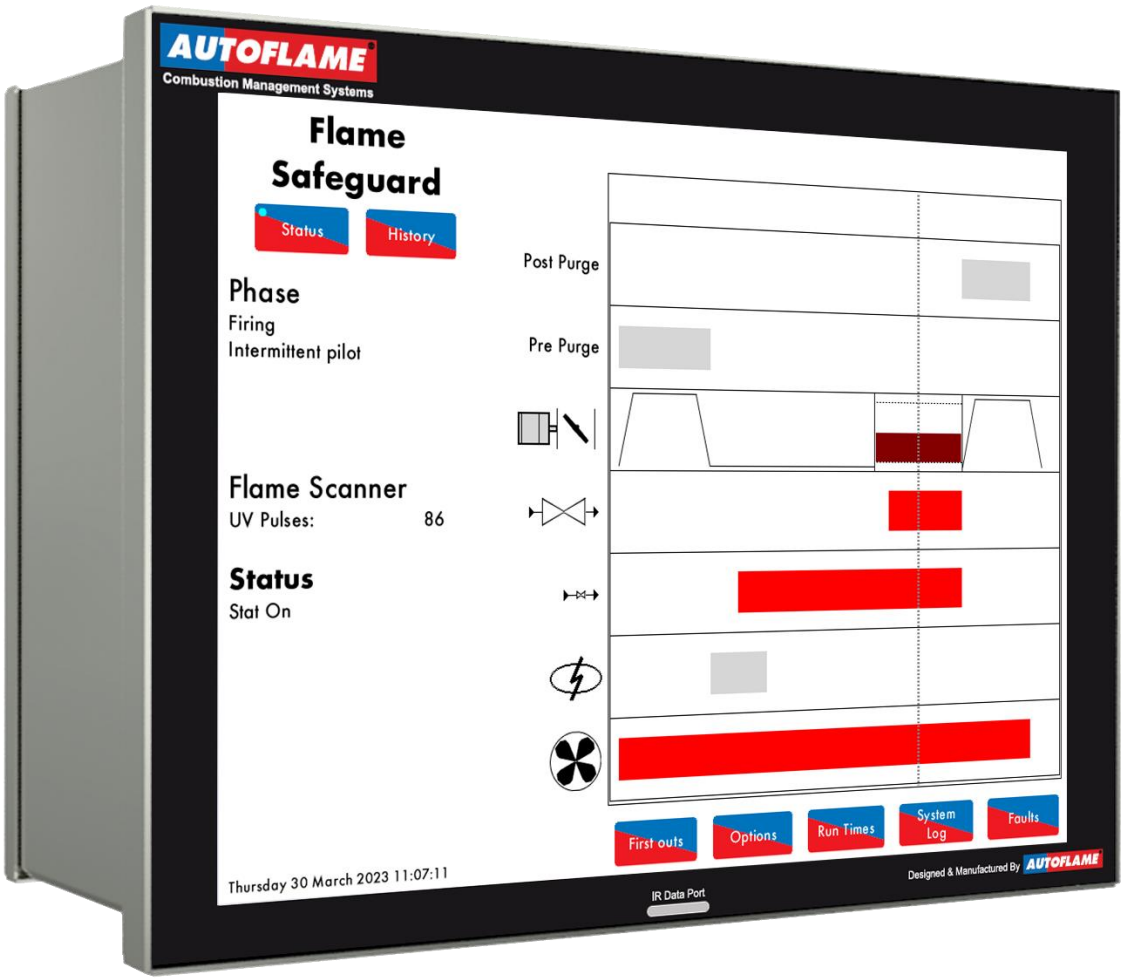
This control module encompasses all the functions required for reliable flame safeguard management. Built into this system is a fully automated flame safeguard, valve proving system and a 12.1" multi-touch screen interface. MODBUS (MK8006) connectivity & First Outs (MK8007) requires unlock codes to use these features.

With the Mk8 MM, it is possible to control all boiler processes from a single 12.1" multi-touch screen interface without any added module.

This system monitors the flame safeguard, as it checks on the flame of the burner from the use of a UV, Flame Switch, or IR Scanner.

Additional expansion features include:

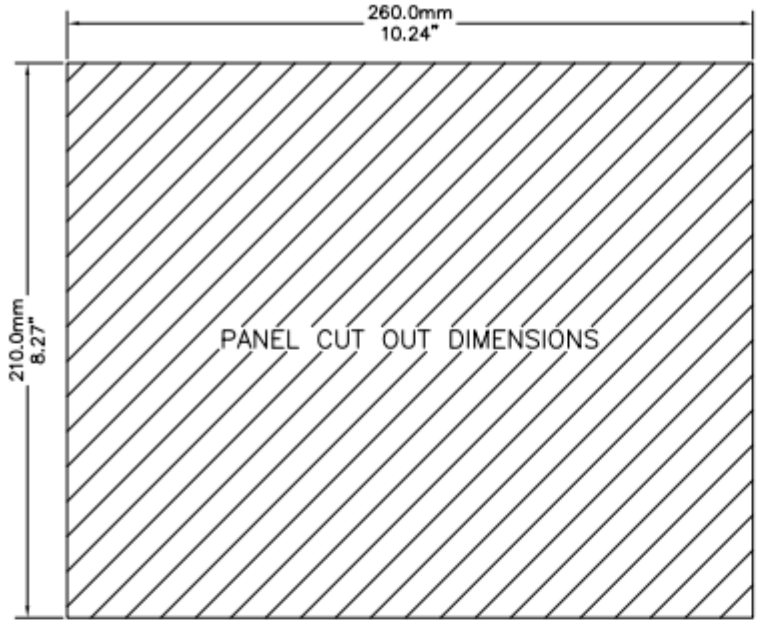
- Direct Modbus connectivity
- First out annunciation

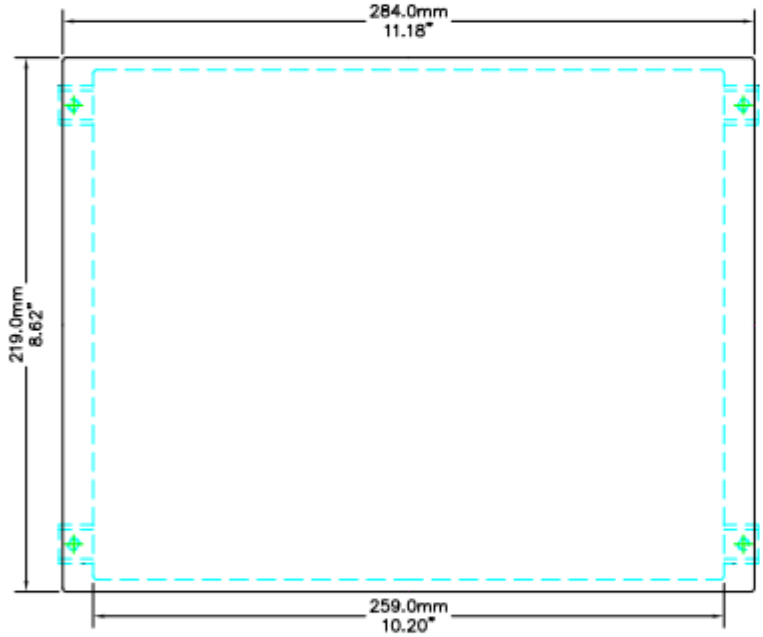


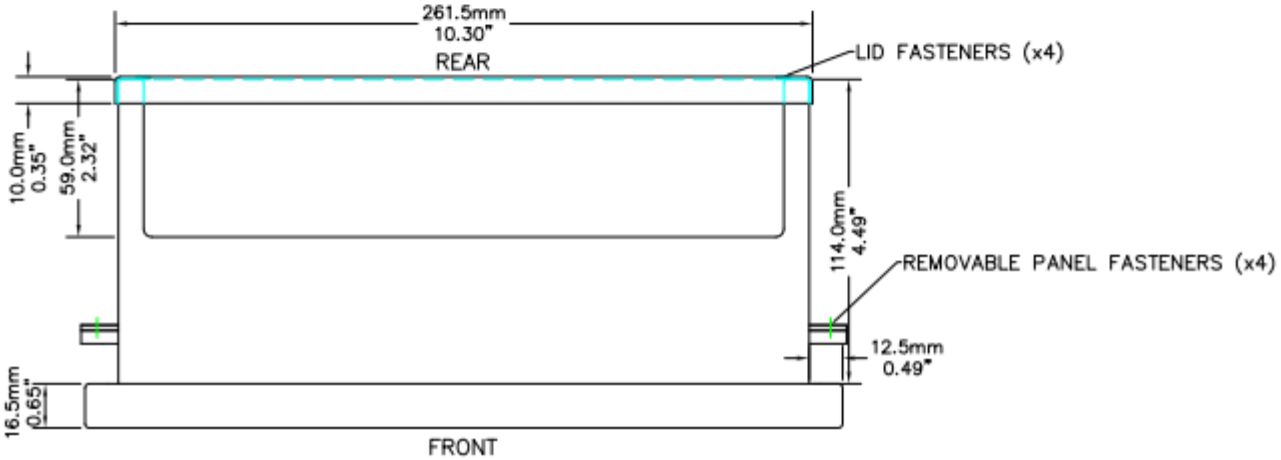
1.1.1 Autoflame Flame Safeguard Main Features

- 12.1” Full colour touch screen
- 120V or 230V standard operation 50/60Hz
- 4 independent fuel programmes
- Internal flame safeguard – full flame supervision with self-check UV, IR & Flame switch.
- Dual flame scanner operation (IR and UV scanners)
- Gas valve train leak supervision via Autoflame gas pressure sensor as a low gas pressure limit
- Air pressure proving and monitoring via Air switch
- 128 lockouts, errors, alarms and warnings stored with date, time, phase and reset
- 1000 entry system log stored with date, time and status
- Burner control safety times user selectable
- Password protection of all safety related functions
- Infra-red port for upload/download of commission data
- First out annunciation inputs
- Download / upload all commissioning data and controller settings from MM module to a PC via Bluetooth or IR
- Direct Modbus communications to BMS or remote monitoring and control
- Flame Safeguard mode, which allows the MM to operate as a standard Flame Safeguard.

1.1.2 Fixing Holes and Dimensions







1.2 Installation

When Installing this Flame Safeguard Controller

Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.

Check the ratings given in the instructions and marked on the product to ensure the product is suitable for your application.

The installer must be an Autoflame trained, experienced, flame safeguard service technician.
After installation is complete, check out the product operation as detailed in these instructions.

Never update the software on the Flame Safeguard Controller without consulting Autoflame first. Using wrong software can damage equipment.



Warning

Fire or Explosion Hazard. Can cause severe injury, death or property damage.
To prevent possible hazardous burner operation, perform verification of safety requirements each time a Flame Safeguard controller is installed on a burner.

IMPORTANT

For on-off gas-fired systems, some authorities, who have jurisdiction, prohibit the wiring of any limit or operating contacts in series between the flame safeguard control and the main fuel valve(s).

Two flame detectors can be connected if necessary (see the latest Autoflame Flame Scanners Guide)

This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class B computing device of part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the users, at their own expense, may be required to take whatever measures are required to correct this interference.
This digital apparatus does not exceed the Class B limits for radio noise of digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

1.2.1. Humidity

The Autoflame Flame Safeguard controller is designed to operate in a maximum 90 percent relative humidity, continuous, noncondensing moisture environment.

Condensing moisture can cause a shutdown.

1.2.2. Vibration

Do not install the Flame Safeguard controller where it could be subjected to vibration in excess of 0.5G continuous maximum vibration.

1.2.3. Weather

The Flame Safeguard controller is not designed to be watertight. If installed outdoors it must be protected by an approved watertight enclosure. See protection rating in section 1.2.4.

1.2.4. Environmental Classification

The Flame Safeguard Controller meets the following climate specification:

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.	

1.3 Wiring

1. **For the internal block diagram of the Autoflame Flame Safeguard controller, see section 1.3.1, 1.3.2 & 1.3.3.**
2. **Disconnect the power supply before beginning installation to prevent electrical shock and equipment damage. More than one power disconnect may be involved.**
3. **All wiring must comply with all applicable electrical codes, ordinances and regulations. Wiring, where required, must comply with NEC Class 1 wiring.**
4. **Recommended wire size and type is defined in section 1.4.6 Cable Specifications. For high temperature installations, use wire selected for a temperature rating above the maximum operating temperature. All wiring must be moisture resistant.**
5. **Do not connect more than two wires per terminal. If more than two wires need to be connected to a terminal, wire into a suitable terminal block in the panel first and from there to the unit terminal with a single wire.**
6. **Recommended wire routing for Autoflame Flame Scanners:**
    a. **Do not run high voltage ignition transformer wires in the same conduit with the flame scanner wiring.**
    b. **Do not route flame scanner wires in a conduit with line voltage circuits.**
    c. **Enclose flame scanner wires in metal conduit.**
    d. **Follow directions given in the Autoflame Flame Scanners Guide.**
7. **Do not exceed the terminal ratings. Refer to the wiring diagram in section 1.3.1, 1.3.2 & 1.3.3 or to the ratings in the section 1.4 Electrical Specifications.**
8. **The voltage tolerance of the power supply must match those of the Flame Safeguard controller. A separate power supply circuit may be required for the Flame Safeguard controller with the required disconnect and overload protection added.**
9. **Check all wiring circuits and complete all the checks before installing the plug-in connectors to the flame safeguard controller; see section 1.3.1, 1.3.2 & 1.3.3.**
10. **Install all electrical connectors.**
11. **Restore power to the panel.**



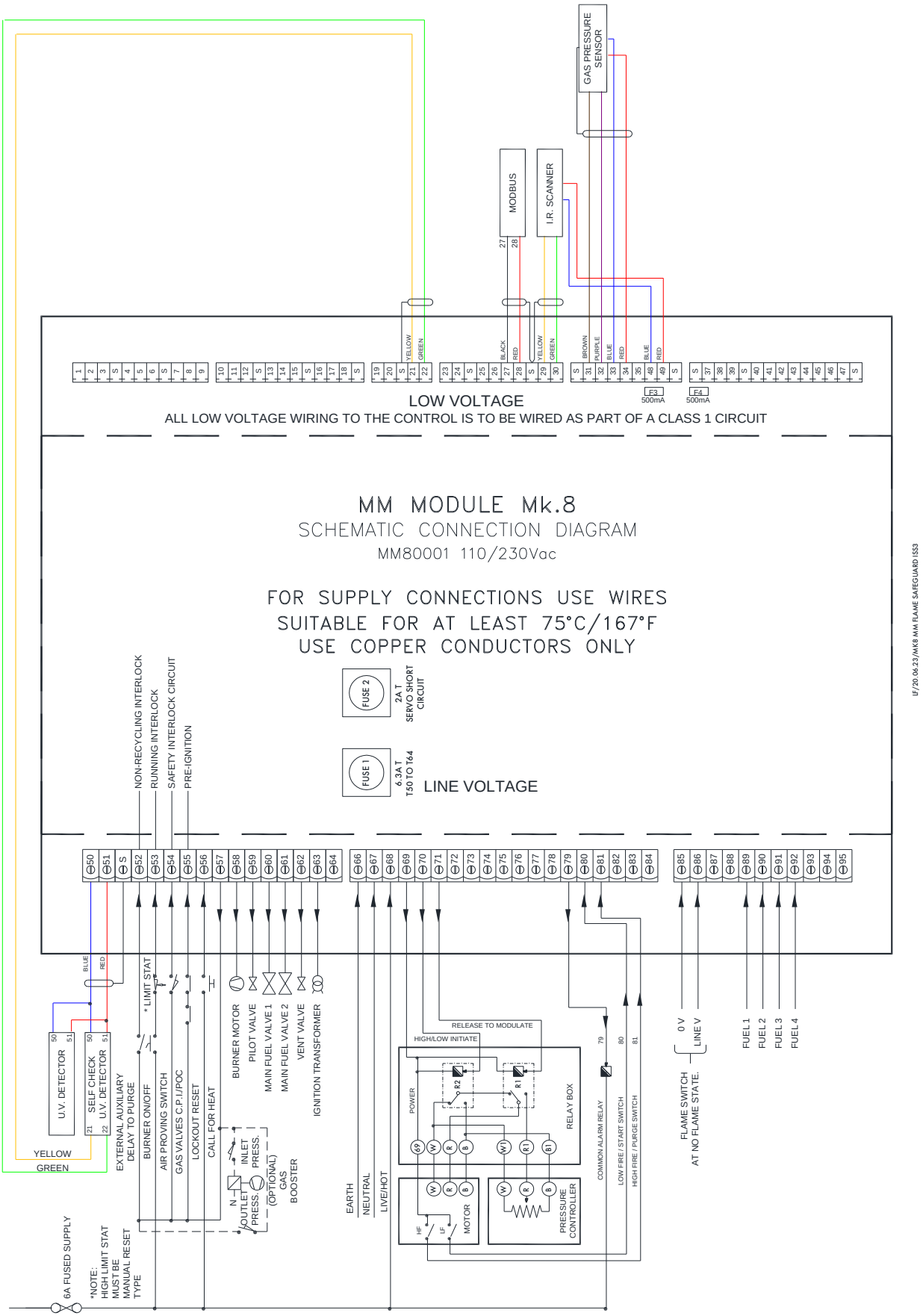
Electrical Shock Hazard

Can cause severe injury, death or property damage.

1. **To prevent electrical shock and equipment damage, disconnect the power supply before beginning installation. More than one power supply disconnect may be involved.**
2. **Wiring connections for the Autoflame Flame Safeguard controller are unique; therefore, refer to sections 1.3 and 1.4 for the correct specifications and connections.**
3. **Wiring must comply with all applicable codes, ordinances and regulations.**
4. **Wiring, where required, must comply with NEC Class 1 wiring.**
5. **Loads connected to the Flame Safeguard controller must not exceed those listed on the wiring label or the specifications (see section 1.4.2 & 1.4.5 of this manual).**
6. **Limits and interlocks must be rated to carry and break current simultaneously to the ignition transformer, pilot valve, and main fuel valve(s).**
7. **All external timers must be listed or component recognized by authorities who have jurisdiction for the specific purpose for which they are used.**

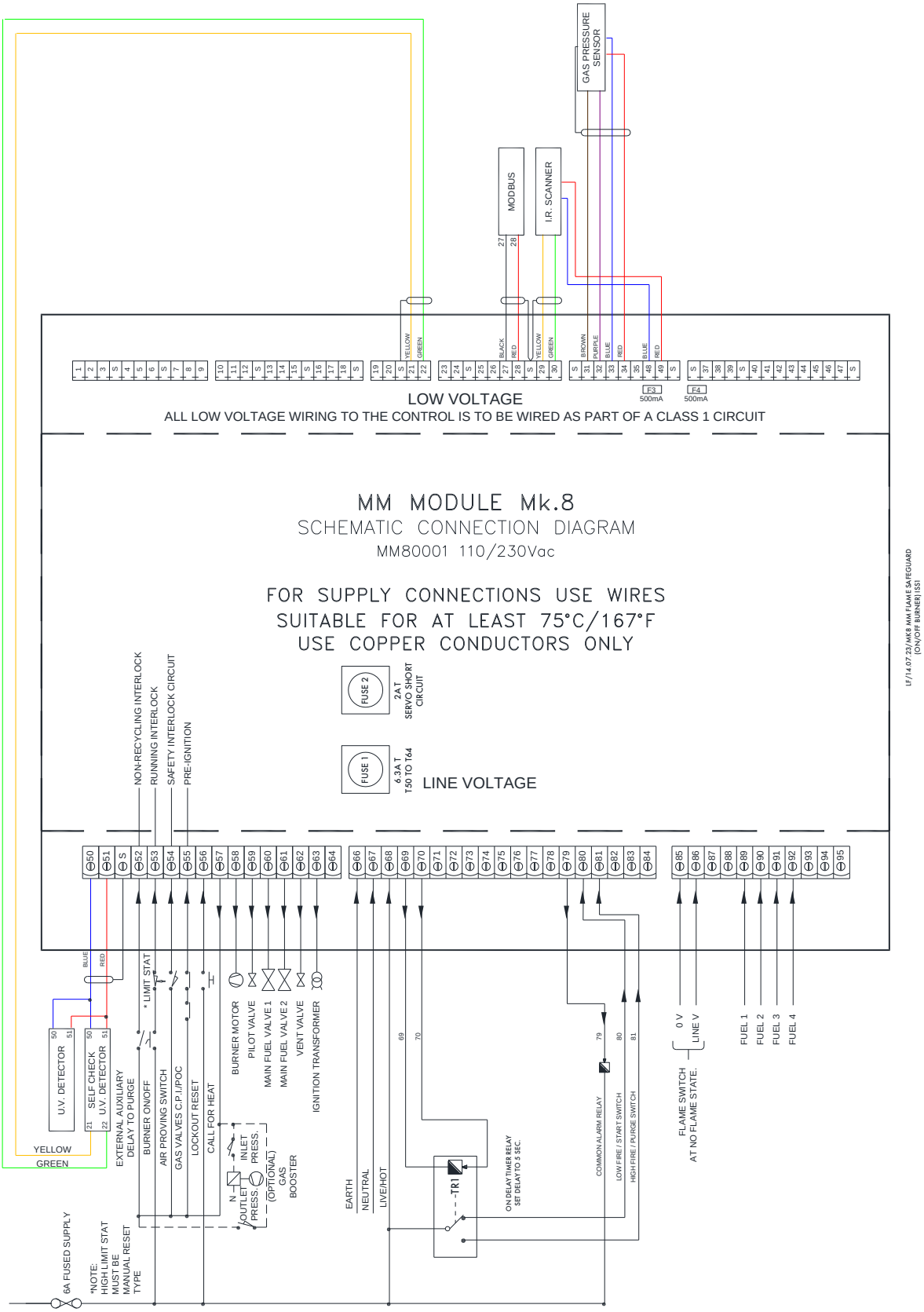
1.3.1 Servo Motor Control Schematic Main Board

IF IN DOUBT ASK AUTOFLAME TECHNICAL DEPARTMENT

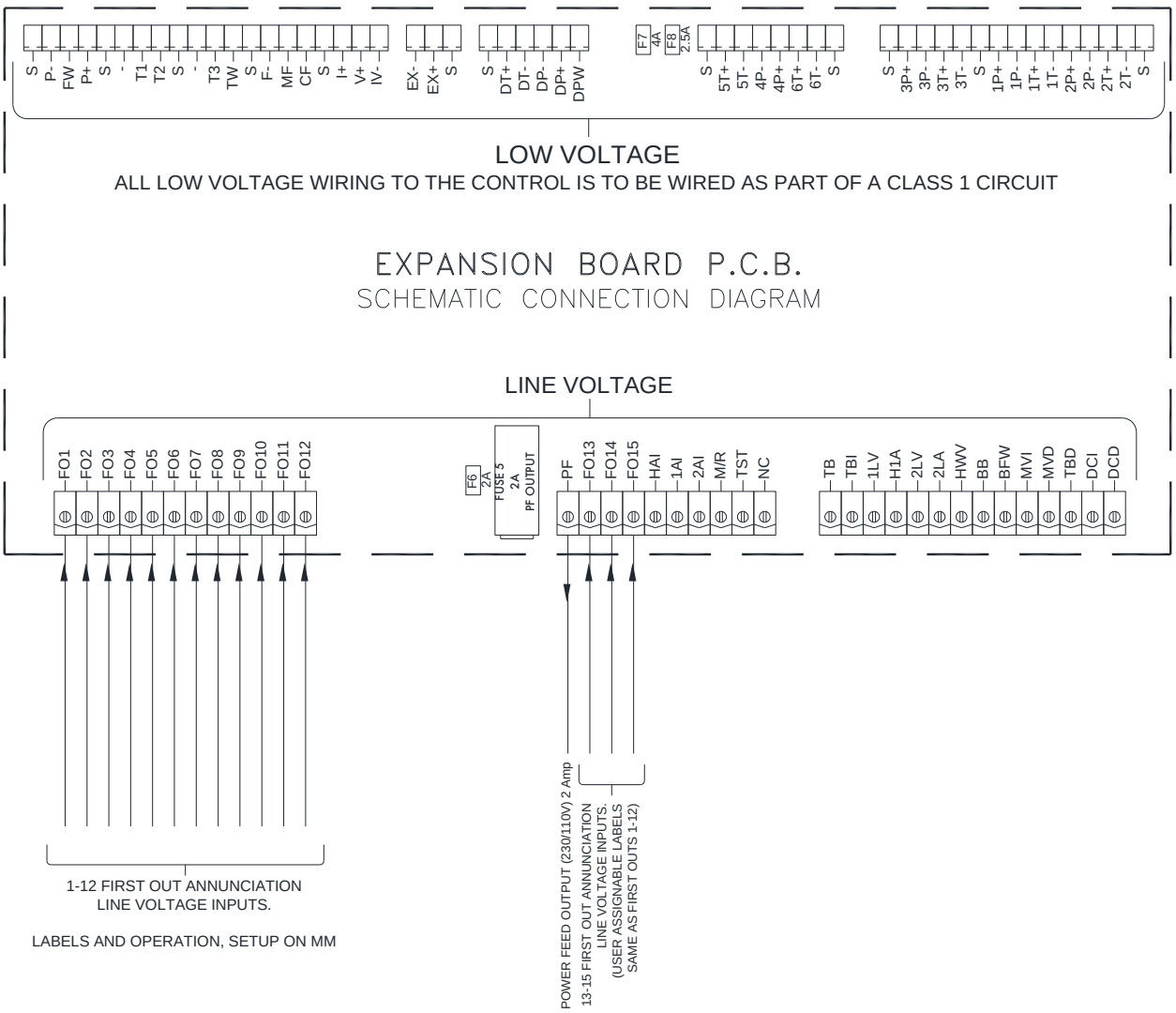


1.3.2 On/Off Burner Control Schematic

IF IN DOUBT ASK AUTOFLAME TECHNICAL DEPARTMENT



1.3.3 Expansion Board



LF/20.06.23/MK8 MM FLAME SAFEGUARD ISS3

IF IN DOUBT ASK AUTOFLAME TECHNICAL DEPARTMENT

1.3.4 Fuse Ratings

Fuse	Rating	Spare Part Number
1	6.3A (T)	FU10026
Fuse 1 protects the mains input to the MM, including the mains output terminals 50 – 64.		
2	2A (T)	FU10034
Fuse 2 protects the power supply (terminal 69) for the servomotors, alarm and 2 port valve. If this fuse blows, error 'Triac Power Supply Error (Check F2)' will occur.		
3	500mA	FU10040
Fuse 3 protects the 13.5V power supply to the oil pressure sensor and IR scanner on terminal 49. If this fuse blows, error 'Fused 13.5V Supply Error (Check F3)' will occur.		
4	500mA	FU10040
Fuse 4 protects the 12V power supply to the gas/air pressure sensor and steam pressure detector on terminals 34 and 39. If this fuse blows, error 'Fused 12V Supply Error (Check F4)' will occur.		
5	2A (T)	FU10034
Fuse 5 protects the power supply (terminal PF) for the expansion servos and alarm outputs. If fuse 5 blows, error 'Expansion PF Output (Check F5)' will occur.		
6	2A	FU10027
Fuse 6 protects the DC circuits. If this fuse blows, the display will be off and both LEDs adjacent to fuse 7 and 8 will be off.		
7	4A	FU10050
Fuse 7 protects the internal 5V supply. If this fuse blows the display will be off and the LED adjacent to the fuse will be off.		
8	2.5A	FU10042
Fuse 8 protects the internal 12V supply. If this fuse blows the display will be off and the LED adjacent to the fuse will be off.		

1.4 Electrical Specifications

1.4.1 Classifications

Classification according to BS EN298:2012

Mains Supply: Single phase 230V, +10%/-15%} 47-63 Hz, unit max. consumption 140W
Single phase 120V, +10%/-15%}

1.4.2 Inputs and Outputs

Output Terminal	Rating (230V)	Rating (120V)	Notes
57	250mA	250mA	Must be connected through contactor
58	250mA	250mA	Must be connected through contactor
59	1A	2A	0.6 power factor
60	1A	2A	0.6 power factor
61	1A	2A	0.6 power factor
62	1A	2A	0.6 power factor
63	1A	2A	0.6 power factor
79	100mA	100mA	To drive relay/lamp only – switched neutral
Max. Load	6A	6A	



Electrical Shock Hazard

Can cause severe injury, death or property damage.

- The high and low voltage connections are not safe to touch. Protection against electric shock is provided by correct installation.
- 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 (shielded) cable as specified in section 1.4.6.
- The burner 'High Limit Stat' must be a manual reset type.
- All external safety devices that require manual reset must be reset external to the Autoflame system and prior to completing the recycling interlock.

The cover (back plate) of the Flame Safeguard controller must always be re-fitted after the wiring is completed to prevent access to the electric shock hazard areas, unauthorised wiring modifications or fuse replacement.

1.4.3 Internal Hardware Status Monitoring

The Flame Safeguard controller analyses the integrity of the internal hardware and diagnostics values for key parameters are available.
The relay safety checks are carried out during every startup sequence and their progress will be displayed on the screen.

1.4.4 Input Checks

All system input circuits are examined to assure that the Flame Safeguard controller is capable of recognising the true status of external controls, limits and interlocks. If any input fails this test, a safety shutdown occurs and the fault will be logged.

1.4.5 Expansion Board Inputs and Outputs

Outputs:	120/230 V	All outputs with the exception of PF are switched neutrals
79	100mA	(alarm indicator on MM board)
PF	Maximum 2A	(load currents for above terminal)

Main Voltage Signal Inputs:
At 120V current loading is approximately maximum 0.7mA per input.At
230V current loading is approximately maximum 1.5mA per input.

1.4.6 Cable Specifications

Low Voltage

The screened cable used for low voltage wiring from the Flame Safeguard unit to the detectors, must conform to the following specification:

UV scanner cable length should not exceed 25m, all other screened cables 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 havebeen 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 MM to BMS systems of Modbus RS485.

Communication cable should not exceed 1km.

Types of data cable that can be used:

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

Samples are available upon request. Low voltage and data cable can be ordered directly from Autoflame Engineering, please contact Autoflame Sales.

1.4.7 Terminals Description

S	All terminals marked S are internally connected. They are provided for connections to the various screened cables
21, 22	Connections to an Autoflame self-check UV sensor
27, 28	Communications port connections for Modbus
29, 30	Digital communications connections to an Autoflame IR scanner
31, 32	Digital communications connections to an Autoflame gas pressure sensor
33	0V supply to an Autoflame gas pressure sensor
34	+12V supply to an Autoflame gas pressure sensor
48	0V supply to an Autoflame IR scanner
49	+15V supply to an Autoflame IR scanner
50, 51	Connections to an Autoflame UV scanner
52	Mains voltage input – external auxiliary delay to purge/ secondary proving set in option/parameter 157
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
56	Mains voltage input - lockout reset
57	Mains voltage output – call for heat
58	Mains voltage output – burner motor
59	Mains voltage output – start/pilot valve
60	Mains voltage output – main fuel valve 1
61	Mains voltage output – main fuel valve 2
62	Mains voltage output – vent valve
63	Mains voltage output – ignition transformer
66	Mains supply – earth
67	Main supply – neutral
68	Mains supply – live/hot
69	Mains voltage output, power to Relay Box (SP80070, SP80070/110)
70	Switched neutral – High/Low Initiate output.
71	Switched neutral – Release to Modulate output.
79	Switched neutral – alarm output for MM lockout/MM error.
80	Low Fire / Start position interlock.
81	High Fire / Purge position interlock.

85	Mains voltage input. For use when using an external flame switch- 0V when at no flame state
86	Mains voltage input. For use when using an external flame switch- line voltage when at no flame state
89	Mains voltage input – selects fuel 1 curve
90	Mains voltage input – selects fuel 2 curve
91	Mains voltage input – selects fuel 3 curve
92	Mains voltage input – selects fuel 4 curve

Note that outputs T70 and T71 are switched neutrals and must be connected to the motor through relays. Autoflame provide the relay box (SP80070, SP80070/110) to facilitate this. Alternatively, relays may be wired in as per the wiring schematic in section 1.3.1.

1.4.8 Expansion Board Terminals Description

S	All terminals marked S are internally connected. They are provided for connections to the various screened cables.
FO1	First Out annunciation line voltage input 1
FO2	First Out annunciation line voltage input 2
FO3	First Out annunciation line voltage input 3
FO4	First Out annunciation line voltage input 4
FO5	First Out annunciation line voltage input 5
FO6	First Out annunciation line voltage input 6
FO7	First Out annunciation line voltage input 7
FO8	First Out annunciation line voltage input 8
FO9	First Out annunciation line voltage input 9
FO10	First Out annunciation line voltage input 10
FO11	First Out annunciation line voltage input 11
FO12	First Out annunciation line voltage input 12
PF	Power feed 2A output (230V/110V)
FO13	First Out annunciation line voltage input 13
FO14	First Out annunciation line voltage input 14
FO15	First Out annunciation line voltage input 15

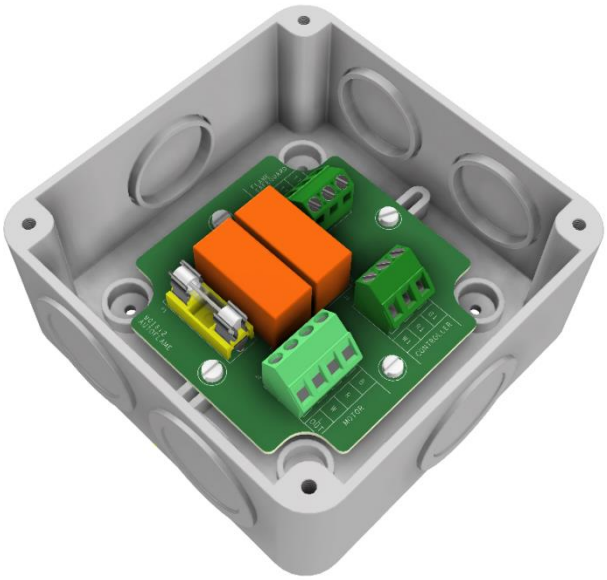
1.5 Relay Box

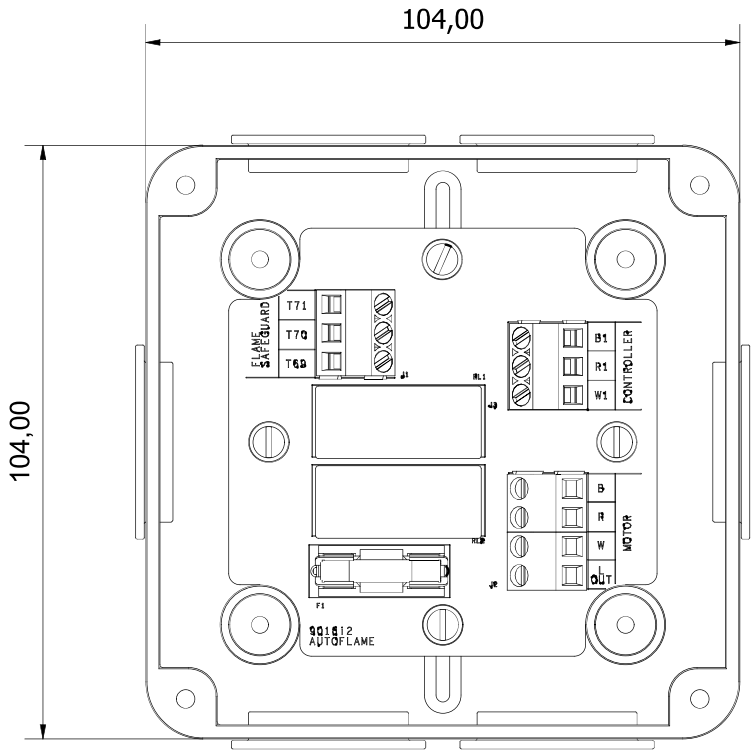
The relay box (SP80070, SP80070/110) provides all the connections shown in section 1.3.1 for wiring between a servo motor with high and low limit switches and the Flame Safeguard controller. It also provides for the switchover of control to a load sensor allowing the burner to modulate once the flame has been established. The Flame Safeguard unit will continue to monitor the status of the flame and initiate a safety shutdown in the event of any issues.

PLEASE NOTE – THAT THERE ARE TWO DIFFERENT VERSIONS OF THE FLAME SAFEGUARD RELAY ADAPTOR (230V & 110V). THE FOLLOWING PART NUMBER USED, FOR THESE VOLTAGES ARE SP80070 FOR 230V & SP80070/110 FOR 110V.

1.5.1 Relay Box Terminal Description

T69	Mains voltage output, power to Relay Box (SP80070, SP80070/110).
T70	Switched neutral – High/Low Initiate output.
T71	Switched neutral – Release to Modulate output.
B1	Connection to a controller (Common Voltage Input)
R1	Connection to a controller (Common Voltage Input)
W1	Connection to a controller (Common Voltage Input)
B	Connection to a motor (Common Voltage Input)
R	Connection to a motor (Common Voltage Input)
W	Connection to a motor (Common Voltage Input)
LOUT	Fused mains voltage output (F1 in Relay box) – for end switches to the motor (the common for T80 & T81)





For an On/Off burner, connections are defined in section 1.3.2 for an On-delay timer relay to allow the start-up sequence to be carried out.

CAUTION - Equipment Damage Hazard.
Improper connection or replacement of relays or the relay box will cause equipment failure.

1.6 Converting a Flame Safeguard unit to an Autoflame Flame Safeguard

The tables below list the connections on other flame safeguard devices and the corresponding Autoflame terminal to be used in an upgrade.

1.6.1 Converting Honeywell Flame Safeguard Units

1.6.1.1 EC7810A:

Honeywell Terminal # (EC7810A)	Abbreviation	Autoflame Terminal #	Type	Description
G	-	-[1]	Input	FLAME SENSOR GROUND
Earth G	-	66	Input	EARTH GROUND
N	-	67	Input	LINE VOLTAGE COMMON (NEUTRAL)
3	L1	68	Input	LINE VOLTAGE SUPPLY (L1)
4	AL	79[2]	Output	ALARM (NORMALLY OPEN)
6	RT	53	Input	LIMITS AND BURNER CONTROL
8	PV1	59	Output	PILOT VALVE 1 (INTERRUPTED)
9	MV	60,61[3]	Output	MAIN FUEL VALVE
10	IGN	63	Output	IGNITION
F (11)	-	-[1]	Input	FLAME SIGNAL
-	HI	B/B1[4]	Output	FIRING RATE HIGH FIRE
13	COM	R[4]	Output	FIRING RATE COMMON
14	MOD	R1[4]	Output	FIRING RATE MODULATE
-	LO	W/W1[4]	Output	FIRING RATE LOW FIRE
16	-	57	Output	CONTROL VOLTAGE
17	ES2	55	Input	PREIGNITION INTERLOCK INPUT
18	ES1	80	Input	LOW FIRE SWITCH INPUT
-	ES3	81	Input	HIGH FIRE SWITCH INPUT
20	LOS	53	Input	LOCKOUT INPUT
21	PV2	59	Output	PILOT VALVE 2 (INTERMITTENT)
22	SHTR	-[1]	Output	SHUTTER

1.6.1.2 EC7820A:

Honeywell Terminal # (EC7820A)	Abbreviation	Autoflame Terminal #	Type	Description
G	-	-[1]	Input	FLAME SENSOR GROUND
Earth G	-	66	Input	EARTH GROUND
N	-	67	Input	LINE VOLTAGE COMMON (NEUTRAL)
3	AL	79[2]	Output	ALARM (NORMALLY OPEN)
4	FAN	58	Output	BURNER/BLOWER MOTOR
6	RT	53	Input	LIMITS AND BURNER CONTROL
7	LD2	54	Input	AIRFLOW SWITCH INPUT
8	PV1	59	Output	PILOT VALVE 1 (INTERRUPTED)
9	MV	60, 61[3]	Output	MAIN FUEL VALVE
10	IGN	63	Output	IGNITION
F (11)	-	-[1]	Input	FLAME SIGNAL
-	HI	B/B1[4]	Output	FIRING RATE HIGH FIRE
13	COM	R[4]	Output	FIRING RATE COMMON
14	MOD	R1[4]	Output	FIRING RATE MODULATE
-	LO	W/W1[4]	Output	FIRING RATE LOW FIRE
16	-	57	Output	CONTROL VOLTAGE
17	ES2	55	Input	PREIGNITION INTERLOCK INPUT
18	ES1	80	Input	LOW FIRE SWITCH INPUT
-	ES3	81	Input	HIGH FIRE SWITH INPUT
20	LOS	53	Input	LOCKOUT INPUT
21	PV2	59	Output	PILOT VALVE 2 (INTERMITTENT)
22	SHTR	-[1]	Output	SHUTTER

1.6.1.3 EC850A:

Honeywell Terminal # (EC7850A)	Abbreviation	Autoflame Terminal #	Type	Description
G	-	-[1]	Input	FLAME SENSOR GROUND
Earth G	-	66	Input	EARTH GROUND
N	-	67	Input	LINE VOLTAGE COMMON (NEUTRAL)
3	AL	79[2]	Output	ALARM (NORMALLY OPEN)
4	L1	68	Input	LINE VOLTAGE SUPPLY (L1)
5	FAN	58	Output	BURNER/BLOWER MOTOR
6	RT	53	Input	LIMITS AND BURNER CONTROL
7	LD2	54	Input	AIRFLOW SWITCH INPUT
8	PV1	59	Output	PILOT VALVE 1 (INTERRUPTED)
9	MV	60, 61[3]	Output	MAIN FUEL VALVE
10	IGN	63	Output	IGNITION
F (11)	-	-[1]	Input	FLAME SIGNAL
12	HI	B/B1[4]	Output	FIRING RATE HIGH FIRE
13	COM	R[4]	Output	FIRING RATE COMMON
14	MOD	R1[4]	Output	FIRING RATE MODULATE
15	LO	W/W1[4]	Output	FIRING RATE LOW FIRE
16	-	57	Output	CONTROL VOLTAGE
17	ES2	55	Input	PREIGNITION INTERLOCK INPUT
18	ES1	80	Input	LOW FIRE SWITCH INPUT
19	ES3	81	Input	HIGH FIRE SWITCH INPUT
20	LOS	53	Input	LOCKOUT INPUT
21	PV2	59	Output	PILOT VALVE 2 (INTERMITTENT)
22	SHTR	-[1]	Output	SHUTTER

Notes

1: Any flame sensing device will need to be replaced with an Autoflame sensor. For more details, please see the Autoflame Flame scanner guide.

2: Switched neutral output should be connected to neutral side of relay coil.

3: Terminal 60 = Main Fuel Valve 1, Terminal 61 = Main Fuel Valve 2. On Autoflame FSG.

4: The connections shown assume the use of an Autoflame relay box. Please consult the wiring diagram, if alternative relays are used.

1.6.2 Converting Fireye Flame Safeguard Units

1.6.2.1 Fireye E110:

Fireye Terminal # (E110)	Autoflame FSG Terminal #	Type	Description
L1	68	Input	HOT – 120 VAC
L2	67	Input	GROUND – NEUTRAL
-	66	Input	EARTH GROUND
S1	-[1]	Input	SCANNER (+)
S2	-[1]	Input	SCANNER (-)
3	55	Output	PRE-IGNITION INTERLOCKS (FUEL VALVE END SWITCH)
M	58	Output	BLOWER MOTOR
D	80	Input	LOW FIRE START INTERLOCK
P	54	Input	RUNNING INTERLOCKS (AIR FLOW SWITCH)
5[2]	63	Output	5 SEC EARLY SPARK TERMINATION
6[2]	59	Output	10 SEC INTERUPTED PILOT
7	60, 61[3]	Output	MAIN FUEL VALVE
8	81	Input	OPEN DAMPER PURGE INTERLOCK
A	79[4]	Output	ALARM
X	B/B1[5]	Output	MODULATION HIGH FIRE
10	R[5]	Output	MODULATION COMMON
11	R1[5]	Output	AUTO MODULATION
12	W/W1[5]	Output	MODULATION LOW FIRE
13	53	Input	OPERATING CONTROL INTERLOCK

1.6.2.2 Fireye Burnerlogix:

Fireye Terminal # (BURNERLOGIX)	Autoflame FSG Terminal #	Type	Description
L1	68	Input	HOT – 120 VAC
L2	67	Input	GROUND – NEUTRAL
E	66	Input	EARTH GROUND
S1	-[1]	Input	SCANNER (+)
S2	-[1]	Input	SCANNER (-)
3	53	Input	OPERATING CONTROL INTERLOCK
M	58	Output	BLOWER MOTOR
D	80	Input	LOW FIRE START INTERLOCK
P	54	Input	RUNNING INTERLOCKS (AIR FLOW SWITCH)
W[2]	63	Output	IGNITION TRANSFORMER
5[2]	63	Output	5 SEC EARLY SPARK TERMINATION
6[2]	59	Output	10 SEC INTERUPTED PILOT
7	60, 61[3]	Output	MAIN FUEL VALVE
8	81	Input	OPEN DAMPER PURGE INTERLOCK
A	79[4]	Output	ALARM
X	B/B1[5]	Output	MODULATION HIGH FIRE
10	R[5]	Output	MODULATION COMMON
11	R1[5]	Output	AUTO MODULATION
12	W/W1[5]	Output	MODULATION LOW FIRE
13	55	Output	PRE-IGNITION INTERLOCKS (FUEL VALVE END SWITCH)

Notes

1: Any flame sensing device will need to be replaced with an Autoflame sensor. For more details, please see the Autoflame Flame scanner guide.

2: The pilot configuration may vary for Terminals W, 5 & 6. Check which connects to the ignition transformer.

3: Terminal 60 = Main Fuel Valve 1, Terminal 61 = Main Fuel Valve 2. On Autoflame FSG.

4: Switched neutral output should be connected to neutral side of relay coil.

5: The connections shown assume the use of an Autoflame relay box. Please consult the wiring diagram, if alternative relays are used.

1.7 Standards

The Autoflame Flame Safeguard unit has been tested and approved to the following standards:

- BS EN 298: 2012
- BS EN 1643: 2014
- BS EN 1854: 2010
- BS EN 12067-2: 2004
- ISO 23552-1:2007
- UL 372, 5th Edition
- CAN/CSA C22.2 No. 199-M89
- AS 4625–2008
- AS 4630–2005
- FM 7610
- FM 7710

The Autoflame Flame Safeguard unit has been manufactured in conformance with the applicable design, manufacturing and inspection requirements of EU Regulation (EU) 2016/426 and ISO 9001:2015 quality system.

2 OPTIONS AND PARAMETERS

The Options, Parameters and Expansion Options must only be changed by factory trained and certified technicians who have a thorough appreciation of the Autoflame combustion systems and the combustion process in general. Any person changing these settings without the correct factory training and understanding of the boiler plant may place themselves and others in a potentially dangerous situation.

2.1 Options

The options, parameters and expansion options and their settings are all viewable while the Flame Safeguard controller is in run mode. In commissioning mode, all of the options, parameters and expansion options can be adjusted according to the application.



Figure 2.1.i Splash Screen

Power up the unit. Press 

when the system starts up.

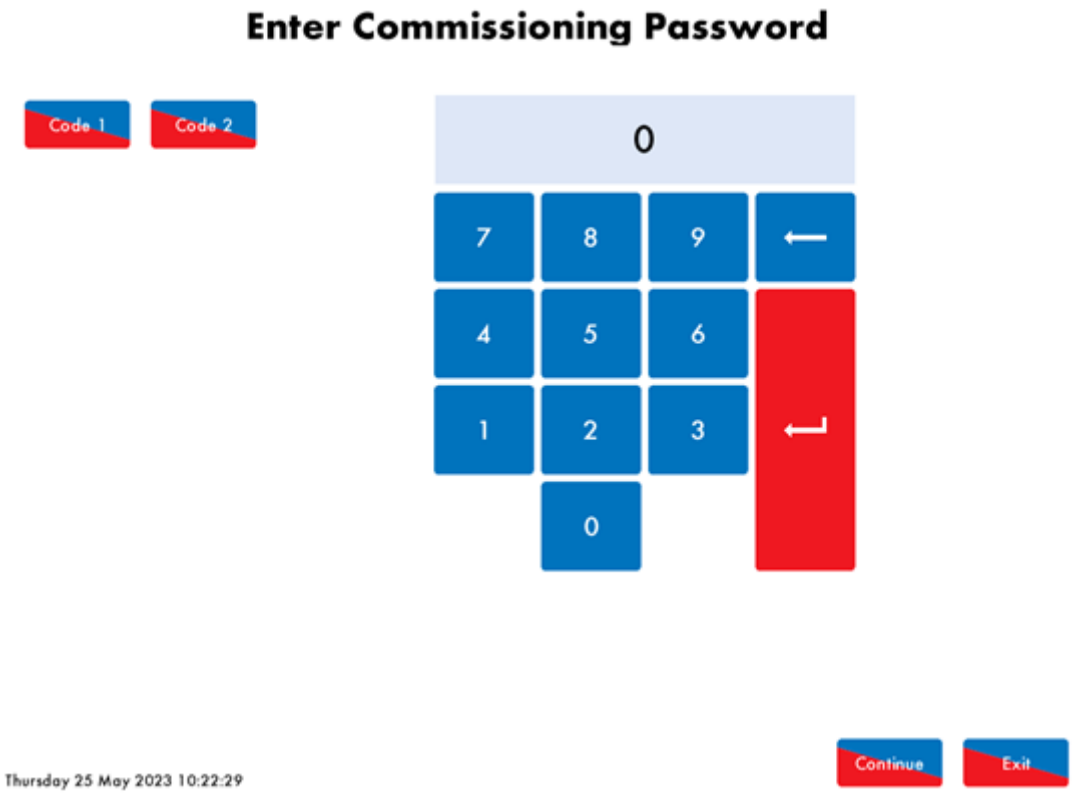


Figure 2.1.ii Enter Commissioning Password

"Enter Commissioning Password" is displayed. Use the keypad to enter the password, then press Continue. Press on Code 1 or Code 2 to change the value of an incorrect entry.

Note: The commissioning password should not be distributed to anyone who is not a factory trained and a certified engineer.

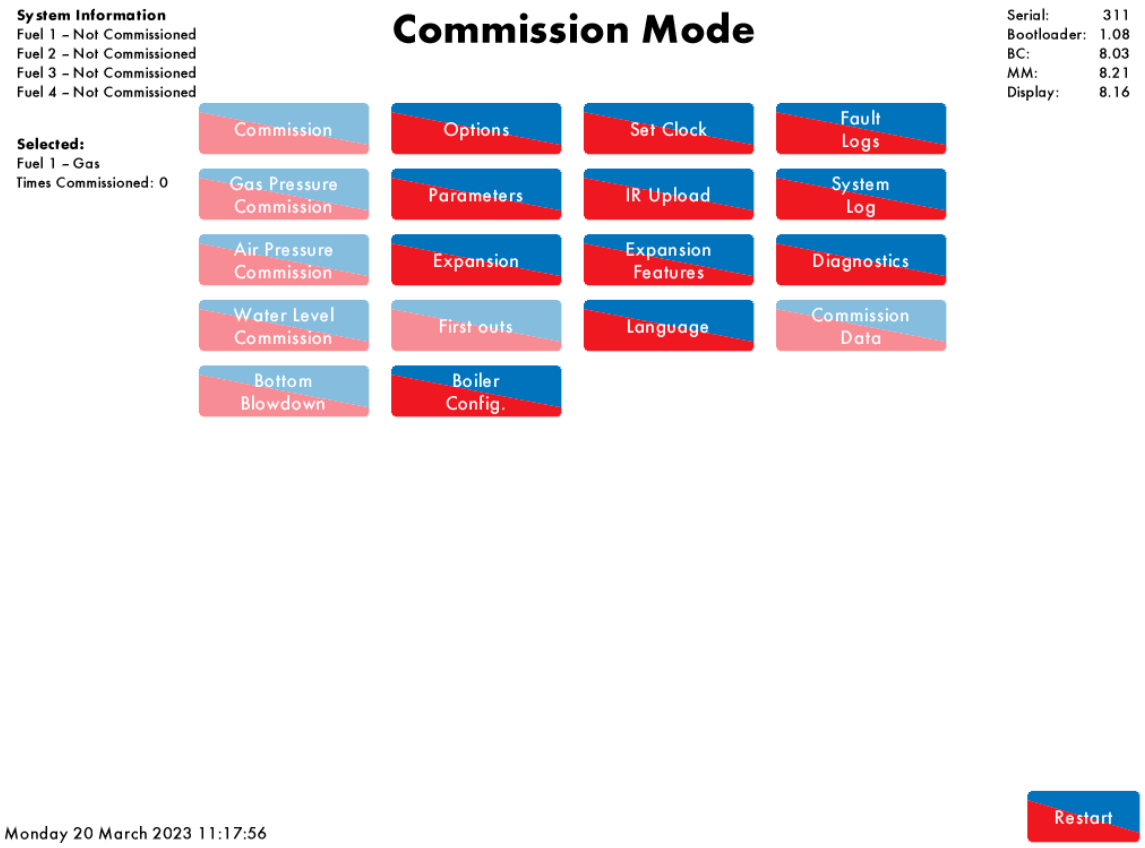


Figure 2.1.iii Commission Mode

The Commission Mode screen gives information on the following:

- Current selected fuel
- Which fuels have been commissioned
- Number of times the unit has been commissioned
- Serial number
- Bootloader version
- BC, MM and Display software

In Commission Mode, the engineer can:

- Adjust options, parameters and expansion options
- Configure first out settings and labels
- Set the time and date
- Upload/download commissioning data
- Unlock expansion features
- Set the language
- View fault logs, system log and diagnostics

Note: Commissions may only be carried out with a fully unlocked Mk8 MM. The number of commissions will remain at zero unless the unit has been fully unlocked at any time and will not increment while in flame safeguard mode.

Commission Mode

Options | Parameters | Expansion

#	Description	Value
1	MM: Boiler Temperature/Pressure Sensor Type	Temperature (MM10006, 0 – 400°C / 752°F)
2	MM: Modulating Motor Travel Speed Limit	1.5
3	MM: Return to Curve Mode	Return to curve at purge speed
4	MM: Flame Safeguard Mode	Enabled
5	MM: Purge Position	Channels 1 to 4 purge at OPEN position
6	PID: Proportional Band	10 °C
7	PID: Integral Time	60 seconds
8	MM: Servomotor Channels	Channels 1 & 2
9	MM: Internal Stat Operation	Burner operates below setpoint
10	MM: Burner Switch-Off Offset	3 °C
11	MM: Burner Switch-On Offset	3 °C
12	EGA: EGA Functionality	Not optioned
13	EGA: EGA Fault Response	EGA faults generate Alarms (Burner stops)
14	MM: Warning Response	Warnings drive Common System Alarm output (T79)
15	MM: User Control	Burner on/off and setpoint control enabled
16	DTI: Sequencing and DTI enable	Sequencing disabled
17	Unused: Option 17	0
18	EGA: Carry Forward of Trim	Enabled
19	EGA: O2 Upper Limit Offset	Disabled

All | MM | PID | EGA | DTI | BC

Exit

Thursday 20 July 2023 09:00:13

Figure 2.1.iv Options

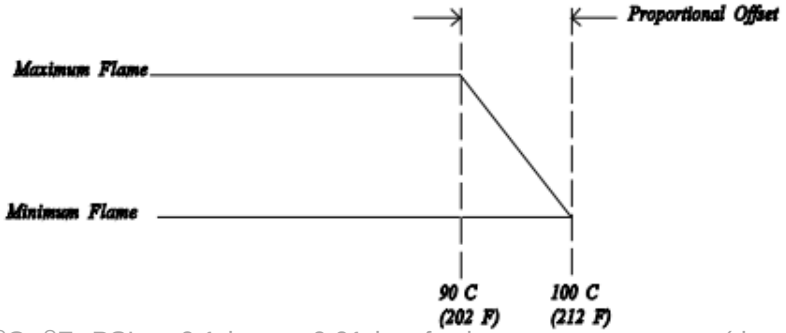
Press Options in the Commission Mode screen to access the options. Any number of options/parameters can be changed at one time. By pressing MM, PID, EGA, DTI or BC at the bottom of the screen, the options/parameters can be grouped together by feature.

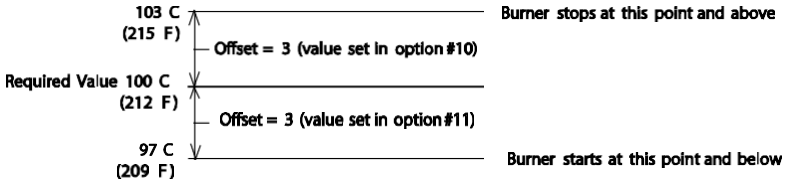
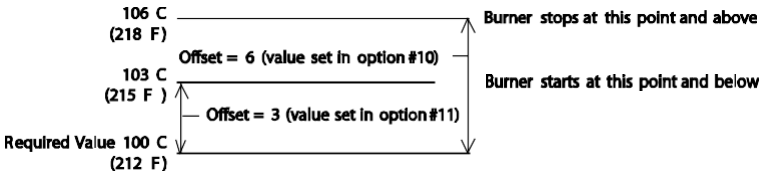
When the changes have been made to suit the application's needs, press Exit to go back to the Commission Mode screen.

Options/parameters 110 – 160 are the burner control settings and are safety critical; these must be entered with the same setting for both the option and parameter value. If these BC options and parameters do not match, there will be an option/parameter conflict.

To set all the options, parameters and expansion options to the default values and erase the commissioning data, set option/parameter 160 to 5. The MM will then automatically restart and go into Commission mode.

PLEASE NOTE: Although all Options/Parameters are settable, the majority only apply to a fully unlocked MK8 MM (MM80001) - details of how to unlock the Flame Safeguard controller to a Mk8 MM is provided in section 8. Options and parameters which have no impact when set as a Flame Safeguard unit have been greyed out in the tables below.

Opt. #	Default	Range	Description
1	0		MM: Boiler Temperature/Pressure Sensor Type
		0	Temperature MM10006
		1	Low pressure MM10010
		2	Medium pressure MM10008
		3	High pressure MM10009
		4	Extra high pressure MM10017
		5	External temperature (voltage input, range set by parameters 52 to 56)
		6	External pressure (voltage input, range set by parameters 52 to 56)
			Note: External load detector wiring low voltage to terminal 37 and high voltage to terminal 38.
2	15		MM: Modulating Motor Travel Speed Limit
			If the modulating speed of the motor is too fast, then decrease the value, and vice versa. At times other than modulation, the motors move at full speed or at the value set in option 75. Movement is limited by the slowest channel i.e. the slowest moving motor.
		6 – 100	0.6 – 10.0
3	0		MM: Return to Curve Mode
			Controls how quickly the MM moves from off-curve positions (Golden Start, FGR) to the firing curve.
		0	Return to curve at purge speed.
		1	Return to curve at modulating speed.
4	0		MM: Flame Safeguard Mode
			Once Enabled the MK8 MM, operates as a simple Flame Safeguard. Option/parameter 154 (T80) Start Position Interlock & option/parameter 155 (T81) Purge Position Interlock must be used.
		0	Disabled
		1	Enabled
5	1		MM: Purge Position
			This purge position applies to channels 1-4 as selected in options 67-70, however VSD channels will always purge at open position as default. This setting applies for post-purge if set, see option/ parameter 118 and 135.
		0	Channels 1 to 4 purge at HIGH position.
		1	Channels 1 to 4 purge at OPEN position.
6	10		PID: Proportional Band
			The proportional band is an offset below the required setpoint; when the actual temperature/ pressure reaches this band, the burner will begin to modulate as it approaches the required setpoint.
			
		5 - 2000	°C, °F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
7	60		PID: Integral Time
			Every 'n' seconds, 10% of the present offset from the required setpoint is added or subtracted when below or above the setpoint, respectively, to the present proportional value. The value of 'n' is the number of seconds set in this option; if set to 0, there will be no integral control.
		0	Disabled
		1 - 250	Seconds

Opt. #	Default	Range	Description
8	0		MM: Servomotor Channels
			Channel 1 is always enabled for fuel; this option sets the channels in use.
		0	Channels 1 & 2
		1	Channels 1, 2 & 3
		2	Channels 1, 2, 3 & 4
			Note: If option 8 is changed after commissioning, then the MM will need to be re-commissioned, unless this option is returned to its previous setting.
9	1		MM: Internal Stat Operation
			The internal stat turns the burner on and off according to the actual value relative to the required setpoint. For setting 0, the internal stat is kept closed all the time, and a working stat must be fitted to the boiler. For setting 1, the internal stat is opened at an offset above the required setpoint, and closed at an offset below the required setpoint. For setting 2,the internal stat is opened at an offset above the required setpoint, and closed an at offset above the required setpoint. The offset values are set in options 10 and 11.
		0	Internal stat always closed
		1	Burner operates below setpoint
		2	Burner operates above setpoint
			E.g. Option 9 = 1, required setpoint = 100^{O}C (212^{O}F)
			
			E.g. option 9 = 2, required setpoint = 100^{O}C (212^{O}F)
			
10	3		MM: Burner Switch-Off Offset
		2 – 1000	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
			Note: This option is only relevant if option 9 is set to 1 or 2.
11	3		MM: Burner Switch-On Offset
		0 – 1000	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
			Note: This option is only relevant if option 9 is set to 1 or 2.
12	0		EGA: EGA Functionality
			For settings 2 or 3, the EGA will trim on the channel 2 air damper once trim data has been added. If option 12 is set to 0 or 1, then trim can be added at a later date by changing this to 2 or 3 in online changes, then going through single point change to add trim data for each fuel-air position.
		0	Not optioned
		1	Monitoring only
		2	Applies trim
		3	Applies trim, combustion limits tested

Opt. #	Default	Range	Description
13	0		EGA: EGA Fault Response
		0	EGA faults generate Alarms (burner stops)
		1	EGA faults generate Warnings (burners runs)
			Note: EGA alarms will drive the common system alarm output (terminal 79), see option 14 for warning response.
14	1		MM: Warning Response
		0	Warnings do not drive Common System Alarm output (terminal 79)
		1	Warnings drive Common System Alarm output (terminal 79)
15	3		MM: User Control
			This option sets whether the user can turn the burner on and off, or change the required setpoint via the flame screen on the MM
		0	Burner on/off and setpoint control disabled
		1	Burner on/off disabled and setpoint control enabled
		2	Burner on/off enabled and setpoint control disabled
		3	Burner on/off and setpoint control enabled
16	0		DTI: Sequencing and DTI Enable
			A lead boiler can be selected by pressing Lead Boiler in the IBS screen or via the DTI if optioned. Only 1 MM may be selected as lead boiler at atime, or the sequencing will not operate. The Lead Boiler button on the MM and the Lead Boiler Select on terminal 88 (see option 55) bothoverride the DTI Lead Boiler Select.
		0	Sequencing disabled
		1	Sequencing enabled
		2	DTI enabled
		3	Sequencing and DTI
17	-		Unused
18	1		EGA: Carry Forward of Trim
			When the system modulates, the correction that may already exist on the air damper position can be carried forward (only relevant if an EGA is operational on the system). Trim will be reset if the rate of change of the fuel valve angle is greater than that set in parameter 14.
		0	Disabled
		1	Enabled
19	0		EGA: O_2 Upper Limit Offset
			If the current O_2 value is above this offset limit from the commissioned value, an alarm/warning (see option13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 100	0.1% - 10.0% O_2
20	0		EGA: CO_2 Upper Limit Offset
			If the current CO_2 value is above this offset limit from the commissioned value, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 100	0.1% - 10.0% CO_2
21	0		EGA: CO Upper Limit Offset
			If the current CO value is above this offset limit from the commissioned value, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 200	1 – 200 ppm CO

Opt. #	Default	Range	Description
22	0		EGA: O_2 Lower Limit Offset
			If the current O_2 value is below this offset limit from the commissioned value, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 100	0.1% - 10.0% O_2
23	0		EGA: CO_2 Lower Limit Offset
			If the current CO_2 value is below this offset limit from the commissioned value, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		0 – 100	0.1% - 10.0% CO_2
24	-		Unused
25	0		EGA: O_2 Absolute Limit
			If the current O_2 value is below this absolute limit, an alarm/warning (see option13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 200	0.1% - 20.0% O_2
26	0		EGA: CO_2 Absolute Limit
			If the current CO_2 value is above this absolute limit, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 200	0.1% - 20.0% CO_2
27	0		EGA: CO Absolute Limit
			If the current CO value is above this absolute limit, an alarm/warning (see option 13) will occur, with option 12 set to 3.
		0	Disabled
		1 – 200	1 – 200 ppm CO
28	20		EGA: Trim Threshold
			The trim threshold is an offset from the required setpoint; if the actual value is below this offset, then the EGA will not trim. This option should be set to 0 if trim is to be effective at all times during firing, and/or if external modulation is optioned. No single point changes can be made if the actual value is below this trim threshold.
		0 – 50	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
29	0		MM: Golden Start
			Golden start allows an optimum ignition position to be set in the fuel-air curve, which is not necessarily low flame or part of the standard modulating index. Parameter 15 sets how long golden start position is maintained and from which point to start counting down.
		0	Disabled
		1	Enabled. Time counted from point of main flame
		2	Enabled. Time counted from ignition
30	50		DTI: Minimum Remote Setpoint (DTI/ Modbus/External)
			If a required value command is received from the DTI or Modbus that is below this minimum remote setpoint value, then it will be ignored by the MM. The MM will continue to fire to meet the previous required setpoint.
		5 – 9990	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)

Opt. #	Default	Range	Description
31	100		DTI: Maximum Remote Setpoint (DTI/ Modbus/External)
		5 – 9990	If a required value command is received from the DTI or Modbus that is above this maximum remote setpoint value, then it will be ignored by the MM. The MM will continue to fire to meet the previous required setpoint. ^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
32	20		EGA: Trim Delay
		0 – 250	After ignition, the EGA does not Trim for the time delay set in this option(if EGA is set to 2 or 3). This allows for the combustion to stabilise before trimming commences. The delay timer starts at the ignition point. Seconds
33	1		DTI: MM Identification
		1 – 10	Each MM within a sequencing/DTI/Modbus/twin burner loop must be set with an individual ID number. For communications between the MMs, there cannot be more than 1 MM with the same ID number. ID number
34	-		Unused
35	10		DTI: Sequence Scan Time
		1 – 100	This is the time period between sequencing requests from the lead and the lag MMs. On the sequence scan time, the lead MM will demand lag burners to be brought online or offline, depending on load requirements. See parameters 86 and 87 for change down and up thresholds. Accurate fuel flow metering must be entered for sequencing to operate. The MMs must be connected using data cable (Belden 9501) screened at one end. Minutes
36	0		EGA: (Mk7 Only) Sensor Selection
		0 1 2 3	This option selects if the Mk7 EGA is fitted with additional cells. No optional sensor NO_2 optioned SO_2 optioned NO_2 and SO_2 optioned
37	0		PID: Derivative Time
		0 1 – 200	The time taken to add/ remove an additional 10% to the firing rate based on the actual value and the required value. Disabled Seconds
38	2		PID: Derivative Deadband
		0 1 - 15	This deadband is the margin above and below the required setpoint in which no derivative control occurs. Disabled ^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
39	-		Unused

Opt. #	Default	Range	Description
40	0		DTI: Warming Facility for Low Pressure Steam
			For sequencing applications where non-return valves are not installed, it is not possible to use a setpoint to keep the boilers in a standby condition. A thermostat (aquastat) can be installed into the boiler's shell. Set option 79 to 0 to enable terminal 93 for warming stat. An input on terminal 93 stops/inhibits the burner when the MM is in warming. The boiler will remain in a warming state based on the settings in options 53 and 54.
		0	Steam sequencing with non-return valves
		1	Steam sequencing without non-return valves
41	0		DTI: Warming Mode
			For setting 0, the first lag boiler is kept in a standby state with the second in warming, and the remaining lag boilers off. For setting 1, the first lag boiler is in standby, and the remaining lag boilers are in warming.
		0	One MM in warming state
		1	All unused MMs in warming state
42	20		DTI: Standby Setpoint or Phantom Setpoint Offset
			For sequencing applications where non-return valves are installed, the first lag boiler uses a standby setpoint to keep the boiler in a standby condition. The standby setpoint is set as an absolute value in this option. When the standby setpoint is in effect, the burner is held at low flame hold.
		5 – 9990	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
43	0		MM: Multi-Burner Function
			The multi-burner function can be used for up to 10 burners, allowing the firing rates to be synchronised for all the burners in the multi-burner loop. For setting 1, if an error or lockout occurs on a burner, all of the other burners will shut down; setting 1 is suitable for firetube boilers. For setting 2, if an error occurs on a burner, all of the other burners will shut down, however if a lockout occurs, the other burners will continue to fire; setting 2 is suitable for watertube boilers. Fuel flow metering must be commissioned accurately for the multi-burner function to operate. Please refer to section 8 for commissioning of the multi-burner function.
		0	Disabled
		1	Fully linked
		2	Independent on Fault
44	1		MM: Multi-Burner ID
			When using the multi-burner function, the multi-burner IDs must be set on the MMs This option should be set to 1 for the master, and 2 onwards for the slave MMs.
		1 – 10	Multi-Burner ID
45	0		MM: External Modulation
			When enabled, the internal PID control is disabled and the firing rate is set by an external controller applied to the appropriate input terminals 7, 8, 9. This input control signal can be 0-10V (2-10V) or 4-20mA (0-20mA) set through parameter 69, and represent zero/low to high fire by setting parameter 68. A manual reset high limit stat must be fitted. For setting 1, an external working stat is required and option 9 should be set to 0. For setting 2, option 9 should be set to 1 or 2. For setting 3 this permanently limits the firing rate according to the input seen on the aux input channel.
		0	Disabled
		1	Enabled, load sensor not shown
		2	Enabled, load sensor shown
		3	Firing Rate Limiter

Opt. #	Default	Range	Description
46	0		MM: Cold Start Inhibit Time
			If the MM progresses from low fire cold start to firing and the burner shuts down within this cold start inhibit time, a cold start will not occur when the burner starts up again. This allows the burner to come straight on in normal firing in situations where the demand has increased drastically and the actual value drops fast.
		0	Disabled
		1 – 120	Minutes
47	0		MM: Cold Start Routine
			On burner start-up, if the actual value is at 30% or below of the required setpoint, then the burner will be held at low fire for the number of minutes set in this option. It will then go to mid-fire. If the actual value is below 60% of the required setpoint, then the burner will be held at mid-fire for the set minutes. Once this cold start time has elapsed, or the value goes above 60% of the required setpoint, the burner will go to high fire as per the internal PID. It is not recommended to use cold start routine with external modulation or sequencing.
		0	Disabled
		1 – 2000	Minutes
48	0		MM: Flue Gas Recirculation – Timer
			This is the time that the MM channels (servomotors/ VSDs) are held at the FGR start positions, after which modulation takes place. This timer starts at the end main flame proving. FGR allows approximately 15% of the boiler flue gases via an auxiliary channel (e.g. 3) to be fed back to the burner and mixed with combustion air, to reduce NOx.
		0	Disabled
		1 – 3600	Seconds
49	0		MM: Flue Gas Recirculation – Offset
			This is an offset from the required setpoint. The MM channels (servomotors/VSDs) are held at the FGR start positions until the actual value reaches this offset value below the required setpoint.
		0	Disabled
		1 – 1000	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
50	0		MM: Flue Gas Recirculation – Temperature Threshold
			The MM channels (servomotors/VSDs) are held at the FGR start positions until the flue gas temperature has reached 120^{O}C (248^{O}F). This option can only be used if an EGA is optioned and operational.
		0	FGR temperature threshold disabled
		1	FGR temperature threshold enabled
51	2		MM: Multi-Burner Highest Slave ID
			This should be set to the highest slave ID set in option 44 for the MMs in the multi-burner loop.
		2 – 10	Multi-burner slave ID
52	0		MM: Multi-Burner Differential Firing Rate Limit
			If the difference between the firing rates of the Master MM and the slave MMs is equal to or greater that this limit, the Master MM will stop modulating and wait for the slaves to catch up. When the difference reduces to less than or equal to 5%, the Master starts modulating again.
		0	Disabled
		1 – 20	1% - 20%

Opt. #	Default	Range	Description
53	0		DTI: Steam Sequencing Burner Off Time
			When the MM is in warming mode, it will warm to the standby setpoint according to the on and off times set in options 53 and 54.
		0	Disabled
		1 – 200	Minutes
54	5		DTI: Steam Sequencing Burner On Time
			When the MM is in warming mode, it will warm to the standby setpoint according to the on and off times set in options 53 and 54.
		1 – 30	Minutes
55	0		MM: Terminal T88 Function
			This option selects the function of terminal 88, see options 16 and 45. For setting 0, a line voltage input on terminal 88 is used to select the lead boiler in sequencing, and overrides the DTI lead boiler select. For setting 1, a line voltage input on terminal 88 is used to select the external modulation signal and 0V for internal PID. For setting 2, a line voltage input on terminal 88 is used to select firing rate limiter. This permanently limits the firing rate according to the input seen on the aux input channel (parameter 69), at 0V the MM uses its internal firing rate. For setting 3 a line voltage input on terminal 88 is used for external setpoint & 0V for internal setpoint. For setting 4 a line voltage input on terminal 88, uses the fixed firing rate set on option 66, at 0V the MM uses its internal firing rate.
		0	T88 selects Lead Boiler
		1	T88 selects External Modulation
		2	T88 selects Firing Rate Limiter
		3	T88 selects External Setpoint
		4	T88 selects Fixed Firing Rate Limit
56	0		MM: Alarm Output Operation (Terminal #79)
			This is a switched neutral output to select how the alarm function operates.
		0	Relay normally off, on during alarm
		1	Relay normally on, off during alarm
57	0		MM: Fuel Flow Metering
			Fuel flow metering determines the firing rate. If no fuel flow meter is available, a 'dummy curve' should be entered using the burner turndown ratio from the burner rating to determine the low fire point, and the burner rating for the high fire point. If enabled, fuel flow metering is initiated once the burner has been commissioned and is firing. The MM will drive to the low fire point first, and then go up the curve. For setting 2, see options 59 and 60. If using setting 2 for fuel flow feedback, then 4-20mA signal is required on terminals EX- and EX+ on the expansion board (this cannot be enabled with external level sensor nor fully metered combustion control, see expansion option 4). For metric units, fuel flow is commissioned in MW for metric units and MMBTU/hr for imperial units.
		0	Disabled
		1	Enabled
		2	Enabled with 4-20mA feedback
58	-		Unused
59	100		MM: Fuel Flow at Maximum Feedback
			This will set the fuel flow value at 20mA feedback, see option 57.
		1 – 10000	0.01MW – 100.0 MW
60	0		MM: Fuel Flow Feedback Fault Tolerance
			The fuel flow feedback fault tolerance allows an upper limit to be set on the fuel flow when option 57 is set to 2. If the fuel flow exceeds this limit for 5 seconds, then a warning will appear.
		0	Disabled
		1 - 500	0.1% - 50.0% of high-fire fuel flow

Opt. #	Default	Range	Description
61	3725		MM: Fuel 1 Calorific Value
		100 – 65000	This is the gross calorific value/higher heating value (HHV) including the latent heat of vaporisation of water. To set either metric or imperial units, see parameter 40. If the units are changed, then this option must be changed accordingly. 100 = 1.00MJ/m^3 or 100 Btu/ft^3
62	2068		MM: Fuel 2 Calorific Value
		100 – 65000	This is the gross calorific value/higher heating value (HHV) including the latent heat of vaporisation of water. To set either metric or imperial units, see parameter 40. If the units are changed, then this option must be changed accordingly. 100 – 1.00 MJ/kg or 100 BTU/lb
63	2068		MM: Fuel 3 Calorific Value
		100 – 65000	This is the gross calorific value/higher heating value (HHV) including the latent heat of vaporisation of water. To set either metric or imperial units, see parameter 40. If the units are changed, then this option must be changed accordingly. 100 – 1.00 MJ/kg or 100 BTU/lb
64	3725		MM: Fuel 4 Calorific Value
		100 – 65000	This is the gross calorific value/higher heating value (HHV) including the latent heat of vaporisation of water. To set either metric or imperial units, see parameter 40. If the units are changed, then this option must be changed accordingly. 100 = 1.00MJ/m^3 or 100 Btu/ft^3
65	-		Unused
66	0		MM: Firing Rate Limit
		0 1 – 100	This is the maximum firing rate that can be obtained by the system, imposed in auto and hand modes. Firing rate limit should not be used with DTI load index control or sequencing. Disabled %
67	1		MM: Channel 1 Purge Position
		0 1	Channel 1 to purge position Channel 1 to remain closed for purge
68	0		MM: Channel 2 Purge Position
		0 1	Channel 2 to purge position Channel 2 to remain closed for purge
69	0		MM: Channel 3 Purge Position
		0 1	Channel 3 to purge position Channel 3 to remain closed for purge
70	0		MM: Channel 4 Purge Position
		0 1	Channel 4 to purge position Channel 4 to remain closed for purge
71	0		MM: Continuous Pilot Shut Off Timer
		0 1 – 1440	If continuous pilot is enabled (see option/parameter 111), then after this timer has elapsed when in continuous pilot firing, the burner will go off. Disabled Minutes

Opt. #	Default	Range	Description
72	0		MM: Continuous Pilot Shut Off Threshold
			If continuous pilot is enabled (see option/parameter 111), then if the actual value is higher than the combined burner switch-off offset (option 10) and this offset above the required setpoint in continuous pilot firing, the burner will go off.
		0	Disabled
		1 – 1000	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
73	0		MM: VSD Channel 5 Purge Position
		0	Purge at Maximum Output
		1	Purge at Minimum Output
74	0		MM: VSD Channel 6 Purge Position
		0	Purge at Maximum Output
		1	Purge at Minimum Output
75	100		MM: Purge Motor Travel Speed
			If the speed of the motor is too fast, then decrease the value.
		6 – 100	0.6 – 10.0
76	0		EGA: Trim Channel
			If an EGA is optioned, then trim can be applied to either channel 2 servomotor or channel 5 VSD. For setting 1, options 91 to 98 must be set.
		0	Trim on Channel 2
		1	Trim on Channel 5
77	0		MM: VSD Channel 5 Output at Closed
		0	Maximum Output at Closed
		1	Minimum Output at Closed
78	0		MM: VSD Channel 6 Output at Closed
		0	Maximum Output at Closed
		1	Minimum Output at Closed
79	0		MM: Terminal T93 Function
		0	Warming Stat
		1	Night setback
80	0		MM: Outside Temperature Compensation
		0	Outside Temperature Compensation Disabled
		1	Outside Temperature Enabled using OTC unit
		2	Outside Temperature Enabled using MM sensor
81	90		MM: Setpoint at Minimum Outside Temperature
			This setpoint is limited by the load detector set in option 1.
		20 – 999	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
82	30		MM: Minimum Outside Temperature
		0 – 145	Value 30 = -10^{O}C or -10^{O}F (see parameter 40)
83	80		MM: Setpoint at Maximum Outside Temperature
			This setpoint is limited by the load detector set in option 1.
		20 – 999	^{O}C, ^{O}F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
84	80		MM: Maximum Outside Temperature
		0 – 145	Value 80 = 40^{O}C or 40^{O}F (see parameter 40)

Opt. #	Default	Range	Description
85	0		MM: Night Setback Offset
			This offset value is subtracted from the required setpoint. An input is required on terminal 93, see option 79.
		0	Disabled
		1 – 100	°C, °F, PSI or 0.1 bar or 0.01 bar for low pressure sensor (depends on load detector set in option 1 and metric/imperial units set in parameter 40)
86	0		MM: Channel 1 Servo Control Method
		0	Autoflame Servo Motor, 0.1 degree control
		1	Autoflame Servo Motor, 0.5 degree control
		2	Industrial Servo Motor, 0.1 degree control
		3	Industrial Servo Motor, 0.5 degree control
		4	IO Unit 4-20mA Servo Motor, 0.5 degree control
		5	IO Unit 4-20mA Servo Motor, 1.0 degree control
87	0		MM: Channel 2 Servo Control Method
		0	Autoflame Servo Motor, 0.1 degree control
		1	Autoflame Servo Motor, 0.5 degree control
		2	Industrial Servo Motor, 0.1 degree control
		3	Industrial Servo Motor, 0.5 degree control
		4	IO Unit 4-20mA Servo Motor, 0.5 degree control
		5	IO Unit 4-20mA Servo Motor, 1.0 degree control
88	0		MM: Channel 3 Servo Control Method
		0	Autoflame Servo Motor, 0.1 degree control
		1	Autoflame Servo Motor, 0.5 degree control
		2	Industrial Servo Motor, 0.1 degree control
		3	Industrial Servo Motor, 0.5 degree control
		4	IO Unit 4-20mA Servo Motor, 0.5 degree control
		5	IO Unit 4-20mA Servo Motor, 1.0 degree control
89	0		MM: Channel 4 Servo Control Method
		0	Autoflame Servo Motor, 0.1 degree control
		1	Autoflame Servo Motor, 0.5 degree control
		2	Industrial Servo Motor, 0.1 degree control
		3	Industrial Servo Motor, 0.5 degree control
		4	IO Unit 4-20mA Servo Motor, 0.5 degree control
		5	IO Unit 4-20mA Servo Motor, 1.0 degree control
90	0		MM: VSD Operation Channel 5
		0	Disabled
		1	Enabled
91	0		MM: Output from MM to VSD Channel 5
		0	Output range 4 to 20mA
		1	Output range 0 to 20mA
		2	Output range 0 to 10V
92	0		MM: Output Units Displayed, VSD Channel 5
		0	Selected output signal
		1	Hertz
93	25		MM: Output Low Speed from MM to VSD Channel 5
		1 – 200	Hertz
94	50		MM: Output High Speed from MM to VSD Channel 5
		1 – 200	Hertz

Opt. #	Default	Range	Description
95	0		MM: Input Signal to MM from VSD Channel 5
		0	Input range 4 to 20mA
		1	Input range 0 to 20mA
		2	Input range 0 to 10V
96	0		MM: Input Units Displayed, VSD Channel 5
		0	Selected input signal
		1	Hertz
97	0		MM: Input Low Speed to MM from VSD Channel 5
		0 – 200	Hertz
98	50		MM: Input High Speed to MM from VSD Channel 5
		0 – 200	Hertz
99	40		MM: VSD Channel 5 Feedback Fault Tolerance
			This is used to check that the feedback varies while modulating. For example, if this option is set to 4%, the tolerance that is allowed while firing is ±4% of the whole VSD range. For commissioning, the difference between the point with the lowest feedback and the point with the highest feedback must be bigger than twice the tolerance, so for the default of 4% tolerance, the difference between the point with the lowest feedback and the point with the highest feedback has to be greater than 8% of the whole VSD range.
		5 – 40	0.5% – 4.0%
100	0		MM: VSD Operation Channel 6
		0	Disabled
		1	Enabled
101	0		MM: Output from MM to VSD Channel 6
		0	Output range 4 to 20mA
		1	Output range 0 to 20mA
		2	Output range 0 to 10V
102	0		MM: Output Units Displayed, VSD Channel 6
		0	Selected output signal
		1	Hertz
103	25		MM: Output Low Speed from MM to VSD Channel 6
		1 – 200	Hertz
104	50		MM: Output High Speed from MM to VSD Channel 6
		1 – 200	Hertz
105	0		MM: Input Signal to MM from VSD Channel 6
		0	Input range 4 to 20mA
		1	Input range 0 to 20mA
		2	Input range 0 to10V
106	0		MM: Input Units Displayed, VSD Channel 6
		0	Selected input signal
		1	Hertz
107	0		MM: Input Low Speed to MM from VSD Channel 6
		0 – 200	Hertz
108	50		MM: Input High Speed to MM from VSD Channel 6
		0 – 200	Hertz

Opt. #	Default	Range	Description
109	40		VSD Channel 6 Feedback Fault Tolerance This is used to check that the feedback varies while modulating. For example, if this option is set to 4%, the tolerance that is allowed while firing is ±4% of the whole VSD range. For commissioning, the difference between the point with the lowest feedback and the point with the highest feedback must be bigger than twice the tolerance, so for the default of 4% tolerance, the difference between the point with the lowest feedback and the point with the highest feedback has to be greater than 8% of the whole VSD range.
		5 – 40	0.5% – 4.0%

For safety reasons, options 110 – 160 must also be entered in as Parameters.

It is the responsibility of the commissioning engineer to ensure that all settings are set in accordance with the appropriate standards, local codes and practices. If options 110 – 160 are not identical with parameters 110 – 160, then the MM will go straight to Commissioning Mode and an option/parameter conflict message will appear.

Opt. #	Default	Range	Description
110	1		BC: UV Flame Scanner Type
			See option/parameter 120 for the UV threshold and 122 for the flame sensor operation. For setting 2, the self-check UV scanner opens and closes a shutter to check that the UV scanner is not giving a false flame signal.
		1 2	Standard scanner Self-check scanner
111	0		BC: Pilot Type
			For interrupted pilot, when lighting off, the pilot valve will close at the point the main flame proving phase begins. For intermittent pilot, when lighting off, the pilot valve will remain open during firing. For continuous pilot, when the burner goes above its off differential of the required setpoint, the burner will continue to fire with the pilot valves energised for the set time period. See options 71 and 72.
		0 1 2 3 4	Interrupted pilot Intermittent pilot No pilot Continuous interrupted pilot Continuous intermittent pilot
			Note: Setting 2 no pilot cannot be used with single valve pilot (option/ parameter 130).
112	40		BC: Pre-Purge Time
			Purging the boiler before burner start-up with air will force any combustion remnants out of the stack. Purge time should be set according to boiler manufacturing guide and local codes and regulations. Time remaining for the pre- purge process to complete is displayed on the main MM screen.
		5 – 240	Seconds
113	3		BC: Pre-Ignition Time
			This is the time period when the ignition transformer is on before the pilot valves opens.
		3 – 5	Seconds
114	3		BC: First Safety Time
			This is the time period when the pilot valve is open, before the flame is checked. The time range of this option depends on whether its gas or oil.
		3 – 10	Seconds
115	3		BC: Pilot Prove Time - Pilot Trial for Ignition (PTFI)
			This is the time period for when the flame is checked after the first safety time, to prove the pilot flame.
		3 – 5	Seconds
116	3		BC: Gas Second Safety Time – Main Trial for Ignition (MTFI)
			This is the time period when the main valves are open and the pilot valve is maintained open, before the flame is checked, for firing on gas. See options/parameters 150 – 153. This does not apply for intermittent pilot, see option/parameter 111. For firing on oil, see option/parameter 123.
		3 – 10	Seconds
117	5		BC: Main Flame Proving Time
			This is the time period after the second safety phase for interrupted pilot or after the pilot proving phase for intermittent pilot, where the flame is checked, before going to normal firing/modulation.
		5 – 20	Seconds

Opt. #	Default	Range	Description
118	0		BC: Post-Purge Time
			If set, a post-purge will occur after a normal burner shutdown. This time set should allow for the servomotors to travel from low fire to purge position. The flame is not checked during post-purge. See option/parameter 135 for NFPA post-purge. Time remaining for the post-purge process to complete is displayed on the main MM screen.
		0 – 100	Seconds (for option/ parameter 135 set to 0 or 2)
		0 – 100	Minutes (for option/ parameter 135 set to 1 or 3)
119	10		BC: Control Box Recycle Time
			This is the time delay between the burner shutting down, and going through post-purge if optioned, and the burner starting up again.
		3 – 120	Seconds
120	10		BC: UV Threshold
			This is the minimum flame signal strength, if the flame strength is lower than this threshold, a lockout will occur. The UV counts will stabilise at 5 times this value when increasing, and 3 times this value when decreasing.
		5 – 50	UV counts
121	5		BC: Delay from Start of Pre-Purge until Air Switch Checked
			This time delay where the air switch is not checked is included within the total pre-purge time set in option/parameter 112.
		5 – 10	Seconds
122	0		BC: Flame Sensor Selection
		0	UV
		1	Flame Switch
		2	IR
		3	IR and UV
		4	IR or UV
123	3		BC: Oil Second Safety Time – Main Trial For Ignition (MTFI)
			This is the time period when the main valves are open and the pilot valve is maintained open, before the flame is checked, for firing on oil. See options/parameters 150 – 153. This does not apply for intermittent pilot, see option/parameter 111. For firing on gas, see option/parameter 116.
		3 – 15	Seconds
124	0		BC: Timeout on Reaching Purge
			If the MM is stuck in Run to Purge or Run to Post-Purge because the servomotors and VSDs are moving to the purge position, then a lockout will occur after this timeout set in this option has elapsed. This does not apply to any requirements on purge timing such as any additional proving inputs.
		0	Disabled
		1 – 3600	Seconds

Opt. #	Default	Range	Description
125	0		BC: Fuel Pressure Sensor Mode – Fuel 1
			Gas: For setting 1, valve proving and pressure limits are checked by an Autoflame gas sensor. For setting 2, low pressure limit can be checked by external pressure switch. For setting 3, the system will wait for a mains voltage input on terminal 55 to confirm that the VPS test is completed. If a voltage is not detected on terminal 55 within 10 minutes, a lockout will occur. Please see Autoflame Sensors Guide for options/parameters and wiring guides on VPS and pressure limits setups. Oil: For setting 2, pressure limits are checked by an Autoflame oil sensor.
		0	Not checked
		1	Pressure limits, valve proving
		2	Pressure limits
		3	External VPS
126	0		BC: Fuel Pressure Sensor Mode – Fuel 2
			Gas: For setting 1, valve proving and pressure limits are checked by an Autoflame gas sensor. For setting 2, low pressure limit can be checked by external pressure switch. For setting 3, the system will wait for a mains voltage input on terminal 55 to confirm that the VPS test is completed. If a voltage is not detected on terminal 55 within 10 minutes, a lockout will occur. Please see Autoflame Sensors Guide for options/parameters and wiring guides on VPS and pressure limits setups. Oil: For setting 2, pressure limits are checked by an Autoflame oil sensor.
		0	Not checked
		1	Pressure limits, valve proving
		2	Pressure limits
		3	External VPS
127	0		BC: Fuel Pressure Sensor Mode – Fuel 3
			Gas: For setting 1, valve proving and pressure limits are checked by an Autoflame gas sensor. For setting 2, low pressure limit can be checked by external pressure switch. For setting 3, the system will wait for a mains voltage input on terminal 55 to confirm that the VPS test is completed. If a voltage is not detected on terminal 55 within 10 minutes, a lockout will occur. Please see Autoflame Sensors Guide for options/parameters and wiring guides on VPS and pressure limits setups. Oil: For setting 2, pressure limits are checked by an Autoflame oil sensor.
		0	Not checked
		1	Pressure limits, valve proving
		2	Pressure limits
		3	External VPS
128	0		BC: Fuel Pressure Sensor Mode – Fuel 4
			Gas: For setting 1, valve proving and pressure limits are checked by an Autoflame gas sensor. For setting 2, low pressure limit can be checked by external pressure switch. For setting 3, the system will wait for a mains voltage input on terminal 55 to confirm that the VPS test is completed. If a voltage is not detected on terminal 55 within 10 minutes, a lockout will occur. Please see Autoflame Sensors Guide for options/parameters and wiring guides on VPS and pressure limits setups. Oil: For setting 2, pressure limits are checked by an Autoflame oil sensor.
		0	Not checked
		1	Pressure limits, valve proving
		2	Pressure limits
		3	External VPS

Opt. #	Default	Range	Description
129	0		BC: VPS Operation
		0	VPS operates before start-up
		1	VPS operates after shutdown
		2	VPS operates before and after
130	2		BC: Gas Valve Configuration
		0	No vent valve
		1	Vent normally closed
		2	Vent normally open
		3	No vent valve. Single valve pilot
		4	Vent normally closed. Single valve pilot
		5	Vent normally open. Single valve pilot
131	1		BC: Fuel valve output configuration
			This sets the way multi-fuels are configured on the MM. Setting 0, allows the configuration of 4 fuels and switching between themis possible using changeover relays. Setting 1 allows 2 fuels to be configured with each fuel having its own set of outputs and switching between fuels is possible without changeover relays. Setting 2 is similar to setting 1 but with the possibility of fuel Change on the Fly (COF). See section 4 of this guide for the full details. Fuel curves must be commissioned for each fuel valve output mode. This option must be set before commissioning the MM.
		0	One set of outputs (changeover relays, 4 fuels)
		1	Two sets of outputs (no changeover relays, 2 fuels)
		2	Two sets of outputs, change on the fly (COF)*
			** requires unlock code*
132	20		BC: Gas Valve Proving Time
			This is the time period for when both gas valves are closed to detect a change in air pressure for the 'VPS air proving' phase, or change in gas pressure for 'VPS gas proving' phase.
		10 – 300	Seconds
133	25		BC: Maximum Pressure Change Allowed During VPS
			If MM detects a pressure change greater than this value, a lockout will occur. See parameter 41 for gas pressure display units.
		0 – 13400	0 mbar – 1340 mbar (value 25 = 2.5 mbar) 0" WG – 537.777" WG (value 25 = (1.003 "WG) 0 PSI – 19.435 PSI (value 25 = 0.036 PSI)
134	3		BC: VPS Valve Opening Time
			This is the time period for when the phases when a gas valve is opened – 'VPS Venting' for the void to vent to atmosphere and 'VPS Void to Gas' for the void to fill with gas.
		3 – 20	Seconds
135	0		BC: Purge Time Units/ NFPA Post-Purge
			See option/ parameter 118 for the purge timing. For setting 2, option/parameter 118 must be set to 15 seconds or higher. During the NFPA post-purge, all the servomotors will remain in the position they were in before normal shutdown or lockout. The NFPA post-purge will occur under any normal shutdown or lockout at any point in firing.
		0	Purge time in seconds
		1	Purge time in minutes
		2	NFPA post-purge in seconds
		3	NFPA post-purge in minutes

Opt. #	Default	Range	Description
136	25		BC: Gas Pressure Switch – Offset Lower Limit
		0 – 13400	This is an offset lower limit from the commissioned gas pressure, see parameter 41 for the gas pressure display units. See option/ parameter 125, 126, 127 and 128 to enable the pressure limits. When used in FSG mode, Option 136 is used while firing, instead of the commissioned gas pressure. It has to maintain a pressure of at least the Option 136 value. 0 mbar – 1340 mbar (value 25 = 2.5 mbar) 0" WG – 537.777" WG (value 25 = (1.003 "WG) 0 PSI – 19.435 PSI (value 25 = 0.036 PSI)
137	25		BC: Gas Pressure Switch – Offset Upper Limit
		0 – 13400	This is an offset upper limit from the commissioned gas pressure, see parameter 41 for the gas pressure display units. See option/ parameter 125, 126, 127 and 128 to enable the pressure limits. 0 mbar – 1340 mbar (value 25 = 2.5 mbar) 0" WG – 537.777" WG (value 25 = (1.003 "WG) 0 PSI – 19.435 PSI (value 25 = 0.036 PSI)
138	25		BC: Gas Static Line Pressure Lower Limit Offset
		0 1 – 50000	For setting 0, if the measure static line pressure during the VPS void to gas phase is below the gas pressure offset lower limit set in option/ parameter 136, a lockout will occur. If both options 136 and 138 are set to 0, then a lockout will occur if the measured static line pressure during VPS void to gas phase is below the absolute value in option 133. For setting other than 0, this measured static line pressure is checked against the value set in this option. When used in FSG mode, Option 138 controls the gas pressure required during valve proving. Option/ parameter 136 offset lower limit used 0.1 mbar – 5000 mbar (value 25 = 2.5 mbar) 0.040"WG – 2006.630"WG (value 25 = 1.003"WG) 0.001 PSI – 72.519 PSI (value 25 = 0.036 PSI)
139	-		BC: Oil Pressure Switch – Offset Lower Limit
		0 1 – 4000	The MM will check the oil pressure is not below this offset lower limit from the commissioned oil pressure, during firing. Disabled 0.001 Bar – 4.000 Bar (0.015 PSI – 58.015 PSI)
140	0		BC: Oil Pressure Switch – Offset Upper Limit
		0 1 – 4000	The MM will check the oil pressure is not below this offset lower limit from the commissioned oil pressure, during firing. Disabled 0.001 Bar – 4.000 Bar (0.015 PSI – 58.015 PSI)
141	0		BC: Air-Proving Pressure Threshold for Purge
		0 – 1200	This is the minimum air pressure that must be detected by the MM during purge, when using an Autoflame air pressure sensor. If this is set to 0, then MM will look for the minimum air pressure set in option/ parameter 149. See parameter 43 for air pressure display units. 0 mbar – 120.0 mbar (0" WG – 48.176" WG)
142	60		BC: UV Shutter Test Interval
		4 – 240	This is the time interval between shutter tests on the self-check UVscanner. See options/ parameter 110 and 122. Seconds

Opt. #	Default	Range	Description
143	0		BC: No Pre-Purge
			For setting 1, there will only be no pre-purge if the burner has recycled due to meeting operational temperature/ pressure, and the system has gone through VPS checks successfully. If the burner has a lockout, or is restarting after a lockout has been cleared, then the MM will force a pre-purge. No pre-purge is only available when the fuel is set to gas.
		0	Enabled
		1	Disabled
144	4		BC: Maximum Allowed UV Self-Check Errors
			The MM will test the flame detection of self-check UV scanner at a time interval, set in option/ parameter 142, and will generate a lockout if it has more errors than set in this option. See options/ parameters 110 and 122.
		1 – 12	Errors
145			BC: First Out Interlock
			This expansion feature will need to be unlocked to enable first out interlock. For setting 1, all of the first outs will be tied to burner safety stat circuit. They will be automatically set for active low, and then can be selected for non-recycle or recycle. Please see expansion option 110.
		0	Disabled
		1	Enabled
146	-		Unused
147	0		BC: Air Pressure Error Window
			This air pressure error window is only active during modulation; the burner will lockout if the air pressure is outside of this window.
		0 – 300	0 mbar – 30.0 mbar (0” WG – 12.040” WG)
148	0		BC: Air Pressure Sensor Type
			For setting 0, and external air pressure switch must be wired to terminal 54. If a reset of voltage is not detected within 2 minutes on terminal 54 during the ‘Wait for Air Switch’ phase before running to purge, a lockout will occur. For setting 1, the air pressure sensor will look for zero air pressure in the ‘Zero Air Sensor’ phase before running to purge. Setting 2 includes the checks made for settings 0 and 1.
		0	Air switch on T54
		1	Autoflame air pressure sensor
		2	Autoflame air pressure sensor and air switch on T54
149	10		BC: Air-Proving Pressure Threshold
			This is the minimum air pressure that must be detected by the MM during normal firing and during purge when option/ parameter 141 is set to 0, when using an Autoflame air pressure sensor. See parameter 43 for air pressure display units.
		7 – 1200	0.7 mbar – 120.0 mbar (0.281” WG – 48.176 “WG)
			Value 10 = 0.401 “WG (1.0 mbar)
150	0		BC: Fuel 1 Type
		0	Gas
		1	Oil
151	1		BC: Fuel 2 Type
		0	Gas
		1	Oil

Opt. #	Default	Range	Description
152	1		BC: Fuel 3 Type
		0	Gas
		1	Oil
153	0		BC: Fuel 4 Type
		0	Gas
		1	Oil
154	0		BC: Terminal T80 Function
			Setting 1 allows an additional safety check on the valves and damper to ensure that they are in the correct position for start/low fire. See Valves and Servomotors manual for information on setup and wiring.
		0	Not used
		1	Start Position Interlock
			Option/Parameter 154 must be set to 1: Start Position Interlock when used in flame safeguard mode.
155	0		BC: Terminal T81 Function
			For setting 1, terminal 81 acts as an input for a mechanical end stop. It must be made for the whole of the timed purge and post purge phases otherwise a lockout is generated. This input must also not be made while not at purge. For setting 2, terminal 81 acts as purge pressure proving switch input. The switch must be made continuously for the whole duration of the purge time. If it drops out, the purge timer restarts once the signal is made again. It must also not be made before the blower motor starts to confirm the input is working correctly. If this input comes on during the relay tests a lockout is generated. Option 158 adds an optional time limit for the purge pressure proving to be made.
		0	Not used
		1	Purge position interlock
		2	Purge pressure proving
			Option/Parameter 155 must be set to 1: Purge Interlock when used in flame safeguard mode.
156	-		Unused
157	0		BC: Delay to Purge (T52) Timeout
			An input on terminal 52 is required to indicate the system is ready to move toward the purge phase. If the MM does not see this input for 1 second within this time set, then a lockout will occur. Setting 0 will disable this timeout, so the MM would sit indefinitely in delay to purge.
		0	Disabled
		1 – 3600	Seconds
158	0		BC: Purge Pressure Proving (T81) Timeout
			If option/parameter 155 is set to 2, then the system will lockout if the purge pressure is not proved within the specified time. Setting to 0 will disable this timeout, so the MM will be in the purge phase indefinitely waiting for the pressure proving signal to be received on terminal 81.
		0	Disabled
		1 – 15000	Seconds
159	-		Unused
160	0		BC: Clear Commissioning Data
		5	Clear all commissioning data, options and parameters
		10	Reset all options to default values
		15	Reset all parameters to default values
		20	Reset all safety options and parameters to default values
		25	Reset all expansion options to default values

2.2 Parameters

Commission Mode

Options | Parameters | Expansion

#	Description	Value
1	DTI: Sequence Scan Time Set When Unit Goes Offline	3 minutes (00:03:00)
2	Unused: Parameter 2	0
3	DTI: Number of Boilers Initially On	10
4	EGA: Delay Before EGA Commission Can Be Stored	45 seconds
5	DTI: Modulation Timeout	4 minutes (00:04:00)
6	Unused: Parameter 6	0
7	Unused: Parameter 7	0
8	EGA: Trim Delay After Drain	30 seconds
9	Unused: Parameter 9	0
10	EGA: EGA Version	Mk8 Protocol (RS485)
11	Unused: Parameter 11	0
12	EGA: CO Used For Trim On Oil	Disabled
13	EGA: Commission Fuel-Rich Trim	5.0 %
14	EGA: Trim Reset Angular Rate	5.0 degrees per minute
15	MM: Golden Start Time	5 seconds
16	EGA: Time Between Air Calibrations	6.0 hours
17	EGA: Number Of Trims Before Limits Error Generated	3
18	EGA: Maximum Trim During Run	10.0 %
19	EGA: Commission Air-Rich Trim	5.0 %

All | MM | PID | EGA | DTI | BC

Exit

Thursday 1 June 2023 10:19:00

Figure 2.2.i Commission Mode – Parameters

Press Parameters in the Commission Mode screen to access the Parameters. Any number of options/ parameters can be changed at one time. By pressing MM, PID, EGA, DTI or BC at the bottom of the screen, the options/ parameters can be grouped together by feature.

When the changes have been made to suit the application's needs, press Exit to go back to the Commission Mode screen.

Options/ parameters 110 – 160 are the burner control settings and are safety critical; these must be entered the same for both the option and parameter value. If these BC options and parameters do not match, there will be an option/parameter conflict.

To set all the options, parameters and expansion options to the default values and erase the commissioning data, set option/ parameter 160 to 5. The MM will then automatically restart and go into Commission mode.

Par.#	Default	Range	Description
1	3		DTI: Sequence Scan Time Set When Units Goes Offline
		0 – 20	If a sequenced MM drops out of the sequence loop, there is a time delay before the next scan time. Minutes
2	-		Unused
3	10		DTI: Number of Boilers Initially On
		1 – 10	This sets the number of boilers which when powered on after a shutdown, are in the On state in the sequence loop. This should be set to the highest MM ID number (see parameter 57) if the application requires all the MMs to be On in the sequence loop when powered back on.
4	45		EGA: Delay Before EGA Commission Can be Stored
		10 – 120	During commission and single point change, there is a delay before the EGA values are stored. This value should be set in proportion to how long it takes for the gases to reach the EGA Seconds
5	4		DTI: Modulation Timeout
		1 – 50	If a sequenced MM does not start modulating after being asked to by the lead MM, it is ignored in the sequencing loop. Upon the next scan time, if the MM modulates as required, it will be included in the sequencing loop. Minutes
6	-		Unused
7	-		Unused
8	30		EGA: Trim Delay After Drain
		5 – 240	This is the delay after draining the sample, before the trim cycle start. Within this delay, the trim correction on the air damper or VSD is maintained while the EGA drains and the cells are purged with air. Seconds
9	-		Unused
10	2		EGA: EGA Version
		0	Mk7 - *For use with Mk7 EGA*
		1	Mk8 Protocol (Legacy) – *For use with Mk8 EGA*
		2	Mk8 Protocol (RS485) – *For use with Mk8 EGA EVO*
11	-		Unused
12	0		EGA: CO Used for Trim on Oil
		0	If the fuel has been set as oil (see options/ parameters 150 to 153), then the trim function can include CO to calculate the required trim correction. Disabled
		1	Enabled
13	50		EGA: Commission Fuel-Rich Trim
		20 – 75	The % of air damper movement when commissioning fuel-rich trim. 2.0% - 7.5%
14	50		EGA: Trim Reset Angular Rate
		0 – 900	This is the change time in the fuel valve angle per minute that will reset the trim correction. 0.0 – 90.0 degrees per minute

Par.#	Default	Range	Description
15	5		MM: Golden Start Time
		2 – 100	This is the time period for how long the servomotors and VSDs are held at the golden start position, see option 29. Seconds
16	12		EGA: Time Between Air Calibrations
		1 – 50	This is the time period between air calibrations if the burner does not go off. 0.5 hours – 25.0 hours
17	3		EGA: Number of Trims Before Limits Errors Generated
		0 – 10	When the combustion limits have been exceeded, the MM will make trim corrections on the air damper. If the number of these trims reaches the value set in this parameter an error will be generated. See options 19, 20, 21, 22, 23, 25, 26, 27 and parameters 94, 96 97 for limits. Number of trims
18	100		EGA: Maximum Trim During Run
		20 – 100	This is the maximum trim % of air damper movement during firing. 2.0% - 10.0%
19	50		EGA: Commission Air-Rich Trim
		20 – 75	This is the % air damper movement when commissioning the air rich trim. 2.0% - 7.5%
20	-		Unused
21	-		Unused
22	-		Unused
23	1		EGA: Add Air When CO Present
		0 1	This sets whether the trim function adds when CO is present. If the O_2 and CO_2 appear air rich but CO appears fuel rich, then the air damper will open further to remove CO. Disabled Enabled
24	120		EGA: (Mk7 Only) Air Calibration Time
		20 – 300	For the Mk8 EGA, this is set as default 6 minutes. Seconds
25	-		Unused
26	8		Trim Samples per Cycle
		1 – 50	A cycle is the period between when does the EGA carries out a drain to get rid of excess moisture in the exhaust gas sample. This parameter sets the number of trim corrections in between drains. Samples Per Cycle
27	-		Unused
28	0		MM: Internal High Limit Setpoint
		0 1 – 9990	Internal High Limit Setpoint is used to define an absolute shutdown setpoint that also operates in commission mode as well as normal running mode. Disabled ^{O}C, ^{O}F, PSI or 0.1 Bar or 0.01 Bar

Par.#	Default	Range	Description
29	1000		MM: Load Sensor Adjustment
		800 – 1200	This adjusts the load sensor (voltage) reading, as a percentage of the reading. Value 1000 = 100.0% of actual reading
30	10		MM: Load Sensor Filter Time
		1 – 40	Seconds
31	0		EGA: (Mk7 Only) Efficiency Calculation Method
			For the Mk8 EGA, efficiency calculation method is set on the EGA itself.
		0	English
		1	European
32	0		MM: User Setpoint Minimum Value
		0 - 9990	This limits the change for the minimum setpoint value in the status screen.
33	0		MM: User Setpoint Maximum Value
		0 - 9990	This limits the change for the maximum setpoint value in the status screen.
34			MM: Vendor Details Line 1
			Enter Vendor Name
35			MM: Vendor Details Line 2
			Enter Address Details (Street)
36			MM: Vendor Details Line 3
			Enter Address Details (Town / City / Zip)
37			MM: Vendor Details Line 4
			Enter Contact Details (Phone / Email Address)
38	***		MM: Commissioning Password Code 1
		0 – 255	Code 1
39	***		MM: Commissioning Password Code 2
		0 – 255	Code 2
40	0		MM: Display Units
		0	Metric units
		1	Imperial units
41	0		MM: Gas Pressure Units
			This will set the units displayed for the Autoflame gas pressure sensor optioned. Note, PSI units are not available for sensor MM80006.
		0	mbar
		1	inWG
		2	PSI
42	0		MM: Oil Pressure Units
			This will set the units displayed for the Autoflame oil pressure sensor optioned.
		0	Bar
		1	PSI
43	-		MM: Air Pressure Sensor Units
			This will set the units displayed for the Autoflame air pressure sensor.
		0	Mbar
		1	inWG

Par.#	Default	Range	Description
47	0		DTI: Standby or Phantom Setpoint Type
			Instead of a fixed setpoint when the MM is in standby mode, it would have It's current setpoint offset down by a value instead. When configured for Phantom Setpoint, the Standby Setpoint Option 42 becomes a Phantom Setpoint Offset.
		0	Use Fixed Standby Setpoint
		1	Use Phantom Setpoint Offset
48	80		PID: Integral Band
			This is the percentage of the proportional band over which the integral control is active.
		0 – 100	0% - 100%
52	0		MM: External Load Detector – Number of Decimal Places
			This affects parameter the external load detector maximum and minimum values set in parameters 53 and 55. See option 1 and parameter 40.
		0	0 decimal place
		1	1 decimal place
		2	2 decimal places
53	20		MM: External Load Detector – Maximum Value
			The scale will depend on how parameter 52 is set. See option 1 and parameter 40.
		0 – 9990	Bar (PSI) or ^{O}C (^{O}F)
			20 = 20 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 0
			20 = 2.0 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 1
			20 = 0.2 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 2
54	0		MM: External Load Detector – Maximum Voltage
		0 – 100	0.0V – 10.0V
55	20		MM: External Load Detector – Minimum Value
			The scale will depend on how parameter 52 is set. See option 1 and parameter 40.
		0 – 9990	Bar (PSI) or ^{O}C (^{O}F)
			20 = 20 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 0
			20 = 2.0 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 1
			20 = 0.2 Bar (PSI) or ^{O}C (^{O}F) if parameter 52 is set to 2
56	0		MM: External Load Detector – Minimum Voltage
		0 – 100	0.0V – 10.0V
57	10		DTI: Highest MM ID
			This sets the highest MM ID number for that sequence or DTI loop.
		1 –10	Sequence ID
58	1		EGA: Air Calibration on Startup
			For the Mk8 EGA, the air calibration schedule is set on the EGA itself.
		0	Disabled
		1	Enabled
59	-		Unused
60	60		MM: Logo Display Timer (Standby)
			If a custom logo is stored on the data SD card in the MM, then after this timer in standby mode, the custom logo will appear on the screen.
		0	Disabled
		1 – 3600	Seconds

Par.#	Default	Range	Description
61	900		MM: Backlight On Time
			If the screen is not pressed and this timer elapses, the backlight will dim.
		0	Disabled
		1 – 1800	Seconds
62	0		DTI: Hot Water Sequencing
			For setting 0 the boilers, the lag boilers will be off. For setting 1, the lag boiler will operate as steam sequencing, as set in option 41.
		0	Hot water sequencing operates normally
		1	Hot water sequencing operates as steam sequencing
63	0		DTI: Two Port Valve Output Parity
			Sets terminal #78 operation
		0	Valve Normally Open (Closed When Energised)
		1	Valve Normally Closed (Opens When Energised)
64	0		MM: Logo Display Preferences
			If enabled from Parameter 60, the custom logo will display for setting 0 & 1, for setting 2 & 3 a black screen will be used as a logo.
		0	Default Behaviour
		1	Logo Displays While Firing
		2	Use Black Screen as Logo
		3	Black Screen as Logo Displays While Firing
68	1		MM: External Modulation Control Range
			The range is set for either low fire to high fire in setting 0, or zero to high fire in setting 1. See options 45 and 55.
		0	Low to high
		1	Zero to high
69	0		MM: Auxiliary Channel Input Range
			This sets the range for external modulation & firing rate limiter input on terminals 7, 8, and 9.
		0	4 to 20mA input
		1	0 to 20mA input
		2	0 to 10V input
70	10		MM: Auxiliary Channel Filter Time
			This sets the time allowed for a reading to be taken on terminals 7, 8 and 9.
		0	Disabled
		1 – 30	Seconds
71	1		MM: Firing Rate Output Control Range
			This sets the range for firing rate output on terminals 16, 17, and 18.
		0	4-20mA, 2-10V, Low to high
		1	4-20mA, 2-10V, Zero to high
		2	0-20mA, 0-10V, Low to high
		3	0-20mA, 0-10V, Zero to high
72	0		MM: External Setpoint Input
			If enabled, terminals 7, 8, and 9 are used for external required setpoint. The range and filtering of the input is set in parameters 69 and 70. The required setpoint range is set in options 30 and 31.
		0	Disabled
		1	Enabled

Par.#	Default	Range	Description
80	0		MM: Distributed Return Temperature Shutdown Delta – T
		0 - 500	A user-defined differential temperature threshold may be configured that causes the burner to stop when breached (i.e. when the difference between inlet & outlet temperatures become too large).
81	0		MM: Distributed Return Temperature Restart Delta - T
		0 - 500	A user-defined differential temperature threshold may be configured that determines when the burner may restart following a shutdown caused by the differential temperature shutdown threshold.
82	0		MM: Distributed Return Temperature Turndown Delta – T
		0 - 500	A differential temperature threshold may be configured that determine the differential temperature at which the maximum firing rate starts to be reduced.
83	-		MM: Display Diagnostic Values
			Enabling this parameter allows the display of more detailed information in the system log.
		0	Disabled
		1	Enabled
84	0		MM: Bluetooth Module
			Enables/disables the on-board Bluetooth module for the purpose of connectivity with the Autoflame Download Manager software. See Autoflame PC Software Guide.
			To enable connectivity via the IR port, this option must be disabled, Bluetooth and IR cannot be used at the same time.
		0	Disabled
		1	Enabled
85	0		MM: Modulation Exerciser Period
			If the modulation exerciser period is enabled, then the MM will repeatedly run between high fire and low fire. This value sets how long the MM will remain at the high fire and low fire positions. This should only be used in test/inspection conditions.
		0	Disabled
		1 – 3600	Seconds
86	85		DTI: IBS Change Down Threshold
			If the combined firing rate of the last 2 MMs in the sequence loop is below this value, then the last lag MM will go from ‘on’ to the next phase(‘standby’, ‘warming’ or ‘off’) depending on how option 41 is set.
		0 – 99	0% - 99%
87	95		DTI: IBS Change Up Threshold
			If the firing rate of the last MM in the sequence loop in the ‘On’ phase is above this value, then the next MM will go to the ‘On’ phase upon the next sequence scan time, to meet the load demand.
		0 – 100	0% - 100%
88	1000		MM: Outside Temperature Sensor Adjustment
			If the outside temperature reading is too high, then decrease this value. If the outside temperature reading is too low, then increase this value.
		500 – 2000	50.0% - 200.0%

Par.#	Default	Range	Description
89			MM: Stat Exerciser Period
			If the stat exerciser period is enabled, then T53 will be turned off for this timer set, and then turned off for this timer set, repeatedly. This should be used in test/inspection conditions.
		0	Disabled
		1 – 3600	Seconds
90	0		MM: VSD Minimum Feedback Variation Check (Fuel 1)
			Enable/disable VSD feedback variation tests for fuel 1.
		0	Enabled
		1	Disabled
91	0		MM: VSD Minimum Feedback Variation Check (Fuel 2)
			Enable/disable VSD feedback variation tests for fuel 2.
		0	Enabled
		1	Disabled
92	0		MM: VSD Minimum Feedback Variation Check (Fuel 3)
			Enable/disable VSD feedback variation tests for fuel 1.
		0	Enabled
		1	Disabled
93	0		MM: VSD Minimum Feedback Variation Check (Fuel 4)
			Enable/disable VSD feedback variation tests for fuel 1.
		0	Enabled
		1	Disabled
94	0		EGA: NO Upper Limit Offset
			If the current NO value is above this offset limit from the commissioned value, an alarm/ warning (see option 13) will occur, for option 12 set to 3.
		0	Disabled
		1 – 200	1 – 200 ppm NO
95	-		Unused
96	0		EGA: Exhaust Temperature Upper Limit Offset
			If the current exhaust temperature value is above this offset limit from the commissioned value, an alarm/ warning (see option 13) will occur, for option 12 set to 3. See parameter 40.
		0	Disabled
		1 – 999	1 – 999 deg^{O}C or deg^{O}F
97	0		EGA: Exhaust Temperature Absolute Limit
			If the current exhaust temperature value is above this absolute limit, an alarm/ warning (see option 13) will occur, for option 12 set to 3. See parameter 40.
		0	Disabled
		1 – 999	1 – 999 ^{O}C or ^{O}F
98	-		Unused
99	1		MM: Graceful Shutdown
			If enabled, when the fuel is deselected, the fuel valve outputs are de-energised, and then a post-purge occurs before the MM restarts. This must not be used if changeover relays are used on the system. Graceful shutdown cannot be used with assured low fire shut off in parameter 100. Cannot be used with DFOM or COF (option/parameter 131 setting 1 & 2).
.		0	Disabled
		1	Enabled

Par.#	Default	Range	Description
100	0		MM: Assured Low Fire Shut Off
			If enabled, when the burner turns off on internal stat, the MM will modulate to low fire, shut down and recycle the system before turning off. Assured low fire shut off cannot be used with graceful shutdown in parameter 99.
		0	Disabled
		1	Enabled
101	0		DTI: Shuffle Sequencing
			This allows the sequence order to be changed remotely through the DTI or Modbus. See option 16 and expansion option 100.
		0	Disabled
		1	Enabled
102	-		Unused
103	0		MM: Air Pressure Warning Lower Offset
		0 – 1000	This is an offset lower limit from the commissioned air pressure. 0 mbar – 100 mbar
104	0		MM: Air Pressure Warning Upper Offset
		0 – 1000	This is an offset upper limit from the commissioned air pressure. 0 mbar – 100 mbar
105	0		MM: Gas Pressure Warning Lower Offset
		0 – 13400	This is an offset lower limit from the commissioned gas pressure, see parameter 41 for the gas pressure display units. These limits are also tested during main flame proving. See option/parameter 125, 126, 127, 128 to enable the pressure limits. A warning will be generated if the measured static line pressure during the VPS void to gas phase is below the absolute value in option 133. 0 mbar (disabled) – 1340 mbar 0 inWG (disabled) – 537.777 inWG 0 PSI (disabled) – 19.435 PSI
106	0		MM: Gas Pressure Warning Upper Offset
		0 – 13400	This is an offset upper limit from the commissioned gas pressure, see parameter 41 for the gas pressure display units. These limits are also tested during main flame proving. See option/parameter 125, 126, 127, 128 to enable the pressure limits. 0 mbar (disabled) – 1340 mbar 0 inWG (disabled) – 537.777 inWG 0 PSI (disabled) – 19.435 PSI
107	***		MM: Online Changes Password Code 1
		0 – 255	Code 1
108	***		MM: Online Changes Password Code 2
		0 – 255	Code 2

Par.#	Default	Range	Description
109	0		MM: Software Voltage Conditioner
			The MM performs internal tests to ensure that the mains power is safe for the unit to operate (zero crossing and mains input tests). When these tests return a negative result the MM generates a fault. This parameter governs the way the MM handle these tests results; setting 1 makes the MM more tolerant to the mains power instability while setting 2 disables the errors altogether. ***Note:*** *Setting 2 should only be used temporarily while investigating and correcting the cause of mains power instability. Running the MM continually on unstable power can degrade the MM and cause permanent damage to the unit.*
		0	Standard
		1	Increased
		2	Errors Disabled

Parameters 110 – 160 are a repeat of their corresponding options and will need to have the same value.

It is the responsibility of the commissioning engineer to ensure that all settings are set in accordance with the appropriate standards, local codes and practices. If options 110 – 160 are not identical with the parameters 110 – 160, then the MM will go straight to Commissioning Mode and an option/ parameter conflict message will appear.

2.3 Language

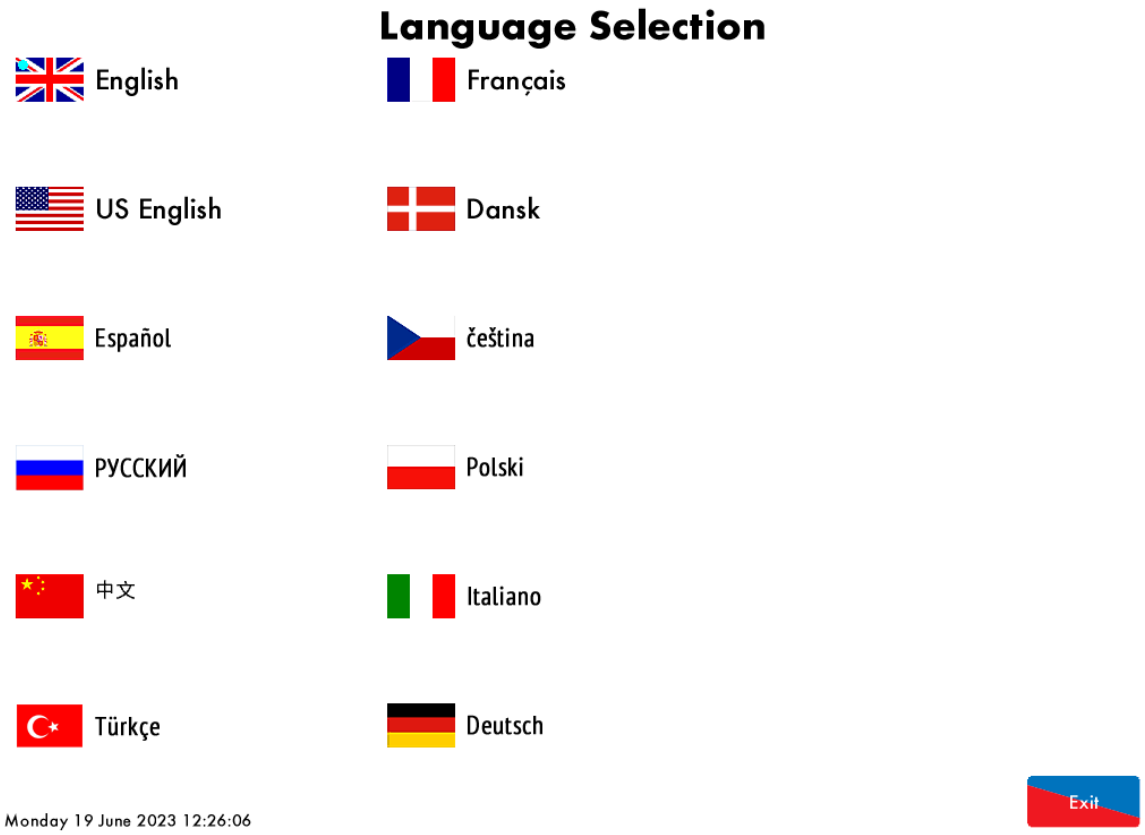


Figure 2.3.i Language Selection

Press Language in the System Configuration screen in Figure 2.3.i to access Language Selection screen; you will be prompted to enter the Online Changes password. Please contact your local approved Autoflame tech centre for this password.

Note: The SD card must contain the language file to be able to select the language. If a language required is not available, please contact the Autoflame office.

2.4 Set Clock

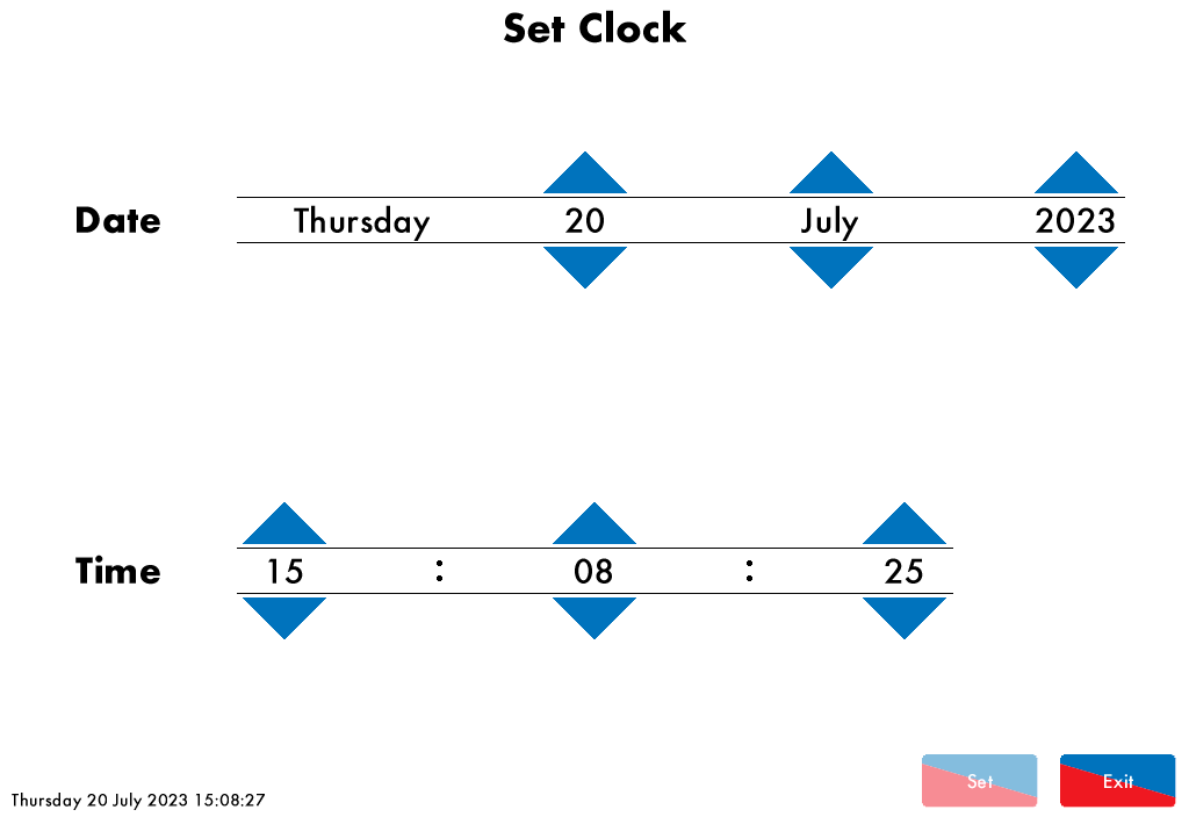


Figure 2.4.i Set Clock

Press Set Clock in the System Configuration screen in Figure 2.4.i to access the Set Clock screen; you will be prompted to enter the password (10, 10). Change the time and data using the ▼ ▲ arrows then press Set and then press Exit.

3 CONFIGURING THE AUTOFLAME FLAME SAFEGUARD UNIT

3.1 Overview



WARNING

Fire, Explosion or Electrical Shock Hazard. Can cause severe injury, death or property damage.

1. **Use extreme care while installing and testing the system. Live voltage is present on most terminal connections when the power is on.**
2. **Switch off the unit power before installing or removing the backplate cover and/or any of the plug-in wiring connectors.**
3. **Replace all limits and interlocks not operating properly.**
4. **Do not bypass limits and interlocks.**
5. **Close all manual fuel shutoff valve(s) before starting any tests.**



FIRE OR EXPLOSION HAZARD

Can cause severe injury, death or property damage. To prevent possible hazardous burner operation, perform verification of safety requirements each time a control is installed on a burner.

Do not allow fuel to accumulate in the combustion chamber. If fuel is allowed to enter the chamber for longer than a few seconds without igniting, an explosive mixture could result. It is recommended that you limit the trial for pilot to ten seconds, and limit the attempt to light the main burner to two seconds from the time the fuel has reached the burner nozzle. In any case, do not exceed the nominal lightoff time specified by the equipment manufacturer. Close the manual shutoff valve(s) if the flame is not burning at the end of the specified time.

PRELIMINARY INSPECTION

Perform the following inspections to avoid common problems.
Make certain that:

1. **The wiring connections are correct and all terminal screws are tight.**
2. **The flame detector(s) is clean, installed and correctly positioned. Consult the Autoflame Flame Scanner guide for instructions.**
3. **The burner is completely installed and ready to fire; consult equipment manufacturer instructions.**
4. **The fuel lines are purged of air.**
5. **The combustion chamber and flues are clear of fuel and fuel vapour.**
6. **Power is connected through a safety shut-off switch.**
7. **Lockouts on the Flame Safeguard controller are reset.**
8. **All limits and interlocks are reset.**

3.1.1 Single Servo Burner Set up

In order to drive the servo motor to the purge and start positions and to allow a load sensor to take over control once firing, the outputs and inputs used in Flame Safeguard Mode are as follows:

Outputs:

- T70 (Switched Neutral) is the High/Low Initiate output.
- T71 (Switched Neutral) is the Release to Modulate output.
    - When T71 is low, and T70 is High, the motor moves to Purge.
    - When T71 is Low and T70 is Low, the motor moves to Light Off.
    - When T71 is High, the Motor releases to Modulate via the external Pressure sensor.

Inputs:

- Input T80 is the Low/Fire Start Switch, which is made when the motor start position mechanical switch has been made.
- Input T81 is the High Fire/Purge Switch, which is made when the motor purge position mechanical switch has been made.

The wiring is to be completed as shown in the schematic in section 1.2.1. The Relay Box (SP80070, SP80070/110) is available from Autoflame to provide all the correct connections for ease of installation. If using other relays, ensure that you conform to the wiring schematic provided.

3.1.2 On/Off Burner Set up

With a simple On/Off burner, The wiring is simplified to provide the following outputs and inputs:

Outputs:

- T70 (Switched Neutral) is the High/Low Initiate output. This starts a timer relay when high to initiate the purge sequence after a short delay and confirms the start position when it goes low.

Inputs:

- T80 is the Low/Fire Start Switch, which is made when the timer relay is driven low.
- T81 is the High Fire/Purge Switch, which is made after a delay of 5 seconds when the timer relay is driven high.

The wiring is to be completed as shown in the schematic in section 1.2.2. A simple ON-delay timer relay such as Allen-Bradley 700-FEA6TU23 or 700-FEM6TU23 set in mode (A) with a 5 second delay is required.

3.1.3 Wiring Checks

Important Note: Do not wire these outputs to a servo, since driving a servo in both directions at the same time would result in damage and must be avoided.

On a newly installed system the following procedures should be carried out as listed:

1. Check all interconnecting wiring between the Flame Safeguard unit and external components is correct.
2. Set the options and parameters required (refer to sections 2.1 and 2.2).



Improper use may result in property damage, serious physical injury or death.

The configuring procedure as described must be strictly adhered to. Anybody configuring a flame safeguard system must have an adequate understanding of combustion plant. In the wrong hands hazardous conditions could be made to exist. The Autoflame products must only be installed, set up, commissioned and adjusted by an Autoflame certified technical engineer.

Please make sure that you fully read and understand the safety notes section before starting the configuration process.

3.2 Installation Checks



WARNING

Electrical Shock Hazard, Fire or Explosion Hazard. Can cause severe injury, death or property damage.

1. **Use extreme care while testing the system. Voltage is present on most terminal connections when power is on.**
2. **Isolate the power before removing or installing the Autoflame Flame Safeguard Controller.**
3. **Make sure all manual fuel shutoff valve(s) are closed before starting the initial lightoff check and the Pilot Turndown tests.**
4. **Do not put the system in service until you have satisfactorily completed all applicable tests as required by regulations and the equipment manufacturer.**

3.2.1 Configuration Checks

When all the installation and burner adjustments are completed, the entire burner control system including the Flame Safeguard should be tested in accordance with the manufacturer's instructions. The procedure should verify the correct operation of:

1. Each operating control (temperature, pressure etc.)
2. Each limit switch (temperature, pressure, low water cut-off, etc.)
3. Each interlock switch (airflow switch, high and low fuel pressure or temperature switches, purge and low fire switches, fuel valve proof of closure interlock etc.)
4. Pilot flame failure response and lockout.
5. Main flame failure response and lockout.
6. Tight shut-off for all valves.

3.2.2 Operational Checks

1. Close manual main shut-off valve.
2. Check all limit circuit wiring for proper operation and correct connection.
3. Confirm that the automatic main fuel valves are wired correctly.
4. Power the control and electronically check the proper sequence of operation.
5. After assuring yourself that all the interlocks and valves are properly wired and that the sequence of operation is correct, open the manual main shut-off fuel valve and proceed cautiously through the boiler light off process. Check all safety interlocks for proper shutdown of the boiler.

3.2.3 Installation Precautions

The reliability of the equipment may be impaired if used in environments where strong electromagnetic fields exist e.g. if the equipment is installed in a boiler house where radio systems exist then additional EMC (Electro Magnetic Compatibility) measures may have to be considered. Please contact Autoflame for more information.

3.2.4 Maintenance and Servicing

The Micro-Modulation unit uses solid state technology. It requires no routine maintenance.

The gas/oil valves do require routine maintenance. Any fault associated with these parts isusually diagnosed by the MM. Contact Autoflame for preventative maintenance procedures, please refer to the Valves and Servomotors manual for general checks.

4 GENERAL FEATURES

4.1 No Pre-Purge

It is possible to minimise the burner start-up time by bypassing the pre-purge. The major advantage of this control means that the overall boiler efficiency is increased by minimising the heat loss to the stack during a purge cycle. This means the burner starts-up quicker therefore reaching setpoint in a reduced time. According to the EN676 European regulation, the burner is allowed to restart without a pre-purge if the burner has recycled due to operational temperature/pressure. When the burner is stopped by a lockout then this procedure is not allowed, and the burner will have to start-up as normal with a pre-purge. In order for no pre-purge to be active, valve proving must take place and finish successfully. If this valve proving operation is successful, then the burner may start-up without a pre-purge.

In order to initiate the no pre-purge feature, option/ parameter 143 must be set to a value of 1. During the first start-up the burner will start with a pre-purge initiated. Once the complete commissioning curve has been entered and the burner has started successfully, the burner will then start-up every time with no pre-purge. If the burner goes above its setpoint and turns off on high temperature/ pressure, then the next time the burner starts-up, it will go through the VPS operation and then light off without a pre-purge, i.e. the burner has shut down in a controlled manner and the gas valves have been checked for integrity.

According to the EN676 regulation, the burner is only allowed to work in this manner if VPS operation has been set to operate before the burner starts up; option/parameter 129 must be set to 0.

The start sequence without pre-purge is as follows:

1. Firstly, the system goes through its internal tests and relay checks.
2. Call for heat on Terminal 57 activates and the system will go through the VPS operation.
3. If this operation is successful, then the MM will drive the channels to the light off or start position.
4. Once all channels reach the start position then the burner will light off.

If the burner shuts down in an abrupt manner, e.g. loss of power to the unit, then the next time the burner starts-up a complete purge will be initiated.

If no pre-purge is enabled in option/parameter 143, and one or more of the following conditions occur, the next time the burner starts up, a complete pre-purge will be initiated:

- Burner lockout
- Loss of power to the MM
- VPS checks have failed
- MM has been in standby for 24 hours or more

Note: Pre-purge is only available on fuels which are optioned as gaseous.

4.2 Autoflame Flame Safeguard Flame Detection Using Flame Switch

The Mk8 MM can utilise an external flame switch for the purpose of flame detection. To configure operation with a flame switch, option/parameter 122 can be set to 1.

The operation of Terminals 85 and 86 will be as follows:

- When the flame switch indicates no flame, the voltage on Terminal 85 must be 0Vac, and the voltage on Terminal 86 must be mains voltage (110/230Vac).

- When the flame switch indicates the presence of a flame, the voltage on Terminal 85 must be mains voltage (110/230Vac), and the voltage on Terminal 86 must be 0Vac.

Terminal 85 is the functional input for detecting the flame.

Terminal 86 is solely for the purpose of checking that Terminal 85 is operating correctly.

Terminal 86 must be seen to be the inverse of Terminal 85, i.e. if Terminal 85 is at 0Vac, Terminal 86 must be at mains voltage and if Terminal 85 is at mains voltage, Terminal 86 must be at 0Vac.

If Terminal 86 does not follow the inverse of Terminal 85 ‘Terminal 86 inverse’ error will be triggered.

Important notes:

- Within the Flame Safeguard unit, there is a latency of 250 milliseconds on the monitoring of Terminal 85. To ensure a 1 second overall flame failure response time, it is essential that the response time of the flame switch is set to no more than 750 milliseconds.

- Flame switches often provide a volt free changeover contact to indicate the flame status. Alternatively, they may provide a pair of `inverse’ outputs. If the flame switch only provides a single output terminal, a relay will have to be installed between the flame switch and the MM to provide a set of volt free changeover contacts.

4.3 Terminals 80 and 81 Functions

4.3.1 T80 Functions

Option/parameter 154 controls the function of terminal 80 and must be set to 1: Start Position Interlock when used in flame safeguard mode.
Setting it to other values will result in an Options/Parameters mismatch lockout.

Start position interlock	Terminal 80 acts as a live input in response to a mechanical end stop. Allows an additional safety check on the valves and damper to ensure that they are in the correct position for start/low fire using end limit switch. Please check Autoflame Valves Guide for further details. When set up as an On/Off burner this is a live input after the completion of the purge sequence to initiate the start-up process.

4.3.2 T81 Functions

Option/parameter 155 controls the function of terminal 81 and must be set to 1: Purge Interlock when used in flame safeguard mode.
Setting it to other values will result in an Options/Parameters mismatch lockout.

Purge interlock	Terminal 81 acts as a live input in response to a mechanical end stop. It must be made for the whole of the timed purge and post purge phases, otherwise a lockout is triggered. This input must not be made while not at purge. When set up as an On/Off burner this is a live input after a 5 second delay to run the burner start up purge sequence.

4.4 Valve Proving with Autoflame Gas Sensor

There's an option to use a Autoflame Gas Sensor, for valve proving. This is enabled using option 125/126/127/128 by selecting "1", Pressure Limits, Valve Proving. The Gas Pressure sensor doesn't require for it to be commissioned, when used for Flame Safeguard mode.

In this mode, valve proving takes place as normal with the usual rules and limits. Once the Flame Safeguard unit reaches firing, where the running gas pressure would normally be tested against commissioned values, it is instead tested against an absolute low limit (Option/Parameter 136).

This is at least 3 mbar, but will also take the value of Option/Parameter 136 Gas Pressure Switch Offset Lower Limit if optioned, so any desired low gas pressure limit can be entered here.

The gas pressure tests done in Flame Safeguard mode will use both Options/Parameters 136 and 138. Option 138 controls the gas pressure required during valve proving. Option 136 is used while firing, instead of the commissioned gas pressure it has to maintain a pressure of at least the Option 136 value, which is normally the lowest that the commissioned pressure is allowed to be.

Please Note: Although External VPS may be used, there's no mains valve proving switch, on the Autoflame Flame Safeguard unit (MM80001/FSG).

5 EXPANSION FEATURES

The Mk8 MM Expansion Features allow additional boiler operations to be controlled using the Autoflame Flame Safeguard unit. Most operations related to the boiler can be controlled using the MM80001/FSG Expansion Features.

The following expansion features are available on the Autoflame Flame Safeguard unit:

Expansion Feature	Part Number
Autoflame Water Level	MK8001
Analogue Water Level (requires Autoflame Water Level)	MK8002
Top Blowdown	MK8003
Bottom Blowdown	MK8004
Draught Control	MK8005
Direct Modbus	MK8006
First Out Annunciation	MK8007
Fully Metered Combustion System	MK8008
Heat Flow (Steam Flow + Hot Water Flow)	MK8009
Fuel Change On the Fly (COF)	MK8010
Setpoint Schedule	MK8011
Setpoint Programs	MK8012
Flame Safeguard Unlock	MK8013

Expansion Features can be unlocked by uploading an unlock code to the MM80001/FSG via Autoflame Download Manager software. The unlock code is unique for each Expansion Feature and for each MM serial number, the unlock code is issued for the MM based on the serial number of that MM and will not work on any other MM.

Multiple Expansion Features can be unlocked at the same time by uploading multiple codes to the MM at the same time. Please see Autoflame PC Software Guide for more details on unlocking Expansion Features.

In commissioning mode, Expansion Features can be enabled, disabled or configured according to the system's requirements. Press 

in the Commission Mode screen to access all the MM Expansion Options.

Non safety-critical Expansion Options can be setup or changed through Online Changes which requires entering the Online Changes passcode.

The Expansion Options can be viewed in read-only while in Flame safeguard mode. From the home screen, press 

and then 

to view the Expansion Options.

By pressing WLC, TBD, BBD, DC, Modbus FO, Flow, FM, Temp at the bottom of the screen, the options can be grouped together by the Expansion Feature.

When changes have been made to suit the application's needs, press 

to go back to the Commission Mode screen.

Direct Modbus & First Outs are the only Expansion features, that can be used for the Autoflame Flame Safeguard unit. For details on other unlock codes, please check the specific expansion feature's section for the relevant expansion options in the Mk8 MM manual.

To set all the options, parameters and expansion options to the default values and erase the commission data set option/ parameter 160 to 5. The MM will automatically restart.

6 DIRECT MODBUS

6.1 Overview

The Mk8 MM can be accessed remotely in one of the following two ways:

- Direct Modbus access from the Mk8 MM.
- Through a Mk8 DTI connected to the Mk8 MM.

If Direct Modbus is used on the Mk8 MM (for example connecting the MM directly to a Building Management System - BMS), then neither Autoflame Intelligent Boiler Sequencing (IBS) nor the DTI can be used on that MM. A Mk8 DTI is required if IBS and Modbus are required at the same time.

There are a limited number of Modbus addresses available on the Mk8 MM which can be accessed directly without using a DTI.

6.2 Direct Modbus Expansion Options

The table below shows the Expansion Options used for configuring Direct Modbus.

#	Default	Range	Description
100	0		Modbus: Sequencing/DTI or Modbus Function
			If Direct Modbus is enabled, then option 16 must be set to 0, as Intelligent Boiler Sequencing cannot be used with direct Modbus.
		0	MM/DTI Sequencing
		1	Modbus
101	0		Modbus: Modbus Baud Rate
			The Baud Rate on the MM should be set the same as the Baud Rate used on the external Modbus communication program.
		0	9600 Baud
		1	19200 Baud
102	0		Modbus: Modbus Parity Setting
			The parity on the MM should be set the same as the baud rate used on the external Modbus communication program.
		0	No parity
		1	Odd parity
		2	Even parity
103	1		Modbus: Modbus Stop Bits Setting
			The stop bits on the MM should be set the same as the baud rate used on the external Modbus communication program.
		1	1 Stop Bit
		2	2 Stop Bits
104	1		Modbus: Modbus Device ID
			This ID is used to recognise the device on the external Modbus communication program.
		1 – 247	ID number
105	0		Modbus: Modbus Data Format
			The binary format on the MM should be set the same as the baud rate used on the external Modbus communication program.
		0	Binary format
		1	ASCII format
106	0		MM: MM Status Modbus Address 30102 Function
			Setting 0 means Modbus shows 1 for Firing or 0 for not Firing. Setting 1 means Modbus shows a value describing the current MM state. For more details for setting 1, see section 6.4.1.
		0	Modbus address 30102 shows Firing Status
		1	Modbus address 30102 shows MM State

6.3 Setup and Configuration

Up to 10 MMs can be linked together and connected to any Management System that supports Modbus protocol via terminals 27 and 28. Each Mk8 MM needs to be set with an individual Modbus Device ID in expansion option 104.

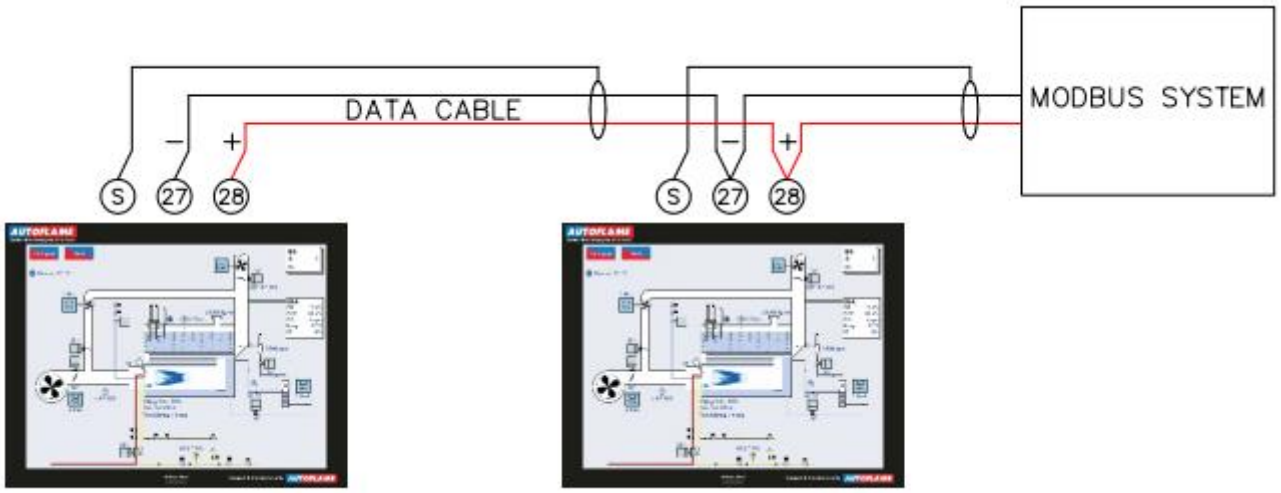
The following expansion options need to be set on the Mk8 MM for to configure Direct Modbus.

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

The MM communicates using an RS485 data link from terminals 27 (-ve) and 28 (+ve), the connection must be screened from the MM side only. Belden 9501 data cable is recommended for the communication.

The following terminals are used for Direct Modbus.

Terminal	Description
27	RS485 -
28	RS485 +
S	Screen



The maximum block of addresses the 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 check the Modbus settings on your Modbus device before configuring it with the Mk8 MM.

6.4 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 1 position Modbus value is 900 which is equivalent to 90.0°.

Address Type: RWD = Read / Write Digital
RD = Read Digital
RWA = Read / Write Analogue
RA = Read Analogue

#	Type	Description	Details
00001	RWD	Enable/Disable MM	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
10001	RD	Heartbeat	0 = No Comms 1 = Comms Output toggles every 500ms to show the unit it is functioning.
10194	RD	Running Interlock Status	0 = Running interlock (T53) is off 1 = Running interlock (T53) is on
10217	RD	EGA Trim Optioned	0 = Trim not optioned 1 = Trim optioned Returns value 0 when option 12 is set for monitoring only.
10218	RD	EGA is Trimming	0 = EGA not trimming 1 = EGA is trimming Returns value 0 is actual temperature/pressure is below trim threshold
10219	RD	EGA Cooler Ready	0 = Cooler is ready 1 = Cooler is not ready Returns value 0 if EGA is in error state
10220	RD	EGA Ambient Temp OK	0 = Temperature OK 1 = Temperature not OK
10221	RD	EGA NO_2 On	0 = NO_2 cell not optioned 1 = NO_2 cell optioned See option 36, valid for Mk7 EGA only
10222	RD	EGA SO_2 On	0 = SO_2 cell not optioned 1 = SO_2 cell optioned See option 36, valid for Mk7 EGA only
10224	RD	EGA OK to Sample	0 = EGA is not sampling 1 = EGA is sampling
10233	RD	Hand Mode	0 = MM not in hand mode 1 = MM in hand mode
10234	RD	Low Flame Hold	0 = MM not in low flame hold 1 = MM in low flame hold
10242	RD	Disabled Status	0 = Burner enabled 1 = Burner disabled Returns state of enable/disable button on MM home screen and same value as address 00001

#	Type	Description	Details
12001	RD	Water Level Optioned	0 = Water level not optioned 1 = Water level optioned
12002	RD	Units Imperial or Metric	0 = Imperial 1 = Metric
12003	RD	Feedwater Pump State	0 = Pump off 1 = Pump on
12004	RD	TDS Units	0 = ppm 1 = µS/cm
12005	RD	Water Level Ready	0 = No, water level is not optioned or a water level fault is active 1 = Yes, requires water level to be optioned and no waterlevel faults
12006	RD	TDS Optioned	0 = TDS not optioned 1 = TDS optioned
12007	RD	First Out 1 State	0 = First Out 1 not active 1 = First Out 1 active (does not mean first out has been cleared)
12008	RD	First Out 2 State	0 = First Out 2 not active 1 = First Out 2 active (does not mean first out has been cleared)
12009	RD	First Out 3 State	0 = First Out 3 not active 1 = First Out 3 active (does not mean first out has been cleared)
12010	RD	First Out 4 State	0 = First Out 4 not active 1 = First Out 4 active (does not mean first out has been cleared)
12011	RD	First Out 5 State	0 = First Out 5 not active 1 = First Out 5 active (does not mean first out has been cleared)
12012	RD	First Out 6 State	0 = First Out 6 not active 1 = First Out 6 active (does not mean first out has been cleared)
12013	RD	First Out 7 State	0 = First Out 7 not active 1 = First Out 7 active (does not mean first out has been cleared)
12014	RD	First Out 8 State	0 = First Out 8 not active 1 = First Out 8 active (does not mean first out has been cleared)
12015	RD	First Out 9 State	0 = First Out 9 not active 1 = First Out 9 active (does not mean first out has been cleared)
12016	RD	First Out 10 State	0 = First Out 10 not active 1 = First Out 10 active (does not mean first out has been cleared)
12017	RD	First Out 11 State	0 = First Out 11 not active 1 = First Out 11 active (does not mean first out has been cleared)
12018	RD	First Out 12 State	0 = First Out 12 not active 1 = First Out 12 active (does not mean first out has been cleared)
12019	RD	First Out 13 State	0 = First Out 13 not active 1 = First Out 13 active (does not mean first out has been cleared)
12020	RD	First Out 14 State	0 = First Out 14 not active 1 = First Out 14 active (does not mean first out has been cleared)
12021	RD	First Out 15 State	0 = First Out 15 not active 1 = First Out 15 active (does not mean first out has been cleared)

#	Type	Description	Details
12022	RD	First Out 1 Not Reset	0 = No First Out 1 Errors, 1= First Out 1 needs to be Reset
12023	RD	First Out 2 Not Reset	0 = No First Out 2 Errors, 1= First Out 2 needs to be Reset
12024	RD	First Out 3 Not Reset	0 = No First Out 3 Errors, 1= First Out 3 needs to be Reset
12025	RD	First Out 4 Not Reset	0 = No First Out 4 Errors, 1= First Out 4 needs to be Reset
12026	RD	First Out 5 Not Reset	0 = No First Out 5 Errors, 1= First Out 5 needs to be Reset
12027	RD	First Out 6 Not Reset	0 = No First Out 6 Errors, 1= First Out 6 needs to be Reset
12028	RD	First Out 7 Not Reset	0 = No First Out 7 Errors, 1= First Out 7 needs to be Reset
12029	RD	First Out 8 Not Reset	0 = No First Out 8 Errors, 1= First Out 8 needs to be Reset
12030	RD	First Out 9 Not Reset	0 = No First Out 9 Errors, 1= First Out 9 needs to be Reset
12031	RD	First Out 10 Not Reset	0 = No First Out 10 Errors, 1= First Out 10 needs to be Reset
12032	RD	First Out 11 Not Reset	0 = No First Out 11 Errors, 1= First Out 11 needs to be Reset
12033	RD	First Out 12 Not Reset	0 = No First Out 12 Errors, 1= First Out 12 needs to be Reset
12034	RD	First Out 13 Not Reset	0 = No First Out 13 Errors, 1= First Out 13 needs to be Reset
12035	RD	First Out 14 Not Reset	0 = No First Out 14 Errors, 1= First Out 14 needs to be Reset
12036	RD	First Out 15 Not Reset	0 = No First Out 15 Errors, 1= First Out 15 needs to be Reset

#	Type	Description	Details
30101	RA	Load Index	Firing rate %
30102	RA	Firing Status	0 = Non-modulating 1 = Modulating Returns value 0 single point change, fuel flow metering and commissioning *For Setting 1 see section 6.4.1
30104	RA	Burner Rating	MW x 10 Metric units determined from fuel flow metering
30105	RA	Actual Value	Imperial: temperature °F, pressure PSI, low pressure PSI x 10
30106	RA	Required Value	Metric: temperature °C, pressure Bar x 10, low pressure Bar x 100 Imperial: temperature °F, pressure PSI, low pressure PSI x 10
30107	RA	Selected Fuel	0 = Fuel 1 1 = Fuel 2 2 = Fuel 3 3 = Fuel 4
30109	RA	Channel 1 Position	Degrees x 10 Range is -6.0° to 96.0°
30110	RA	Channel 2 Position	Degrees x 10 Range is -6.0° to 96.0°
30111	RA	Channel 3 Position	Degrees x 10 Range is -6.0° to 96.0°
30112	RA	Channel 4 Position	Degrees x 10 Range is -6.0° to 96.0°
30113	RA	MM Error Number	0 = System is does not have an error N = error number, check error codes
30114	RA	Multi-Burner ID	MM ID number set in option 44
30115	RA	EGA Current O_2 Value	% x 10
30116	RA	EGA Current CO_2 Value	% x 10
30117	RA	EGA Current CO Value	ppm x 10
30118	RA	EGA Current Exhaust Gas Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30119	RA	EGA Current Efficiency Value	% x 10
30120	RA	EGA Current NO Value	ppm x 10
30121	RA	EGA Current SO_2 Value	ppm x 10
30122	RA	EGA Commissioned O_2 Value	% x 10
30123	RA	EGA Commissioned CO_2 Value	% x 10
30124	RA	EGA Commissioned CO Value	ppm x 10
30125	RA	EGA Commissioned Exhaust Gas Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30126	RA	EGA Commissioned Efficiency Value	% x 10
30127	RA	EGA Commissioned NO Value	ppm x 10
30128	RA	EGA Commissioned SO_2 Value	ppm x 10
30129	RA	EGA Error Code	0 = EGA does not have a fault, N = EGA error
30130	RA	Minimum Remote Setpoint	Metric: temperature °C, pressure Bar x 10, low pressure mbar x 100 Imperial: temperature °F, pressure PSI, low pressure PSI x 10
30131	RA	Maximum Remote Setpoint	Metric: temperature °C, pressure Bar x 10, low pressure mbar x 100 Imperial: temperature °F, pressure PSI, low pressure PSI x 10

#	Type	Description	Details
30132	RA	Current Flow Thousands	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	RA	Current Flow Millions	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	RA	Fuel 1 Flow Total Thousands	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	RA	Fuel 1 Flow Total Millions	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	RA	Fuel 1 Flow Total Billions	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	RA	Fuel 2 Flow Total Thousands	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	RA	Fuel 2 Flow Total Millions	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
30139	RA	Fuel 2 Flow Total Billions	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	RA	Fuel 3 Flow Total Thousands	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	RA	Fuel 3 Flow Total Millions	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	RA	Fuel 3 Flow Total Billions	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	RA	EGA Current Ambient Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30144	RA	EGA Current Delta Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30145	RA	EGA Commissioned Ambient Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30146	RA	EGA Commissioned Delta Temperature	Metric: temperature x 10 °C Imperial: temperature x 10 °F
30147	RA	UV Counts	Returns value displayed on MM
30148	RA	IR Counts	Returns value displayed on MM

#	Type	Description	Details
30149	RA	Flame Switch Status	0 = Off 1 = On
30150	RA	EGA Current NO_2 Value	ppm x 10
30151	RA	EGA Commissioned NO_2 Value	ppm x 10
30801	RA	Fuel 4 Flow Total Thousands	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
30802	RA	Fuel 4 Flow Total Millions	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
30803	RA	Fuel 4 Flow Total Billions	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
30804	RA	VSD 1 Output	mA x 10 or V x 10
30805	RA	VSD 1 Input	mA x 10 or V x 10
30806	RA	VSD 2 Output	mA x 10 or V x 10
30807	RA	VSD 2 Input	mA x 10 or V x 10
30808	RA	Channel 7 Position	Degrees x 10 Range is -6.0° to 96.0°
30830	RA	Lockout Number	0 = System is not in lockout N = lockout number
30831	RA	Fuel 1 Type	0 = Gas 1 = Oil Option / Parameter 150 value
30832	RA	Fuel 2 Type	0 = Gas 1 = Oil Option / Parameter 151 value
30833	RA	Fuel 3 Type	0 = Gas 1 = Oil Option / Parameter 152 value
30834	RA	Fuel 4 Type	0 = Gas 1 = Oil Option / Parameter 153 value
30839	RA	Fuel 1 Hours Run	Completed hours
30840	RA	Fuel 2 Hours Run	Completed hours
30841	RA	Fuel 3 Hours Run	Completed hours
30842	RA	Fuel 4 Hours Run	Completed hours
30843	RA	Fuel 1 Start-ups	Number of start-ups on Fuel 1
30844	RA	Fuel 2 Start-ups	Number of start-ups on Fuel 2
30845	RA	Fuel 3 Start-ups	Number of start-ups on Fuel 3
30846	RA	Fuel 4 Start-ups	Number of start-ups on Fuel 4
30847	RA	Current Air Pressure	mbar x 10 “wg x 10 Parameter 43 value
30849	RA	Current Gas Pressure	mbar x 10 “wg x 10 PSI x 100 Parameter 41 value
32001	RA	Capacitance Probe 1 Signal	Hz reading
32002	RA	Capacitance Probe 1 Reading on MM	Metric: mm Imperial: inches x 10

#	Type	Description	Details
32005	RA	Capacitance Probe 2 Signal	Hz reading
32006	RA	Capacitance Probe 2 Reading on MM	Metric: mm Imperial: inches x 10
32009	RA	Alarm Status	0 = No alarm 1 = Alarm
32010	RA	Warning Status	0 = No warning 1 = Warning
32012	RA	Alarm Code	0 = System is not in alarm N = Alarm number
32013	RA	Warning Status	0 = System is not in warning N = Warning number
32014	RA	Steam Temperature	°C
32015	RA	Feed Water Temperature	°C
32016	RA	Steam Flow Rate	lbs per hour
32017	RA	Heat to Steam Output	BTU per lb
32018	RA	Feed Water Control Element	%
32020	RA	Sudden Pressure Drop	0 = Sudden pressure drop not detected 1 = Sudden pressure drop detected
32021	RA	Boiler Efficiency	% Returns value 0 if no heat flow function is enabled
32022	RA	Economiser Efficiency	% Returns value 0 if no heat flow function is enabled
32023	RA	Totalised Steam low word (lbs)	Total steam output = steam low word + (65536 x steam high word)
32024	RA	Totalised Steam high word (lbs)	Total steam output = steam low word + (65536 x steam high word)
32025	RA	Steam Temperature (°F)	°F
32026	RA	Feed Water Temperature (°F)	°F
32027	RA	Steam Flow Rate	Kg per hour
32028	RA	Heat to Steam Output (KJ/kg)	KJ per kg
32029	RA	Totalised Steam low word (kg)	Total steam output = steam low word + (65536 x steam high word)
32030	RA	Totalised steam kg high word (kg)	Total steam output = steam low word + (65536 x steam high word)
32037	RA	Cold Start Status	0 = System not in cold start mode 1 = System in cold start mode
32040	RA	TDS Target Value	Target value in ppm or µS/cm
32041	RA	TDS Measured Value	Measured value in ppm or µS/cm
32045	RA	Current Draught Servo Angle	Metric: mbar x 10 Imperial: “wg x 10
32046	RA	Current Draught Pressure	Metric: mbar x 10 Imperial: “wg x 10
32047	RA	Commissioned Draught Pressure	Metric: mbar x 10 Imperial: “wg x 10
32048	RA	Time to Next Bottom Blowdown	Returns value = (hours x 100) + minutes e.g. 215 is 2 hours 15 minutes
32049	RA	Current Heat Flow	Metric: MW x 10 Imperial: MMBTU/hour x 10
32050	RA	Current Water Flow	Metric: Litres per second x 1000 Imperial: US gallons per minute x 1000
32051	RA	External Level Sensor Reading Depth	Metric: mm Imperial: inches x 10
32052	RA	Second Low Probe Input	0 = No water is detected 1 = Water is detected

#	Type	Description	Details
32053	RA	Auxiliary High Water Input	0 = Input not active 1 = input active
32054	RA	Auxiliary 1st Low Input	0 = Input not active 1 = input active
32055	RA	Auxiliary 2nd Low Input	0 = Input not active 1 = input active
32056	RA	Combined Water level Reading Depth	Metric: mm Imperial: inches x 10
32057	RA	Current steam flow, high word Lb/hr	Lbs per hour This is an extension of the existing address 32016. If the value gets too large to fit in a 16 bit Modbus register this address holds any value greater than 65535, in the same way that the existing registers with high word/low word work. Value = (65536 * high word) + low word
32058	RA	Current steam flow, high word Kg/hr	Kgs per hour This is an extension of the existing address 32027. If the value gets too large to fit in a 16 bit Modbus register this address holds any value greater than 65535, in the same way that the existing registers with high word/low word work. Value = (65536 * high word) + low word
32060	RA	Makeup water temperature	°C
32061	RA	Condensate temperature	°C
32062	RA	Water in temperature	°C
32063	RA	Economiser input temperature	°C
32064	RA	Economiser output temperature	°C
32065	RA	Make up temperature	°F
32066	RA	Condensate temperature	°F
32067	RA	Water in temperature	°F
32068	RA	Economiser input temperature	°F
32069	RA	Economiser output temperature	°F
33001	RA	Fully Metered Excess Air Reading Valid	0 = Invalid reading 1 = Valid reading
33002	RA	Fully Metered Current Excess Air %	Excess air % x 1000
33003	RA	Fully Metered Commissioned Excess Air %	Excess air % x 1000
33010	RA	Fully Metered Current Fuel Mass Flow Thousands	Metric: kgs x 1000 Imperial: lbs x 1000
33011	RA	Fully Metered Current Fuel Mass Flow Singles	Metric: 0 to 999 kgs Imperial: 0 to 999 lbs
33012	RA	Fully Metered Commissioned Fuel Mass Flow Thousands	Metric: kgs x 1000 Imperial: lbs x 1000
33013	RA	Fully Metered Commissioned Fuel Mass Flow Singles	Metric: 0 to 999 kgs Imperial: 0 to 999 lbs
33014	RA	Fully Metered Current Fuel Volume Flow Thousands	m^3 per hour
33015	RA	Fully Metered Current Fuel Volume Flow Singles	m^3 per hour
33016	RA	Fully Metered Fuel Flow Meter Current (4-20mA) Signal	mA x 10
33017	RA	Fully Metered Fuel Temperature	Metric: °C x10 Imperial: °F x 10

#	Type	Description	Details
33018	RA	Fully Metered Fuel Pressure	Metric: mbar x 10 Imperial: “WG x 10 or PSI x 100
33019	RA	Fully Metered Fuel Channel Correction Fraction	Applied correction x 1000
33020	RA	Fully Metered Current Air Mass Flow Thousands	Metric: kgs x 1000 Imperial: lbs x 1000
33021	RA	Fully Metered Current Air Mass Flow Singles	Metric: 0 to 999 kgs Imperial: 0 to 999 lbs
33022	RA	Fully Metered Commissioned Air Mass Flow Thousands	Metric: kgs x 1000 Imperial: lbs x 1000
33023	RA	Fully Metered Commissioned Air Mass Flow Singles	Metric: 0 to 999 kgs Imperial: 0 to 999 lbs
33024	RA	Fully Metered Current Air Volume Flow Thousands	m^3 per hour
33025	RA	Fully Metered Current Air Volume Flow Singles	m^3 per hour
33026	RA	Fully Metered Air Flow Meter Current (4-20mA) Signal	mA x 10
33027	RA	Fully Metered Air Temperature	Metric: °C x10 Imperial: °F x 10
33028	RA	Fully Metered Air Pressure	Metric: mbar x 10 Imperial: “WG x 10
33029	RA	Fully Metered Air Channel Correction Fraction	Applied correction x 1000
33030	RA	Fully Metered Atmospheric Air Pressure	Metric: mbar x 10 Imperial: “WG x 10
40001	RWA	Remote Required Setpoint	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 MM will ignore this required value and use the required setpoint set on the MM’s status screen.
40121	RWA	Remote Firing Rate	Percentage (%) 40131 must be set to 1 to change the firing rate remotely
40131	RWA	Remote Firing Rate Enable	0 = Remote firing rate disabled 1 = remote firing rate enabled

6.4.1 Modbus Address for MM Status (30102)

MM Expansion option 106 sets how Modbus address for MM status (30102) operates. When Expansion Option 106 is set to 1. “Modbus address 30102 shows MM State”. The following values are shown on the table below.

Code	Explanation
1	Recycle
2	Standby
3	Starting
4	Wait Secondary Proving
5	Wait CPI
6	Wait Air Switch
7	Zero Air Sensor
8	Valve Proving
9	Run to Pre-Purge
10	Pre-Purge
11	Run to Start
12	Pre-Ignition
13	Pilot Proving
14	Main Flame Proving
15	Golden Start
16	FGR
17	Firing
18	Moving to low fire to shut down
19	Moving to low fire for COF Changeover
20	COF Changeover
21	Firing on Continuous Pilot Only
22	Run to Post-Purge
23	Post-Purge
24	Post-Firing Valve Proving
255	Fault

7 FIRST OUTS

7.1 Overview of First Outs

When the control circuit has a long series chain of various thermostats and switching elements, it can be difficult to identify which element has opened the control circuit. With First Outs expansion feature it is possible to monitor up to 15 different inputs in a series control circuit on the Flame Safeguard unit. Each input responds to a signal voltage of between 110V to 230Vac.

The First Outs can be configured for active input state low or high. When the active input state is set to low, the first out is triggered when the input is low, and when it is set for high, it will be triggered when the input is high. The table below shows the functions that can be set for the first outs.

The First Out logs can be displayed by pressing 

in the Home screen (Figure 8.1.i), then pressing 

tab button which gives information on the First Out number, trigger time and the time it was reset.

7.2 First Outs Expansion Options

The table below shows the Expansion Options used for configuring First Outs.

#	Default	Range	Description
110	0		FO: First Outs Function
			If first outs are enabled, they can be configured and labelled in Commission mode and Online Changes. To tie the first outs interlock to the MM's safety stat, see option / parameter 145.
		0	Disabled
		1	Enabled

7.3 First Outs Configuration

7.3.1 Enabling First Outs

To enable first outs, the following expansion must be set.

Expansion Option	Description	Setting
110	First Outs function	1

7.3.2 Accessing First Outs

First Outs can only be configured in Commission mode. Press First outs in commission mode or press First outs in Flame Safeguard mode to access the First outs screens.

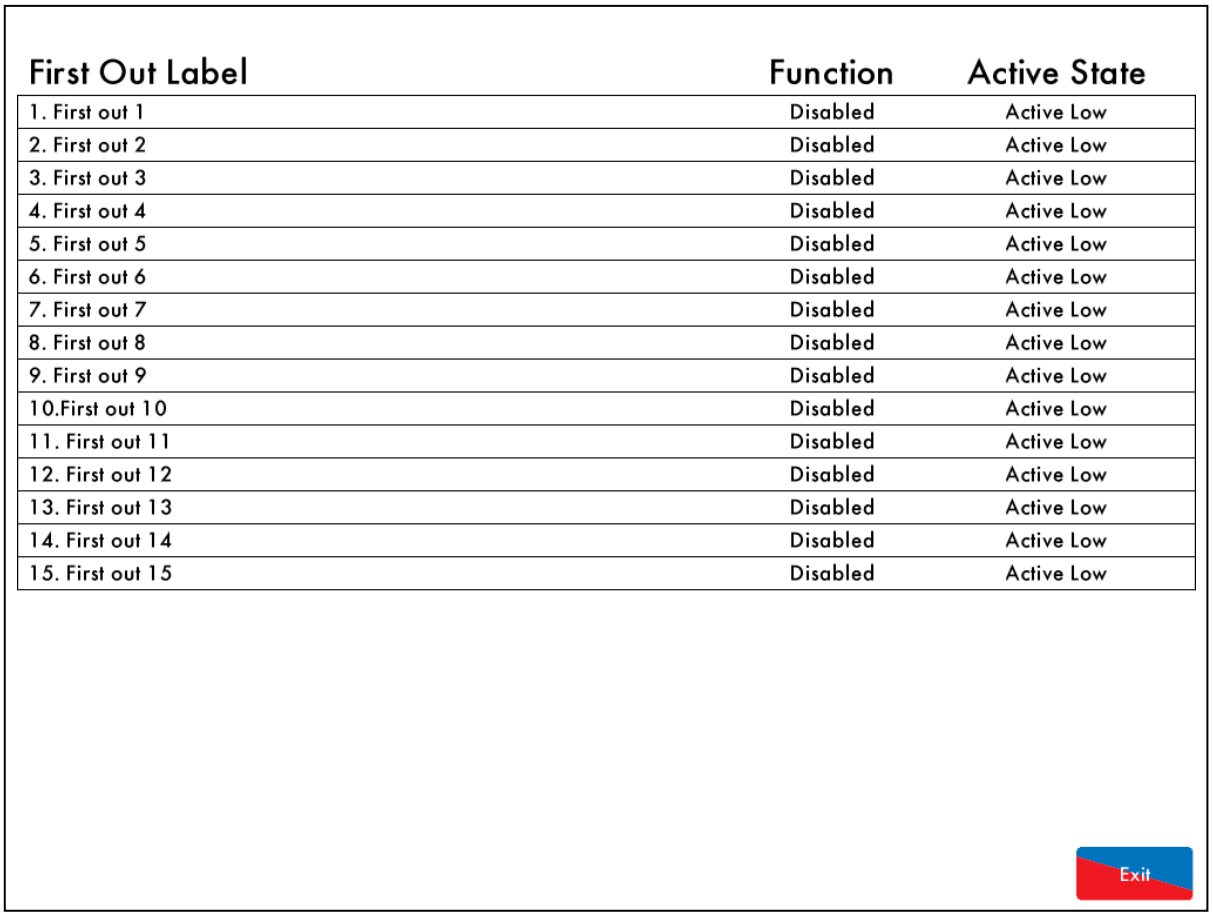


Figure 7.3.2 First Outs main screen

7.3.3 First Out Function

In the First Outs screen, press on the First Out number to be configured and select the function of first out when upon the active state set for high or low.

Function When Active	Description
Disabled	Does not function.
Monitor	Burner continues firing, but the events will be logged.
Non-recycle	Burner stops firing and the first out must be reset for the burner to restart.
Recycle	Burner stops firing and restarts automatically when the input state changes.
Stop EGA Sampling	Burner continues firing, but the EGA stops sampling.
Stops EGA Trimming	Burner continues firing, but the EGA trim stops operating.
External Stat	Used if external stat is optioned.

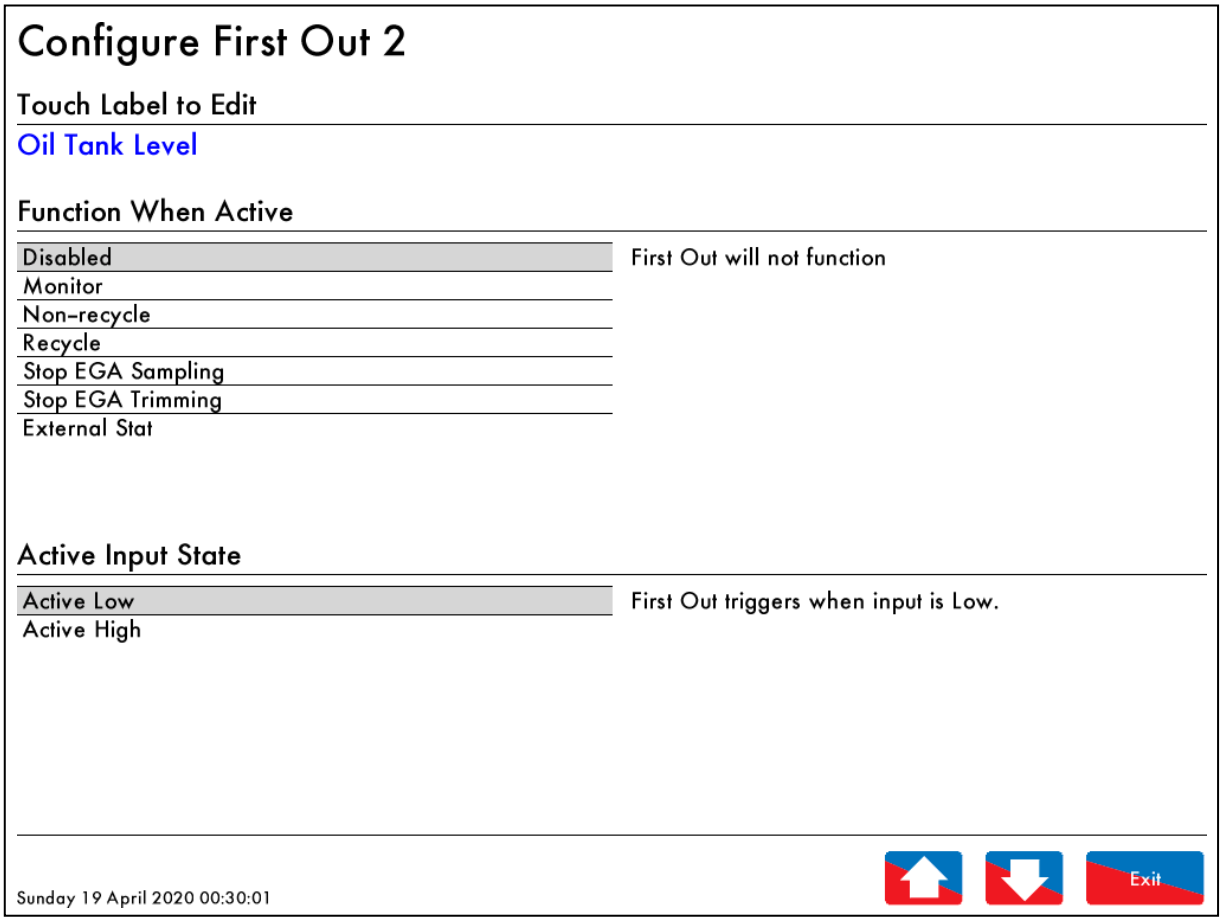
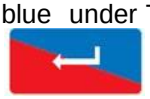


Figure 7.3.3 Configuring a First Out

7.3.4 Edit First Out Label

On the Configure First Out screen, press the First Out label highlighted in blue under Touch Label to Edit, use the on-screen keyboard to edit the name as required, once finished press  to save the change.

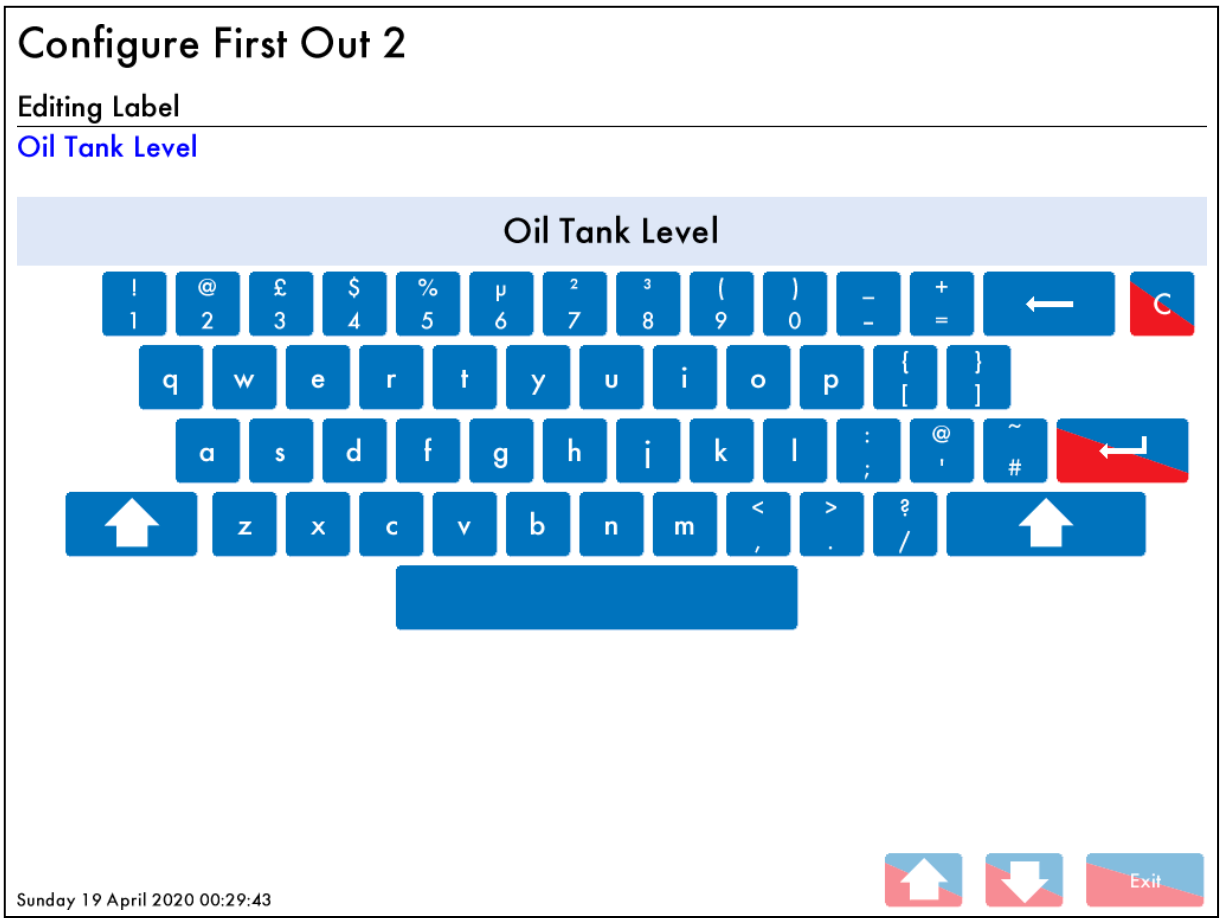


Figure 7.3.4 Editing First Out Label

7.3.5 First Outs Interlock

The First Outs can be directly and automatically connected to the stat circuit on the Autoflame Flame safeguard unit without the need to physically connect the First Outs to terminal 53 on the MM.

The table below shows the settings which must be set for First Out Interlock.

Option/Parameter	Description	Setting
145	First Out Interlock	1

For Option 145 setting 1 (Enabled), once a First outs has been detected a lockout will occur.

Any unused inputs need to be tied to mains level, as you can't disable these inputs, like you can with the First Outs on their own.

First Out Interlock only allows the First Outs to be configured as:

- Non-recycle or recycle
- Active low

The First Out Interlock function is UL approved.

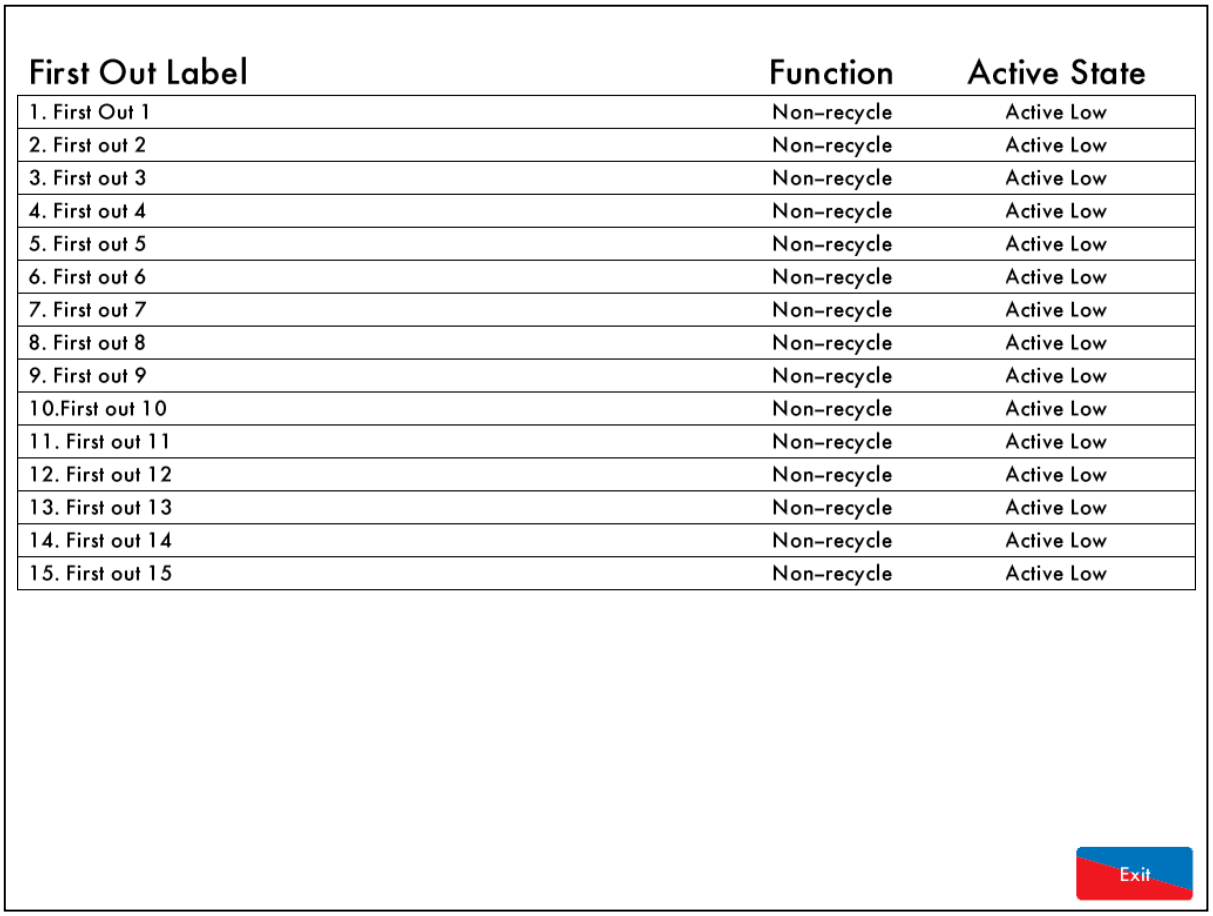


Figure 7.3.5 i First Out Interlock Enabled

The schematic below shows an example of wiring First Outs on a Autoflame Flame Safeguard unit.

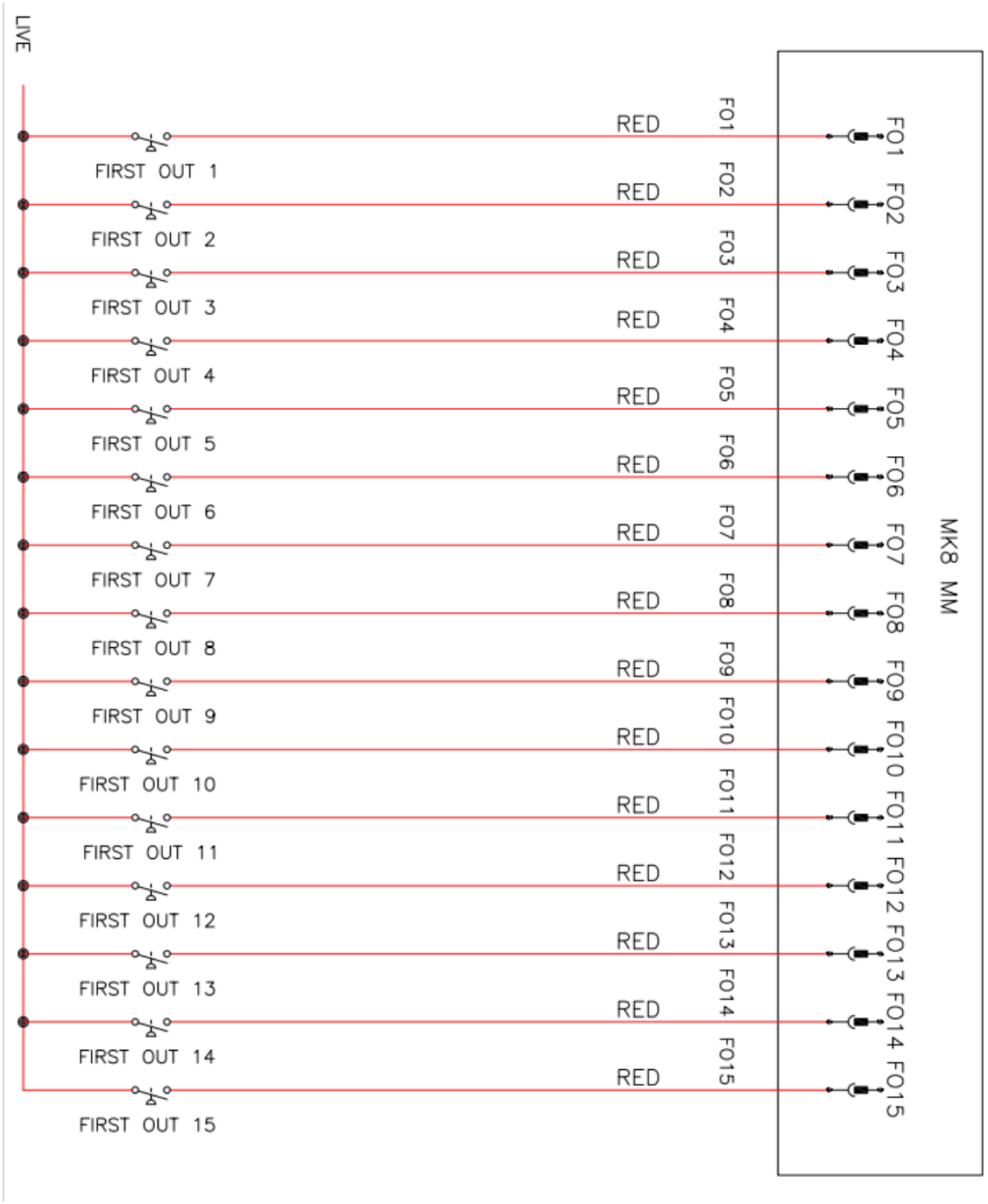


Figure 7.3.5 ii First Outs Wiring Diagram

8 OPERATION

8.1 Home Screen

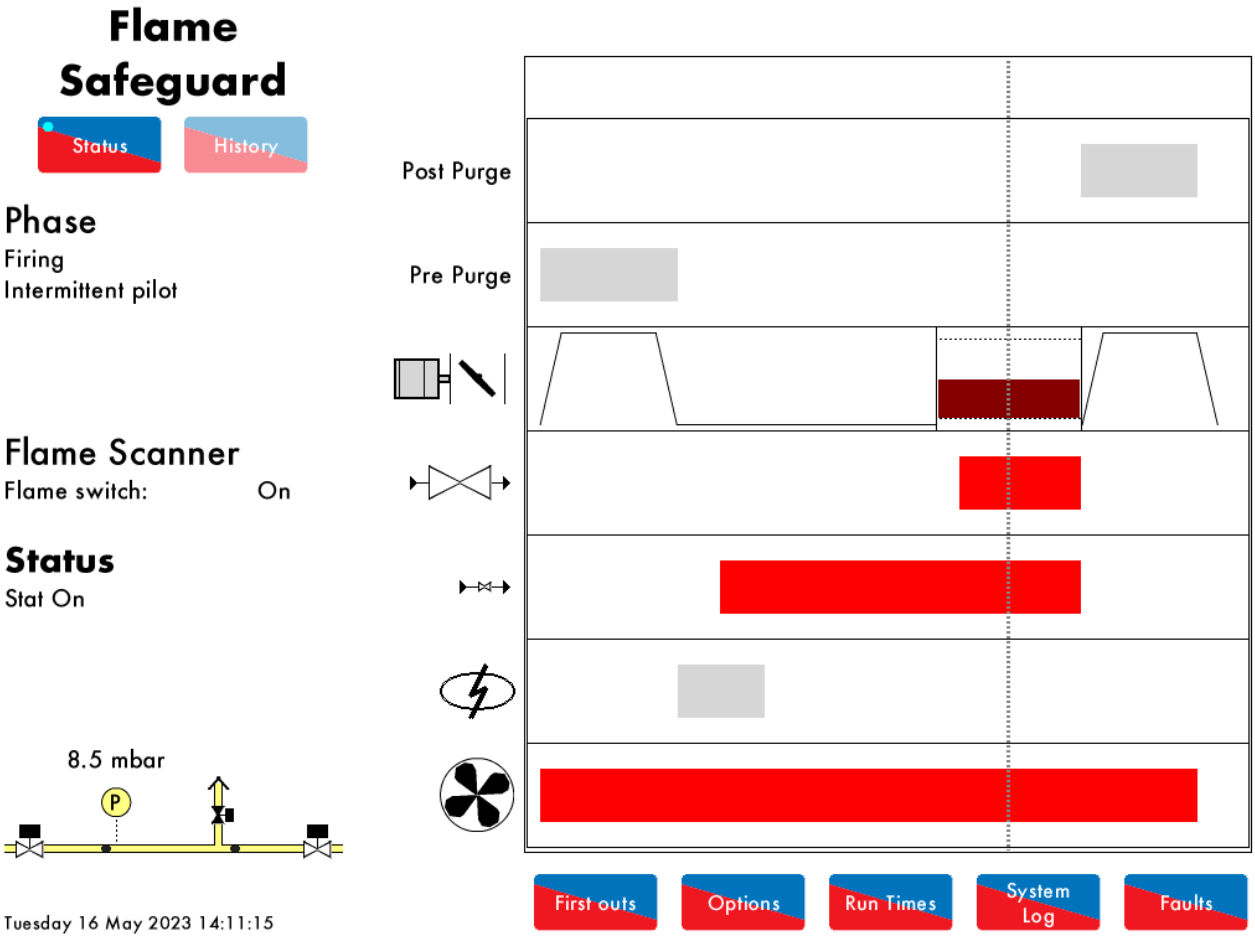


Figure 8.1.i Home

The home screen shown in Figure 8.1.i. displays the Flame Safeguard screen. The Flame Safeguard screen displays the following information:

- Current phase of the MM
- Flame scanner signal strength (UV, IR) or Flame detected (Flame Switch)
- Gas Pressure (If enabled)

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
- Main fuel valve
- Pilot valve
- Ignition
- Blower motor

8.1.1 Flame Safeguard - History

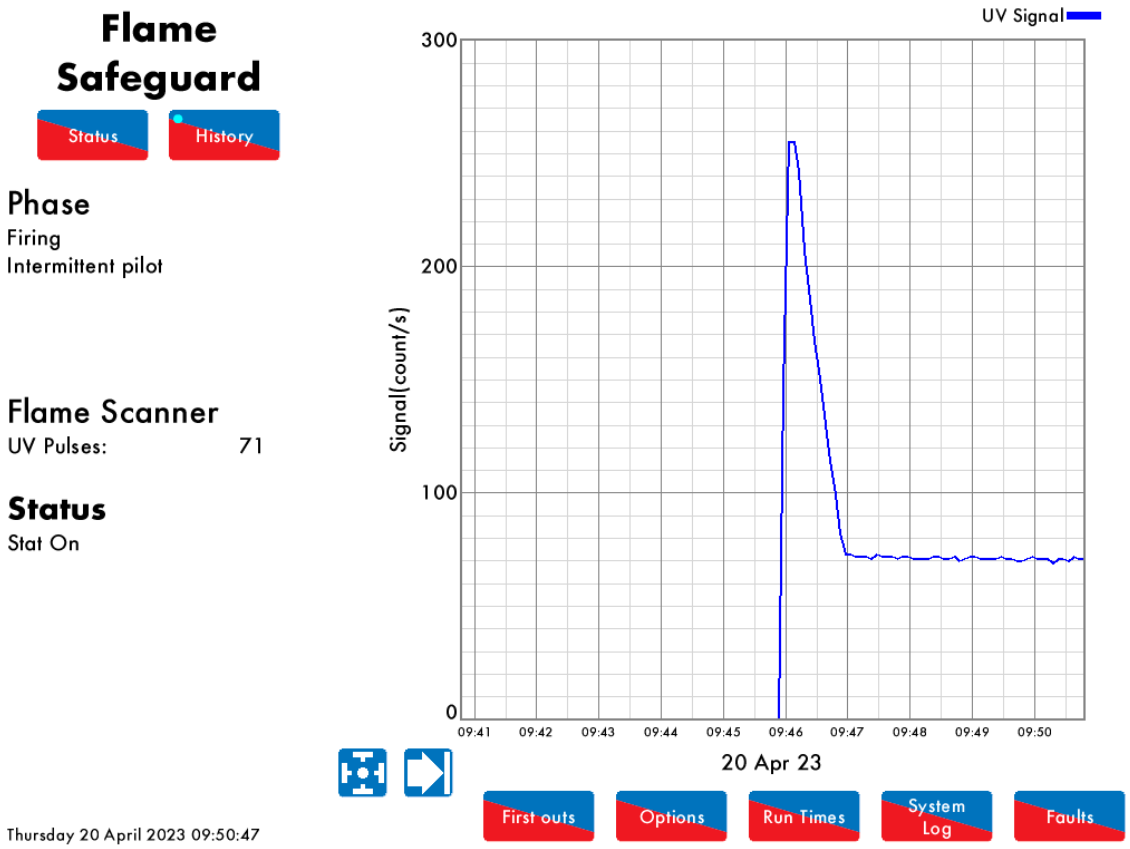


Figure 8.1.1.i Flame Safeguard – History

Press 

in the Flame Safeguard screen (Figure 8.1.i) to view Flame Safeguard History screen in Figure 8.1.1.i (History screen won't be accessible if using a Flame Switch). The flame scanner signal history is displayed. This data is logged for 24 hours on the unit.

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.

Note: Power cycling the Flame Safeguard controller or changing fuel will reset this data log.

8.1.2 Options

Read Only

Options | Parameters | Expansion

#	Description	Value
1	MM: Boiler Temperature/Pressure Sensor Type	Temperature (MM10006, 0 – 400°C / 752°F)
2	MM: Modulating Motor Travel Speed Limit	1.5
3	MM: Return to Curve Mode	Return to curve at purge speed
4	MM: Flame Safeguard Mode	Enabled
5	MM: Purge Position	Channels 1 to 4 purge at OPEN position
6	PID: Proportional Band	10 °C
7	PID: Integral Time	60 seconds
8	MM: Servomotor Channels	Channels 1 & 2
9	MM: Internal Stat Operation	Burner operates below setpoint
10	MM: Burner Switch-Off Offset	3 °C
11	MM: Burner Switch-On Offset	3 °C
12	EGA: EGA Functionality	Not optioned
13	EGA: EGA Fault Response	EGA faults generate Alarms (Burner stops)
14	MM: Warning Response	Warnings drive Common System Alarm output (T79)
15	MM: User Control	Burner on/off and setpoint control enabled
16	DTI: Sequencing and DTI enable	Sequencing disabled
17	Unused: Option 17	0
18	EGA: Carry Forward of Trim	Enabled
19	EGA: O2 Upper Limit Offset	Disabled

All | MM | PID | EGA | DTI | BC

Exit

Thursday 20 July 2023 09:00:51

Figure 8.1.2.i Options

Press Options in the main screen (8.1.i) to view Options screen in Figure 8.1.2.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 2.

8.1.3 Parameters

Read Only

Options | Parameters | Expansion

#	Description	Value
1	DTI: Sequence Scan Time Set When Unit Goes Offline	3 minutes (00:03:00)
2	Unused: Parameter 2	0
3	DTI: Number of Boilers Initially On	10
4	EGA: Delay Before EGA Commission Can Be Stored	45 seconds
5	DTI: Modulation Timeout	4 minutes (00:04:00)
6	Unused: Parameter 6	0
7	Unused: Parameter 7	0
8	EGA: Trim Delay After Drain	30 seconds
9	Unused: Parameter 9	0
10	EGA: EGA Version	Mk8 Protocol (RS485)
11	Unused: Parameter 11	0
12	EGA: CO Used For Trim On Oil	Disabled
13	EGA: Commission Fuel-Rich Trim	5.0 %
14	EGA: Trim Reset Angular Rate	5.0 degrees per minute
15	MM: Golden Start Time	5 seconds
16	EGA: Time Between Air Calibrations	6.0 hours
17	EGA: Number Of Trims Before Limits Error Generated	3
18	EGA: Maximum Trim During Run	10.0 %
19	EGA: Commission Air-Rich Trim	5.0 %

All | MM | PID | EGA | DTI | BC

Exit

Thursday 20 July 2023 09:01:04

Figure 8.1.3.i Parameters

Press Parameters tab in the Option screen (Figure 8.1.2.i) to view the Parameters screen in Figure 8.1.3.i. The Parameters screens display all the parameters and their settings. To make changes to these Parameters, refer to section 2.

8.1.4 Expansion

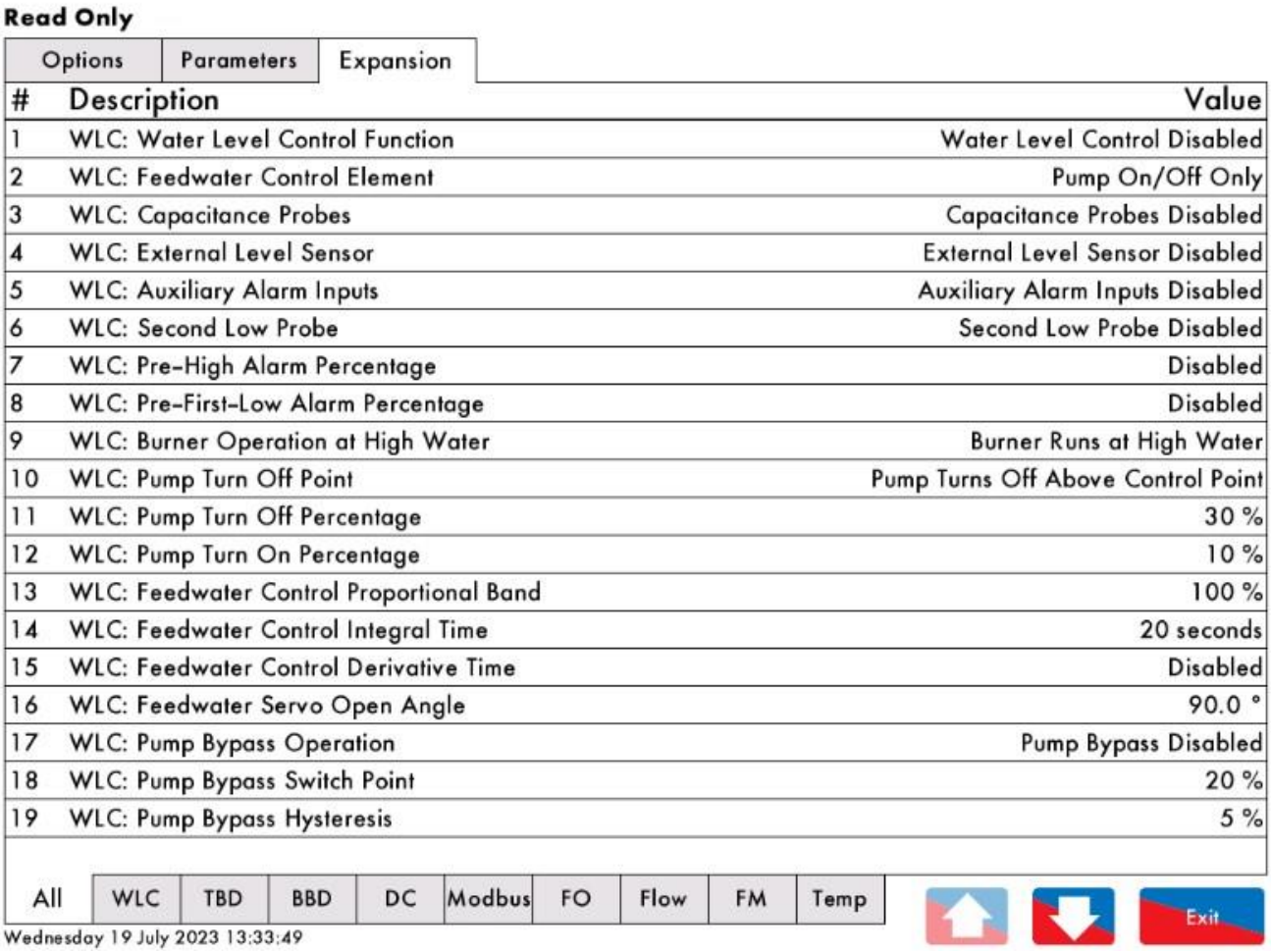


Figure 8.1.4.i Expansion

Press Expansion tab in the Option screen (Figure 8.1.2.i) to view the Expansion screen in Figure 8.1.4.i. The Expansion screens display all the Expansion options and their settings. To make changes to these Expansion options, refer to section 2.

8.1.5 Run Times

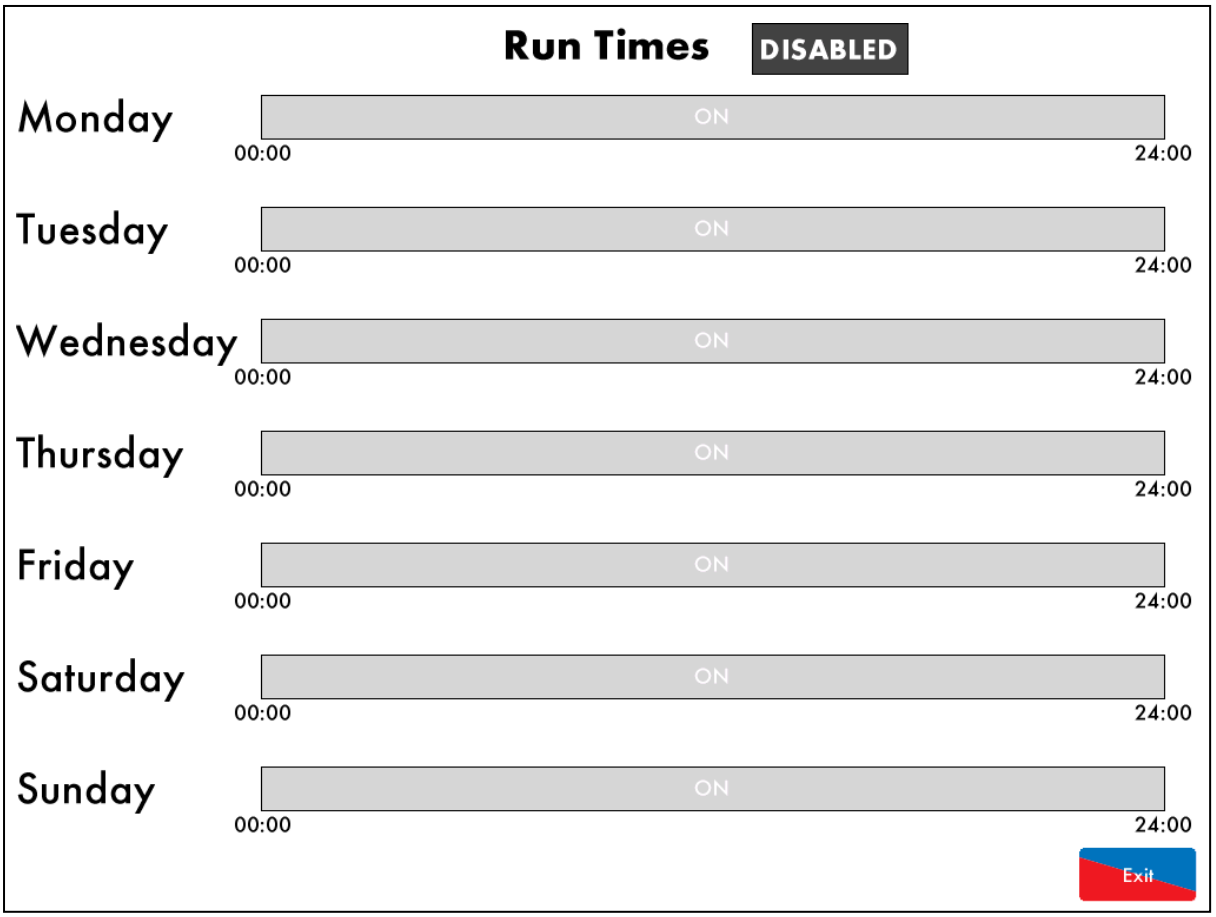


Figure 8.1.5.i Run Times - OFF

Press 

in the main screen (Figure 8.1.i) to access the Run Times screen in Figure 8.1.5.i. You will be prompted to enter a password (11, 11). Run times sets when the Autoflame Flame Safeguard unit is scheduled to be on and firing or off.

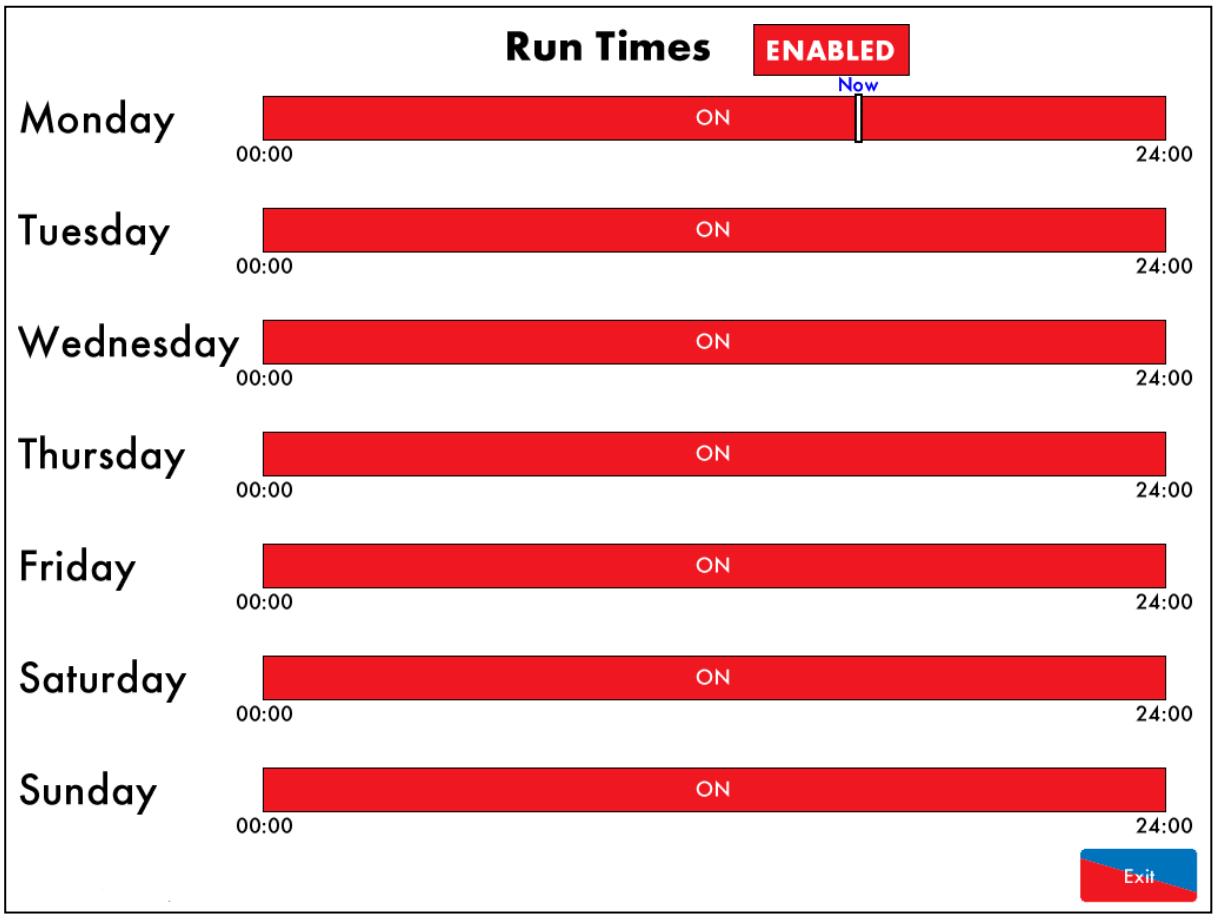


Figure 8.1.5.ii Run Times – Enabled

Press DISABLED in the Run Time screen in Figure 8.1.5.i to enable Run Times. Press on the bar next to the day to set the run times for that day of the week.

To disable the run times press ENABLED.

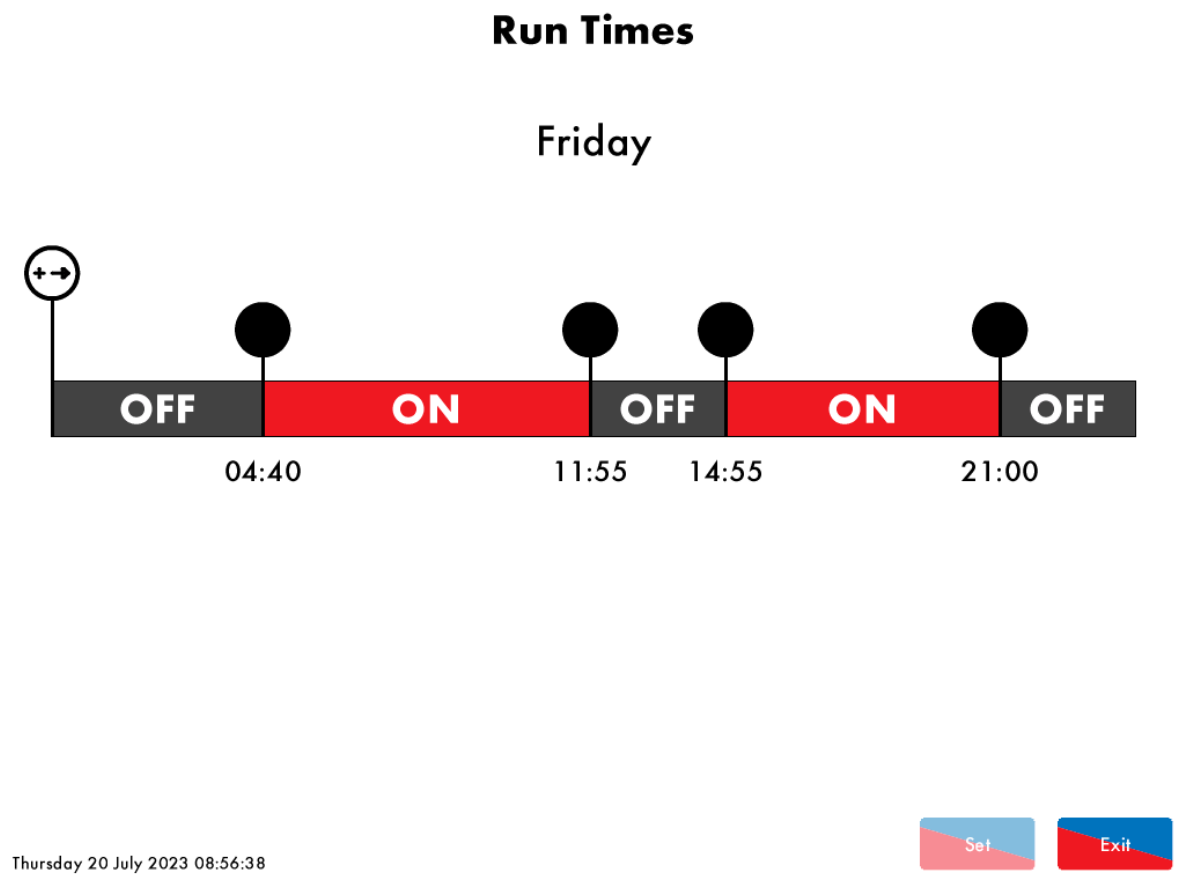


Figure 8.1.5.iii Run Times - Friday

To set the schedule, press on the bar for that day in the Run Times On/Off screen (Figure 8.1.5.ii) to bring up the individual day editing screen (Figure 8.1.5.iii).

Drag the  at the 00:00 time to add new intervals, and drag them to the required time position. Up to 4 time periods can be set. Then press the bar between the markers to toggle the intervals between ON and OFF.

8.1.6 System Log

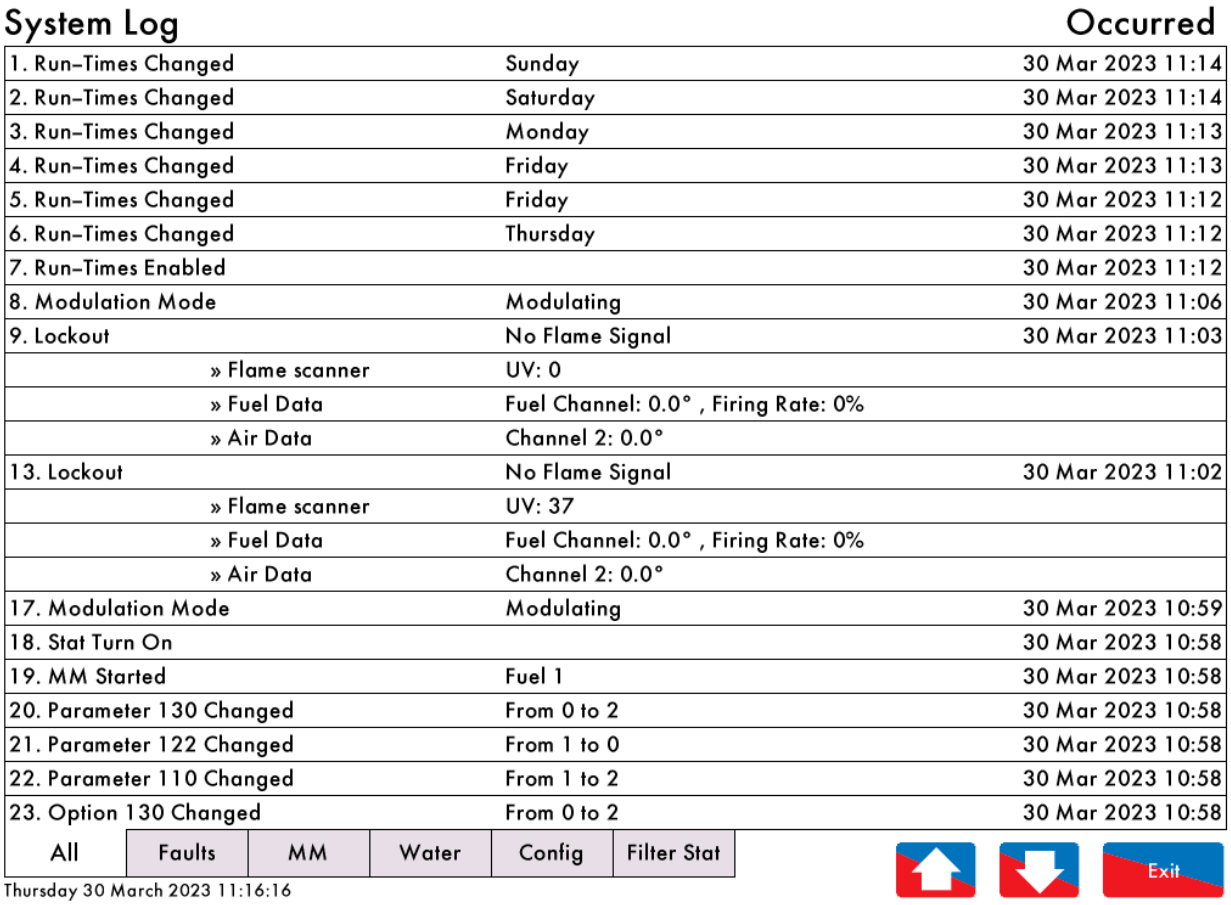


Figure 8.1.6.i System Log

Press 

in the Commission Mode screen or Flame Safeguard Home screen (Figure 2.1.ii or 8.1.i) to view the System Log screen as shown in Figure 8.1.6.i. This data is stored on the MM and the SD card for 1000 entries.

8.1.7 First Outs

First Out Label	Function	Active State	Status
1. First out 1	Disabled	Active Low	Inactive
2. 2	Disabled	Active Low	Inactive
3. First Out 3 Test	Recycle	Active Low	Inactive
4. 4	Non-recycle	Active Low	Inactive
5. 5	Non-recycle	Active Low	Inactive
6. 6	Non-recycle	Active Low	Inactive
7. 7	Non-recycle	Active Low	Inactive
8. 8	Non-recycle	Active Low	Inactive
9. 9	Non-recycle	Active Low	Inactive
10.10	Non-recycle	Active Low	Inactive
11. 11	Non-recycle	Active Low	Inactive
12. 12	Non-recycle	Active Low	Inactive
13. 13	Non-recycle	Active Low	Inactive
14. 14	Non-recycle	Active Low	Inactive
15. 15	Non-recycle	Active Low	Inactive

Wednesday 19 April 2023 11:03:13



Figure 8.1.7.i First Outs screen

First outs can be used in Flame Safeguard mode, but MK8007 must be unlocked. If this is locked/disabled, then the 

button won't appear on the main screen as shown on figure 8.1.i.

You can view the First outs screen, by pressing 

button.

8.1.8 Faults

Lockouts		Occurred	Reset
1. (63.0) Purge Limit Switch	Run to Ignition	25 Apr 2023 10:06	25 Apr 2023 10:10
2. (53.0) IR Comms Lost	Recycle	17 Apr 2023 16:19	17 Apr 2023 16:20
3. (53.0) IR Comms Lost	Recycle	17 Apr 2023 16:17	17 Apr 2023 16:19
4. (53.0) IR Comms Lost	Recycle	17 Apr 2023 16:17	17 Apr 2023 16:17
5. (53.0) IR Comms Lost	Recycle	17 Apr 2023 16:15	17 Apr 2023 16:17
6. (52.0) High IR Ambient	Recycle	30 Mar 2023 16:51	30 Mar 2023 16:52
7. (13.0) No Flame Signal	Pilot Ignition	30 Mar 2023 16:51	30 Mar 2023 16:51
8. (13.0) No Flame Signal	Firing	30 Mar 2023 16:49	30 Mar 2023 16:49
9. (52.0) High IR Ambient	Recycle	30 Mar 2023 14:15	30 Mar 2023 14:16
10. (52.0) High IR Ambient	Recycle	30 Mar 2023 14:12	30 Mar 2023 14:13
11. (53.0) IR Comms Lost	Firing	30 Mar 2023 13:47	30 Mar 2023 14:12
12. (53.0) IR Comms Lost	Recycle	30 Mar 2023 12:44	30 Mar 2023 12:45
13. (63.0) Purge Limit Switch	Run to Ignition	30 Mar 2023 11:23	30 Mar 2023 12:26
14. (10.0) Simulated Flame	Recycle	30 Mar 2023 11:17	30 Mar 2023 11:17
15. (13.0) No Flame Signal	Pilot Ignition	30 Mar 2023 11:03	30 Mar 2023 11:04
16. (13.0) No Flame Signal	Firing	30 Mar 2023 11:02	30 Mar 2023 11:02
17. (63.0) Purge Limit Switch	Run to Ignition	29 Mar 2023 17:12	29 Mar 2023 17:31
18. (63.0) Purge Limit Switch	Run to Ignition	29 Mar 2023 16:51	29 Mar 2023 17:06
19. (63.0) Purge Limit Switch	Run to Ignition	29 Mar 2023 14:44	29 Mar 2023 15:04
20. (53.0) IR Comms Lost	Recycle	24 Mar 2023 12:28	24 Mar 2023 12:28
21. (53.0) IR Comms Lost	Recycle	24 Mar 2023 12:28	24 Mar 2023 12:28
22. (53.0) IR Comms Lost	Recycle	24 Mar 2023 12:26	24 Mar 2023 12:27
23. (13.0) No Flame Signal	Pilot Ignition	24 Mar 2023 12:24	24 Mar 2023 12:25

Lockouts | Errors | Alarms | Warnings | First outs



Tuesday 25 April 2023 16:02:22



Press Faults in the Home screen (Figure 8.1.i) to view the burner Lockouts, Errors, Alarms and Warnings (Figure 8.1.8.i). The MM will store up to 64 burner Lockouts and MM errors.

Fault	Type	Shuts Down Burner	Reset By
Lockout	Burner control fault	Yes	Reset button or input on T56
Error	Internal or hardware fault	Yes	Power cycle
Alarm	Critical system fault	Yes	Reset button or input
Warning	Non-critical fault	No	Reset button
First out	Configurable fault	Optional	Reset button/ auto

9 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.
- 1 Valve proving system – No vent valve.
- Intermittent pilot.
- UV scanner.
- Air switch on T54.
- Gas Pressure sensor – VPS and pressure limits checked.
- VPS operates before start-up.
- Pre-purge and post-purge.

9.1 Recycle

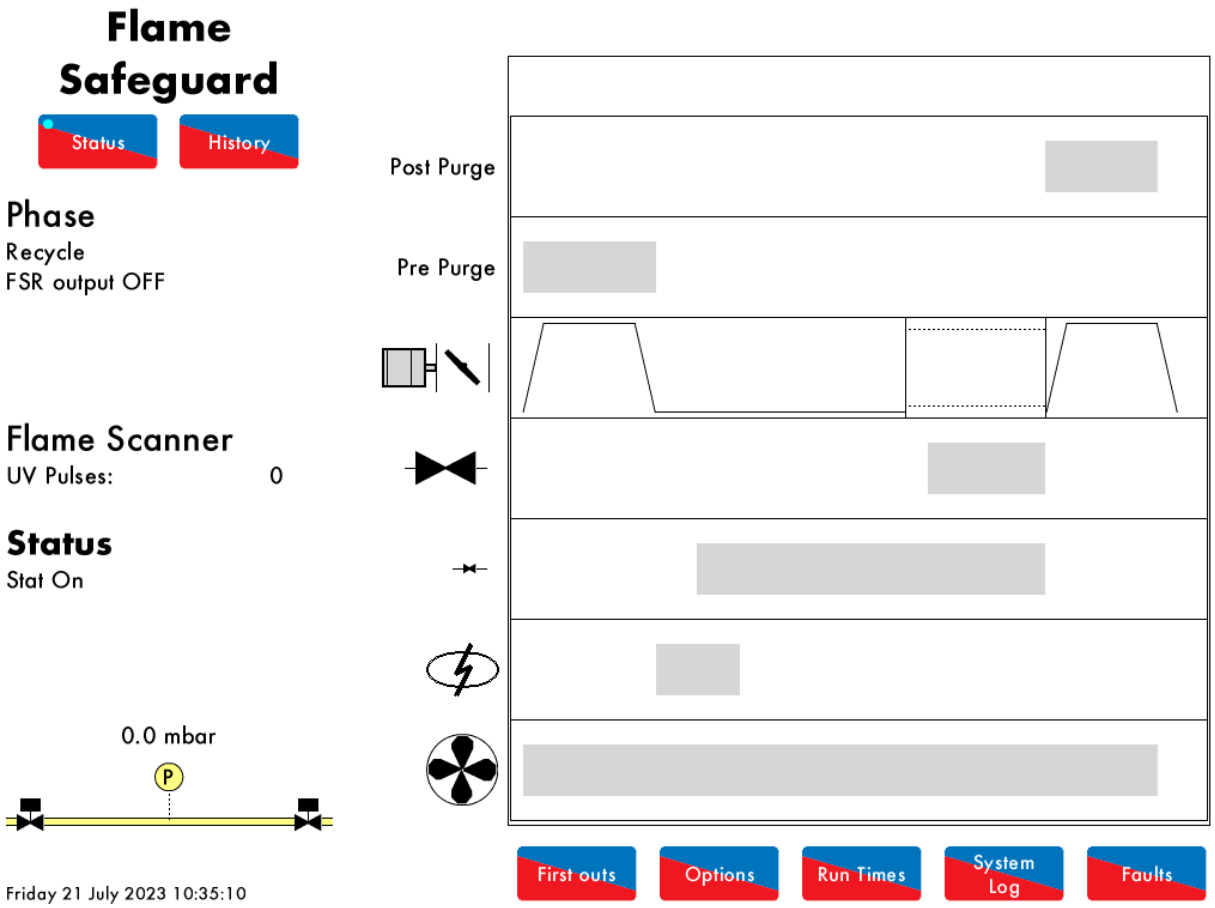


Figure 9.1.i Recycle

When the burner enters the Recycle phase shown in Figure 9.1.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 a time delay before the burner starts up. See option/parameter 119.

9.2 Standby

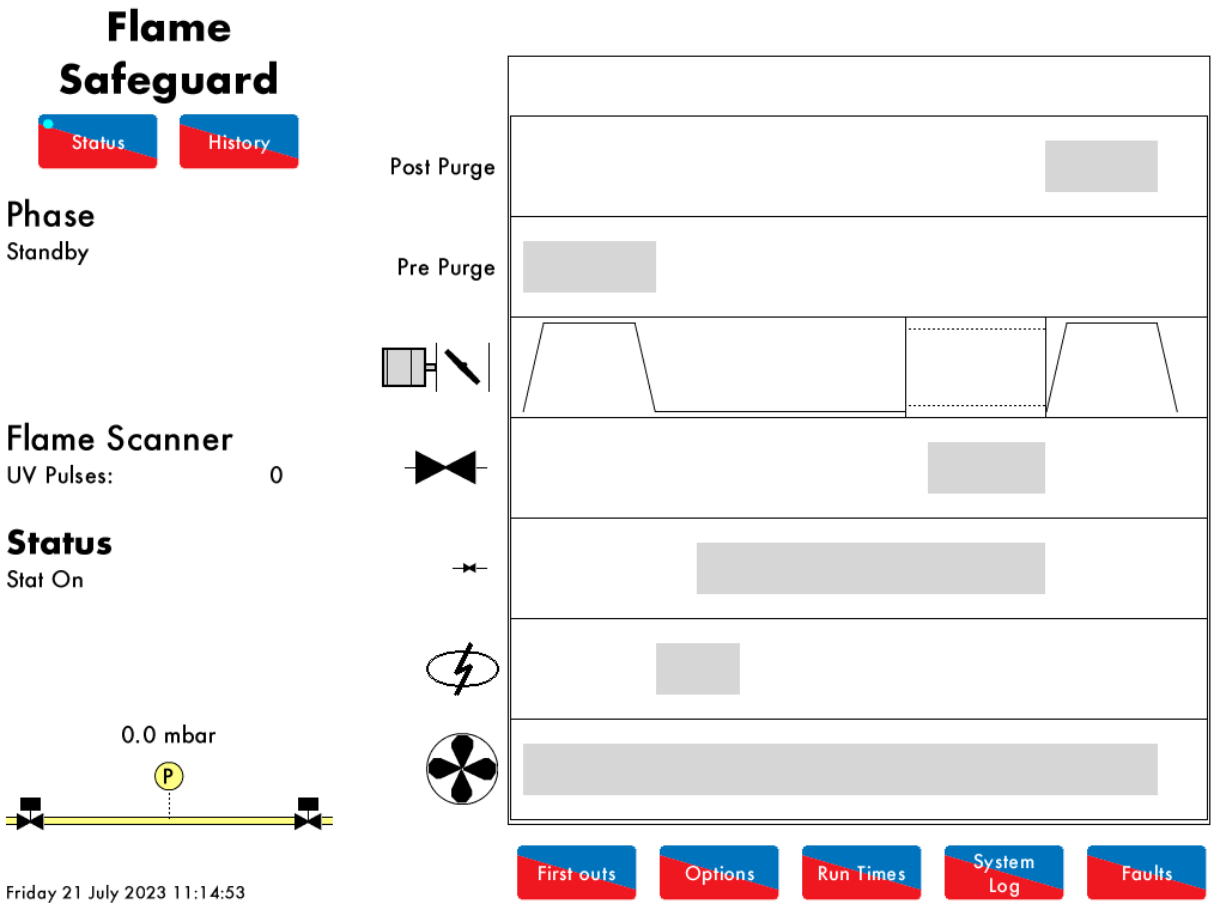


Figure 9.2.i Standby

The burner will go into Standby shown in Figure 9.2.i., before the safety checks begin to initiate the burner start-up sequence.

The Flame Safeguard controller will remain in this phase if it is waiting due to the Run Schedule being active, but the current phase being OFF. 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 remain in Standby if the burner has been disabled, via T53.

9.3 Internal Relay Tests

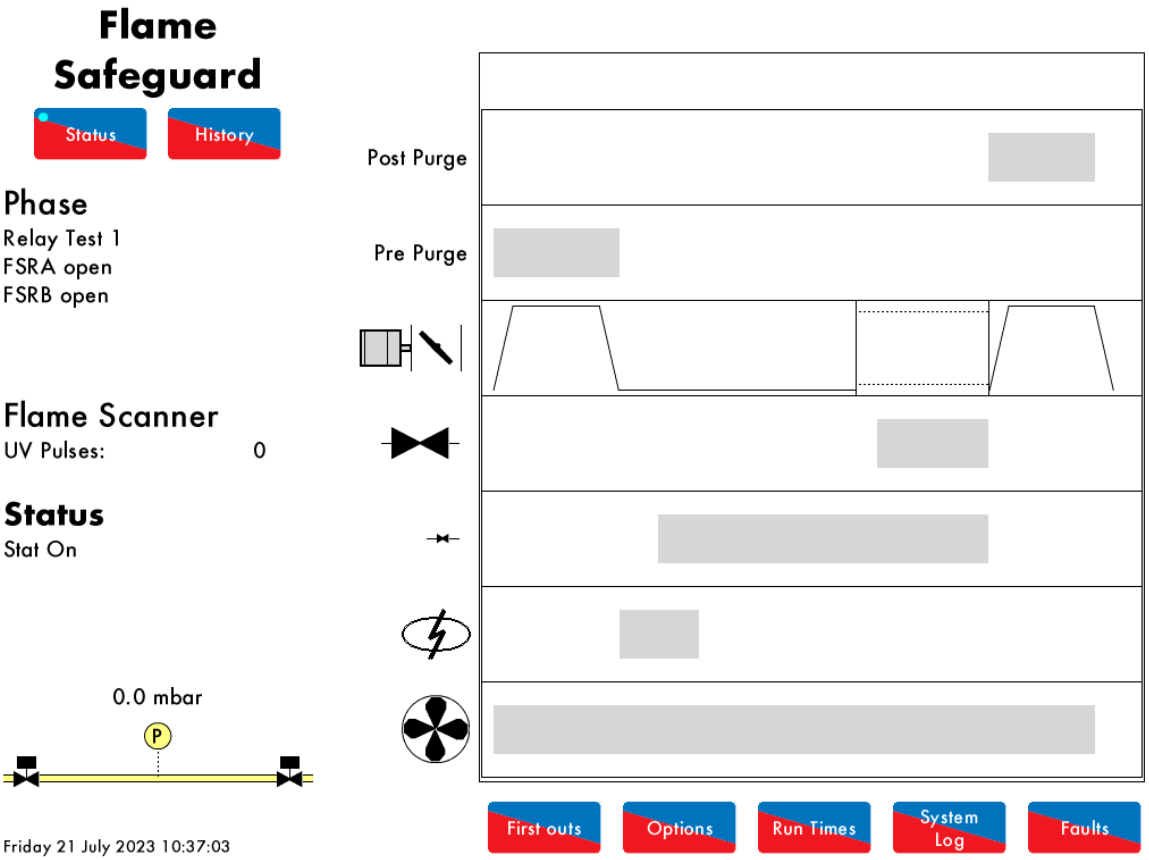


Figure 9.3.i Relay Test 1

During the Internal Relay Tests phase shown in Figure 9.3.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.

9.4 CPI Input

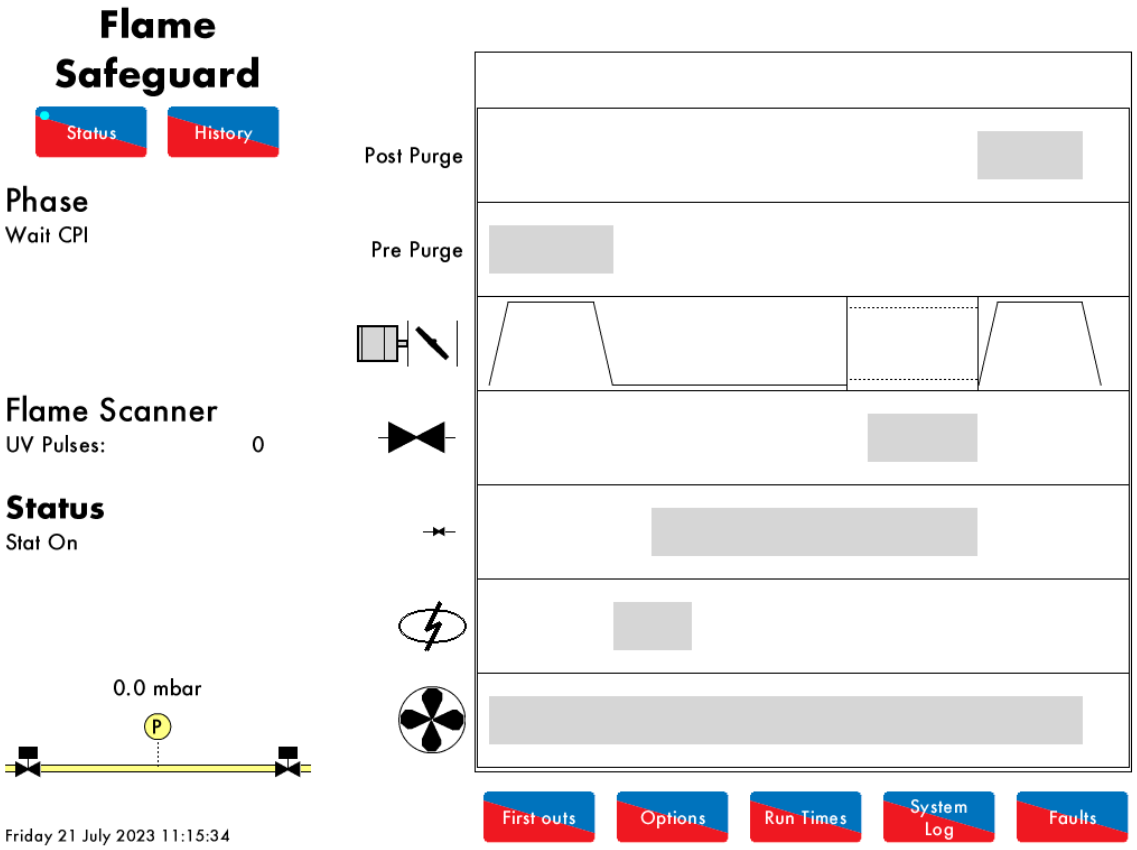


Figure 9.4.i CPI Input

In the Wait CPI phase shown in Figure 9.4.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.

9.5 Valve Proving

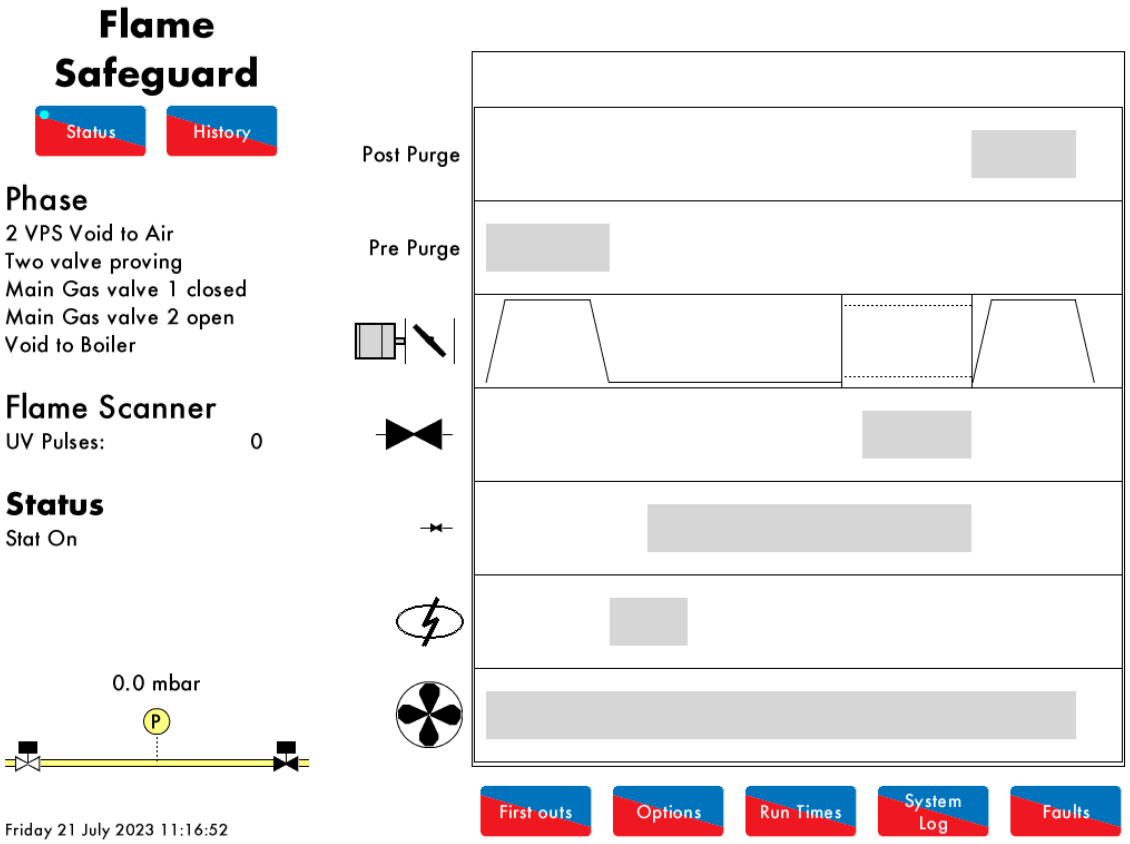


Figure 9.5.i VPS Venting

In this example, the Flame Safeguard controller 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 9.5.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 T61 should be on (and vice versa), the lockout 'Main Gas 2 Output Fault' will occur.

Note: If valve proving has been optioned with no vent valve and with single valve pilot, then the pilot valve is used for this VPS venting phase.

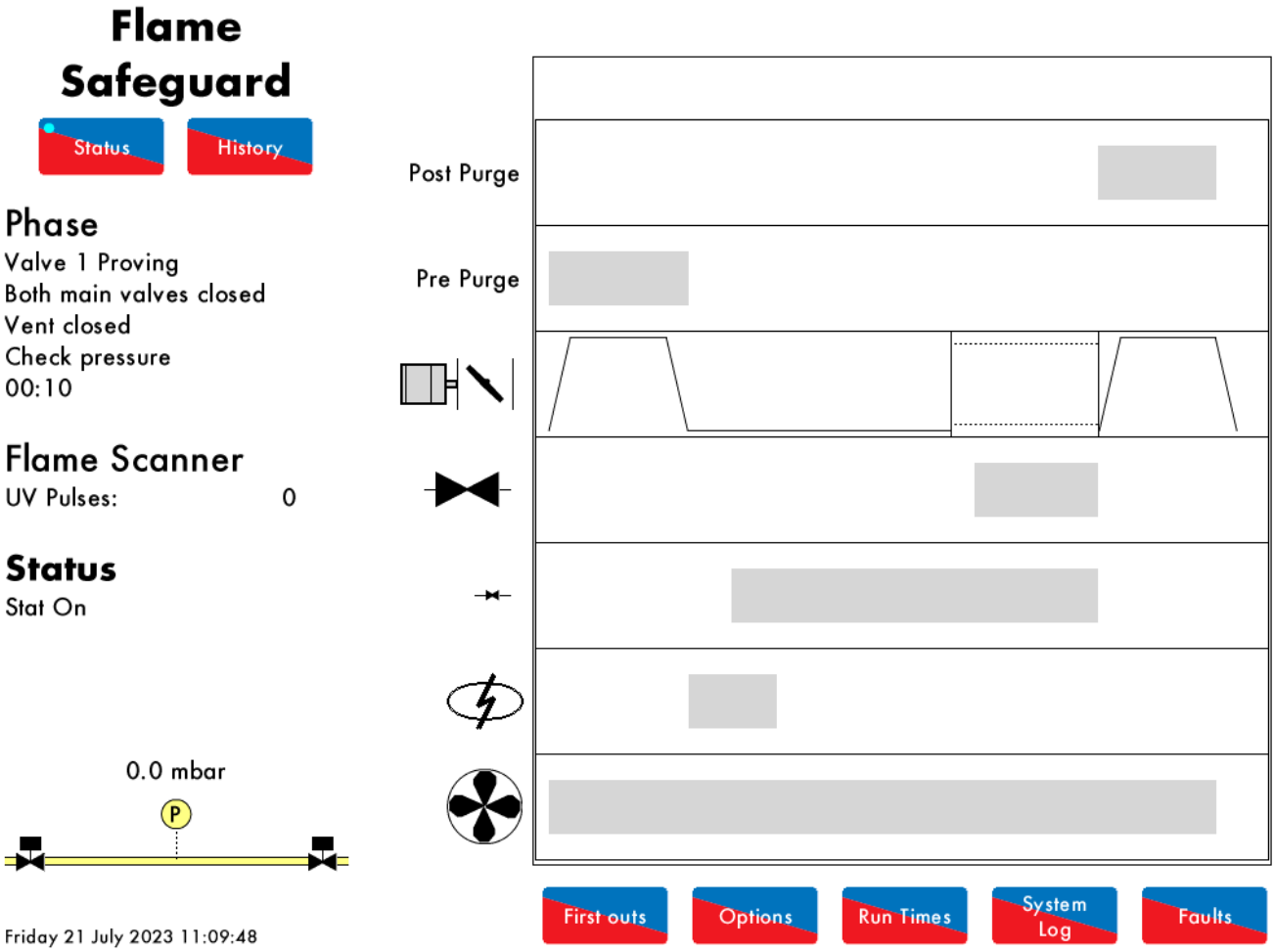


Figure 9.5.ii VPS Air Proving

In the VPS Air Proving phase shown in Figure 9.5.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 after which the air pressure switch must remain off. If a signal is detected here, 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.

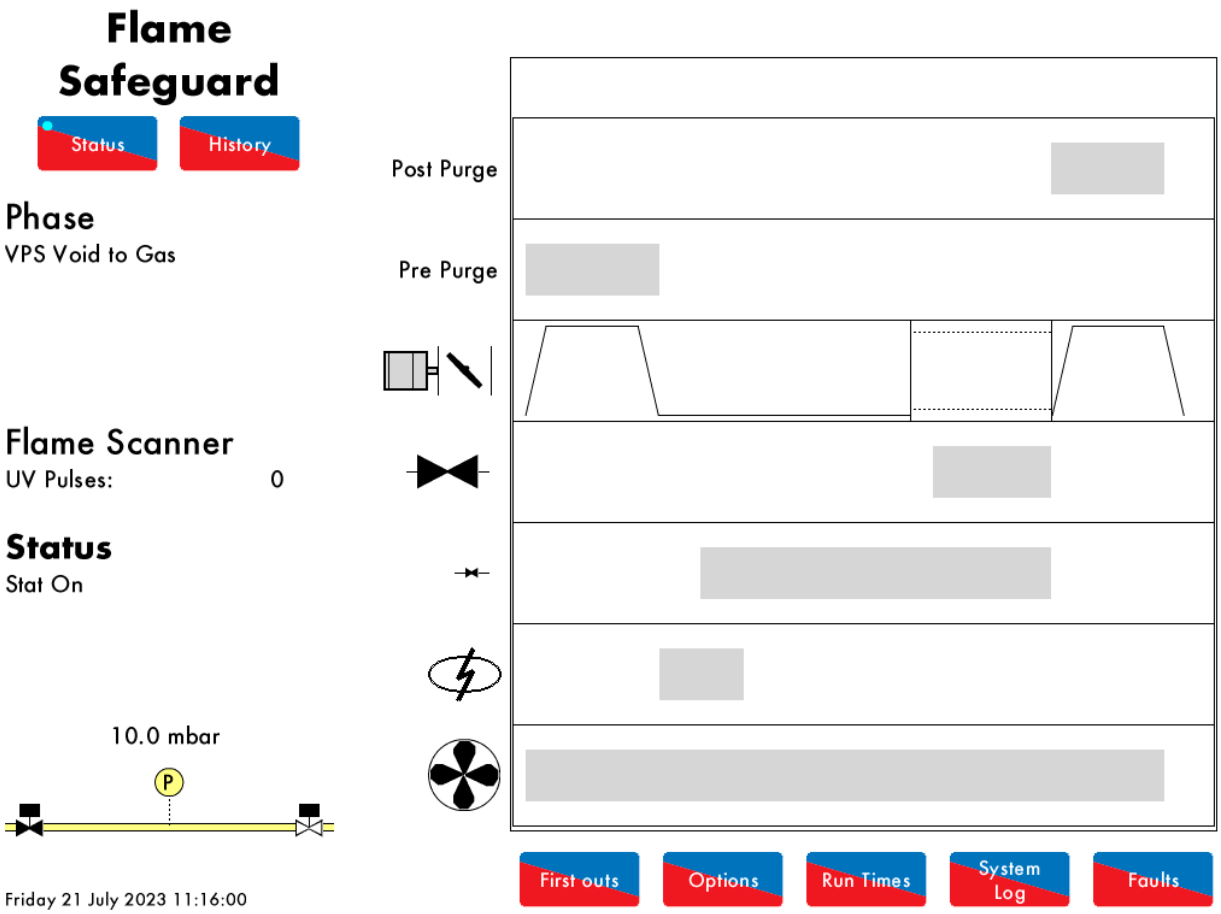


Figure 9.5.iii VPS Void to Gas

In the VPS Void to Gas phase shown in Figure 9.5.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.

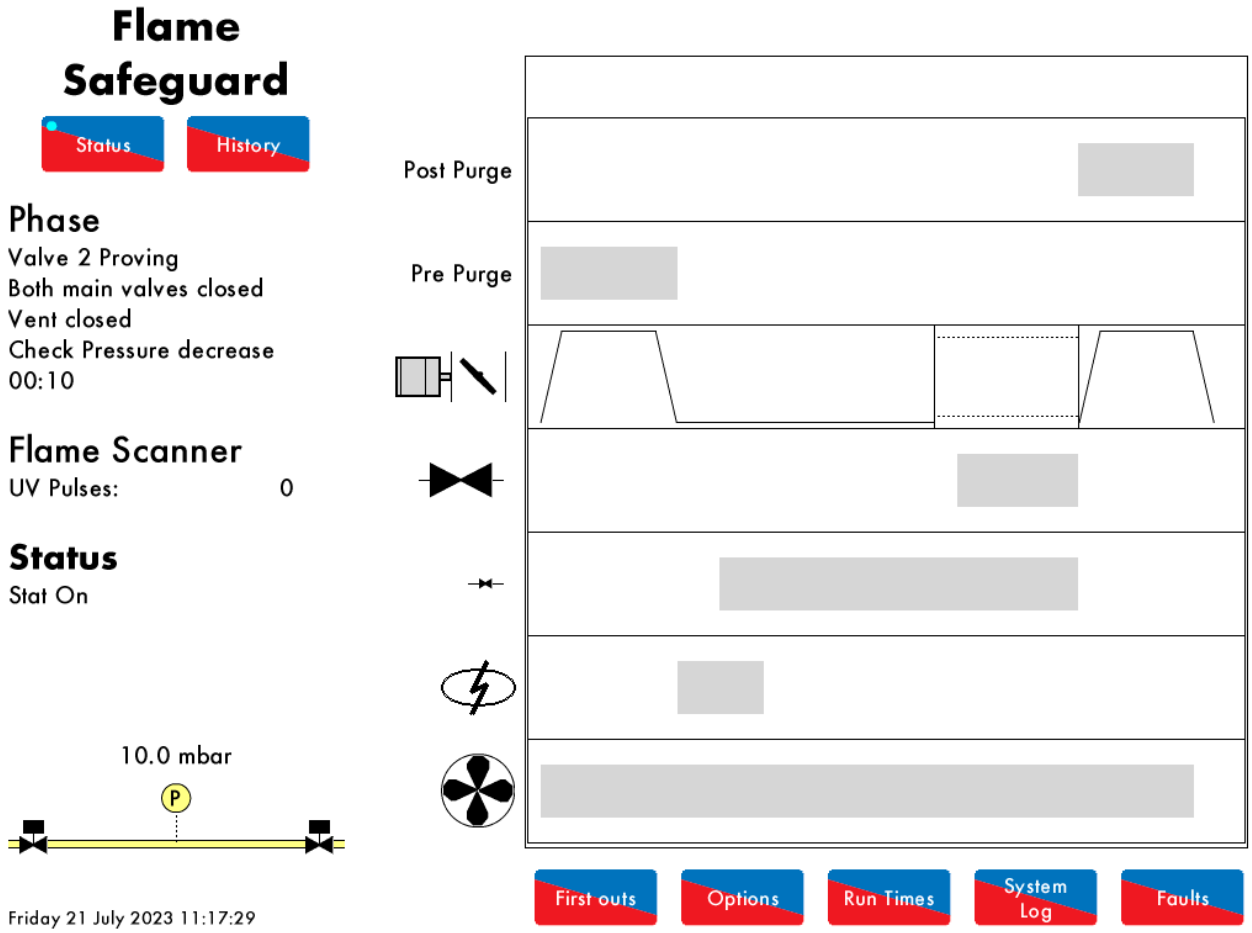


Figure 9.5.iv VPS Gas Proving

In the VPS Gas Proving phase shown in Figure 9.5.iv, the outputs of main gas valves 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.

9.6 Wait for Air Switch

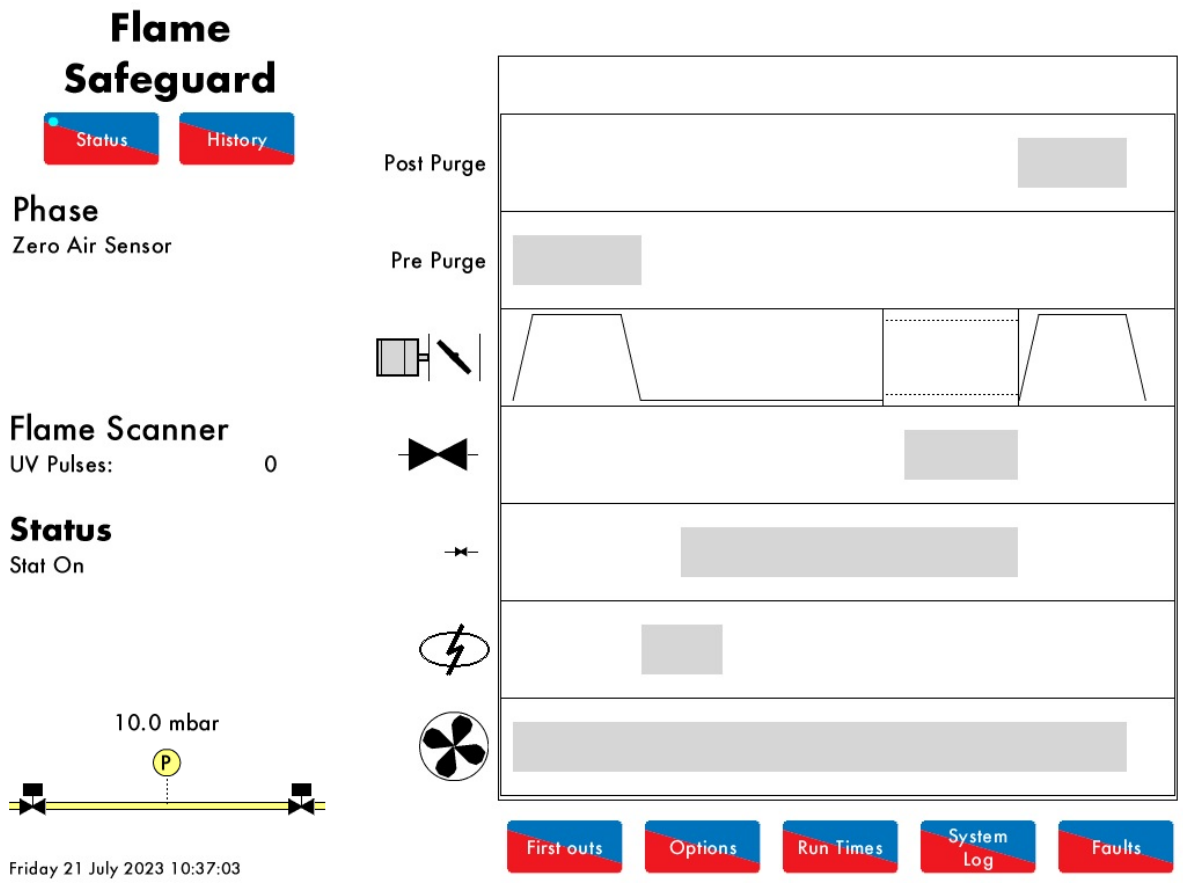


Figure 9.6.i Zero Air Sensor

Once the VPS checks are competed, if an air switch is used on T54, the Flame Safeguard controller 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 2 minutes, the lockout 'Wait Air Switch Timeout' will occur.

9.7 Purge

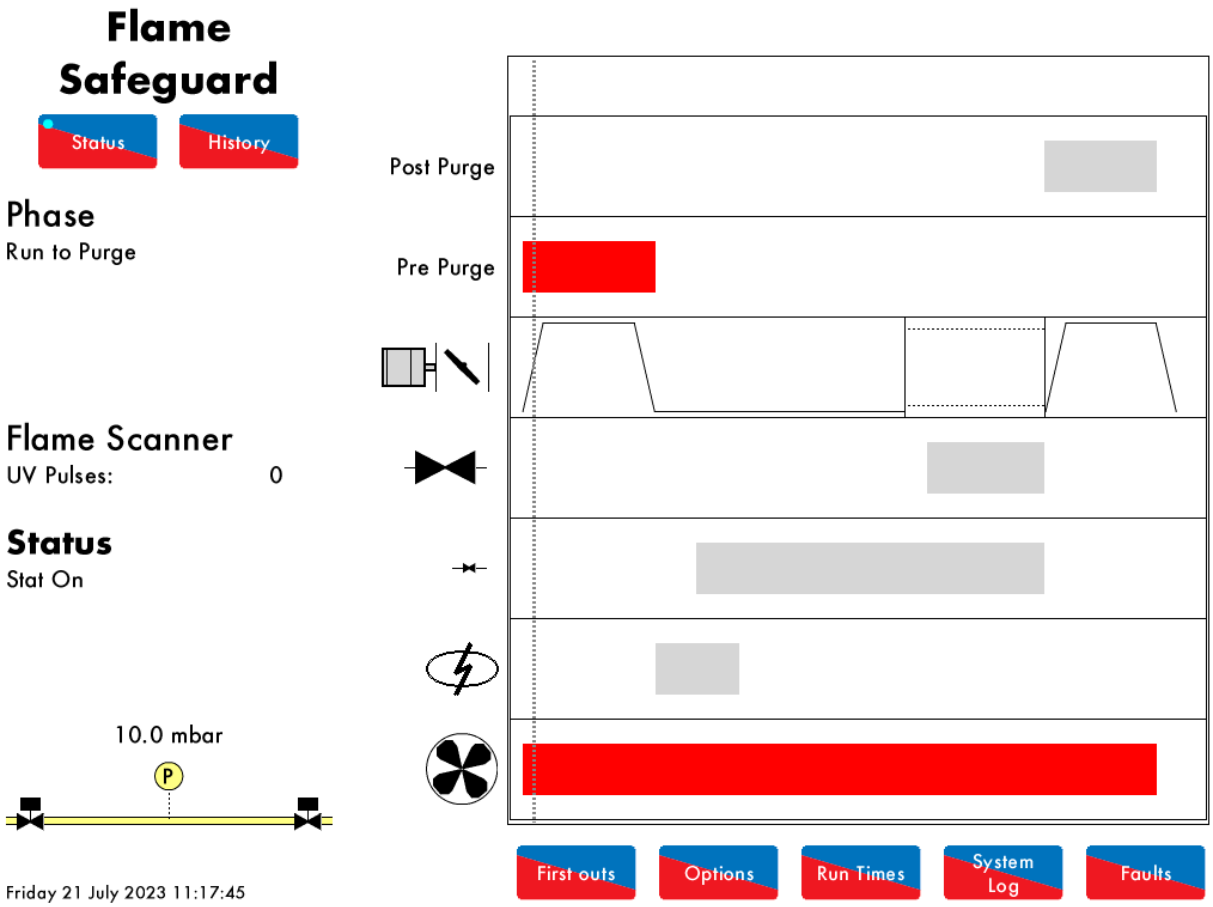


Figure 9.7.i Run to Purge

Once all the internal relay and VPS checks have been made, the motor moves to their purge positions in the Run to Purge phase shown in Figure 9.7.i. The burner motor output is switched on.

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

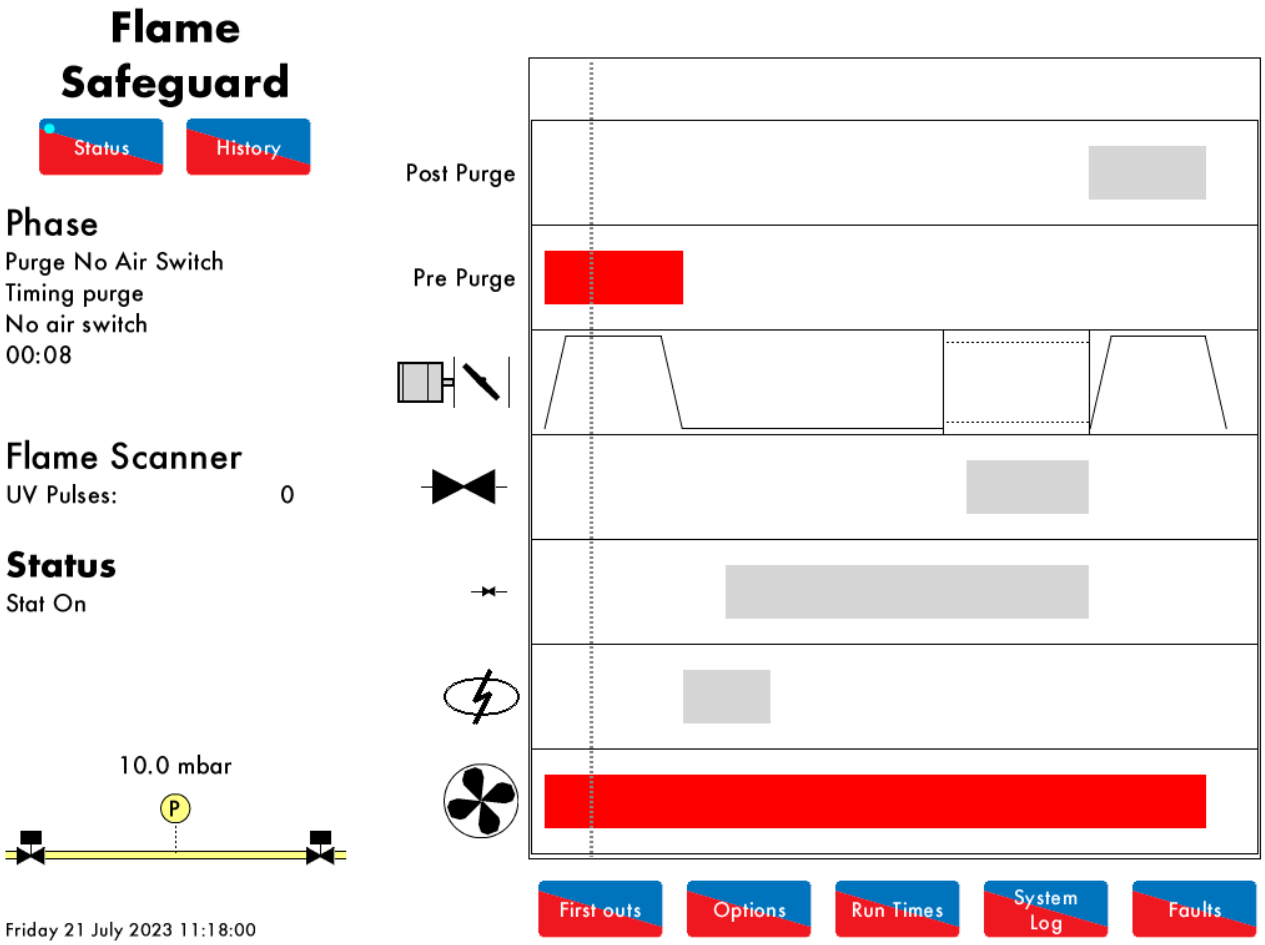


Figure 9.7.ii Purge No Air Switch

The Purge No Air Switch phase shown in Figure 9.7.ii allows a delay before the air switch is checked. See option/parameter 121.

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

In the On/Off burner setup, The T70 (switched neutral) can be used to drive T81 (Purge Switch) through a 5 second ON-delay timer relay to initiate the purge phase.

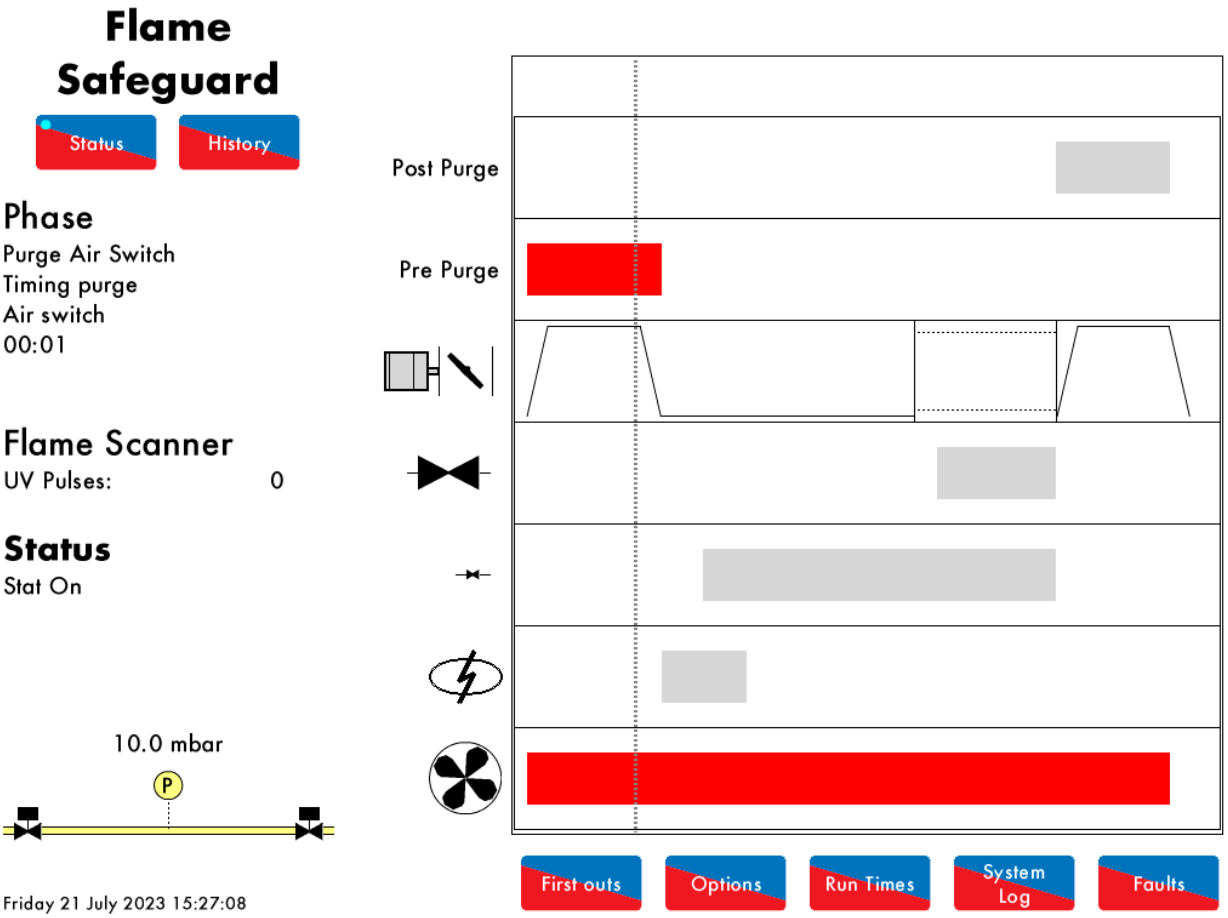


Figure 9.7.iii Purge Air Switch

Once the 'delay from start of the purge before the air switch is checked' has elapsed, 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.

9.8 Ignition

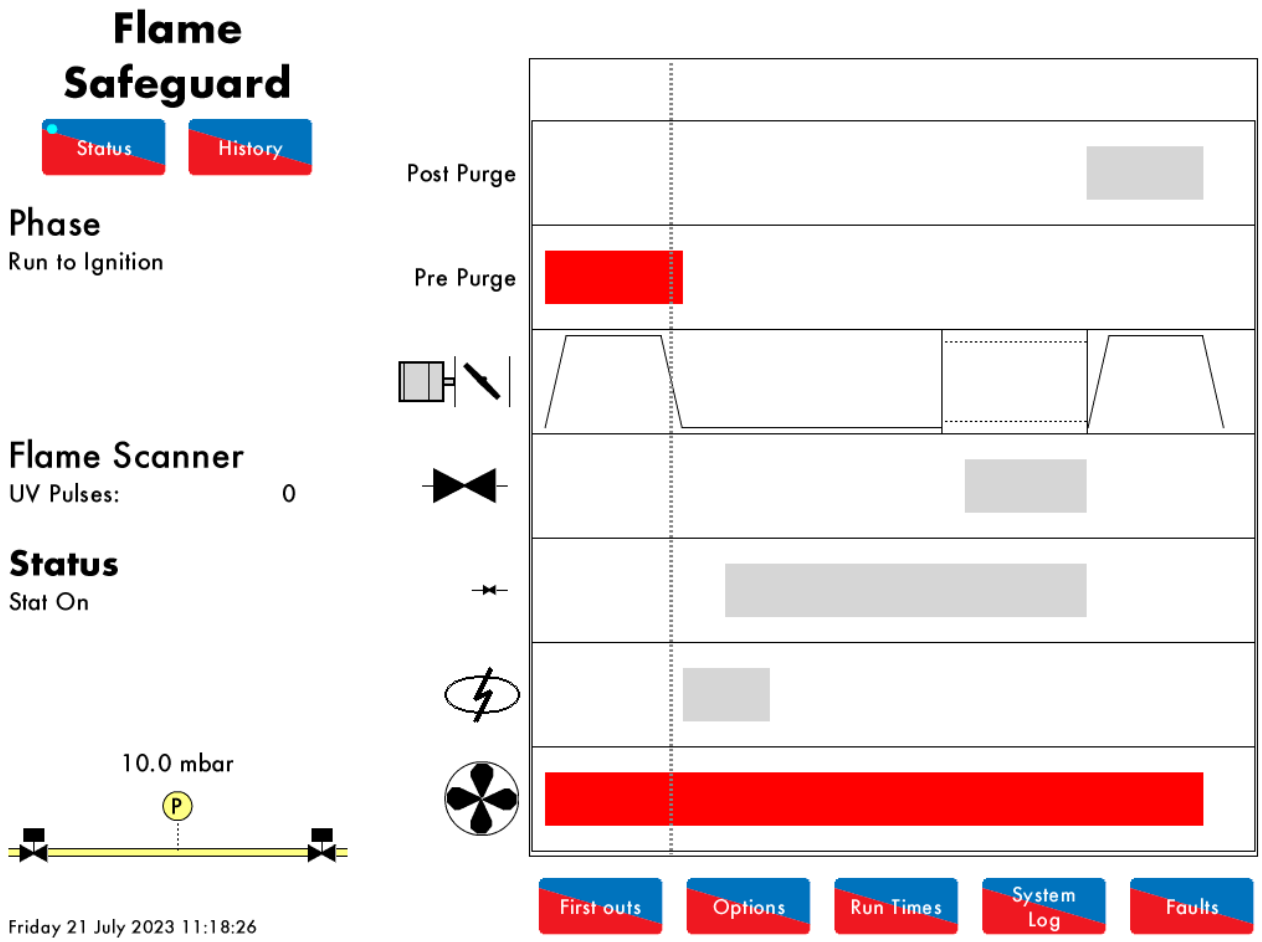


Figure 9.8.i Run to Ignition

In the Run to Ignition phase shown in Figure 9.8.i, the motor will move to the start position. A start position interlock is connected to terminal 80; This input must be made to initiate the ignition phase.

In the On/Off burner setup, The T70 (switched neutral) turning off can be used to swap the drive from T81 to T80 (Start Switch) through the relay to initiate the ignition phase.

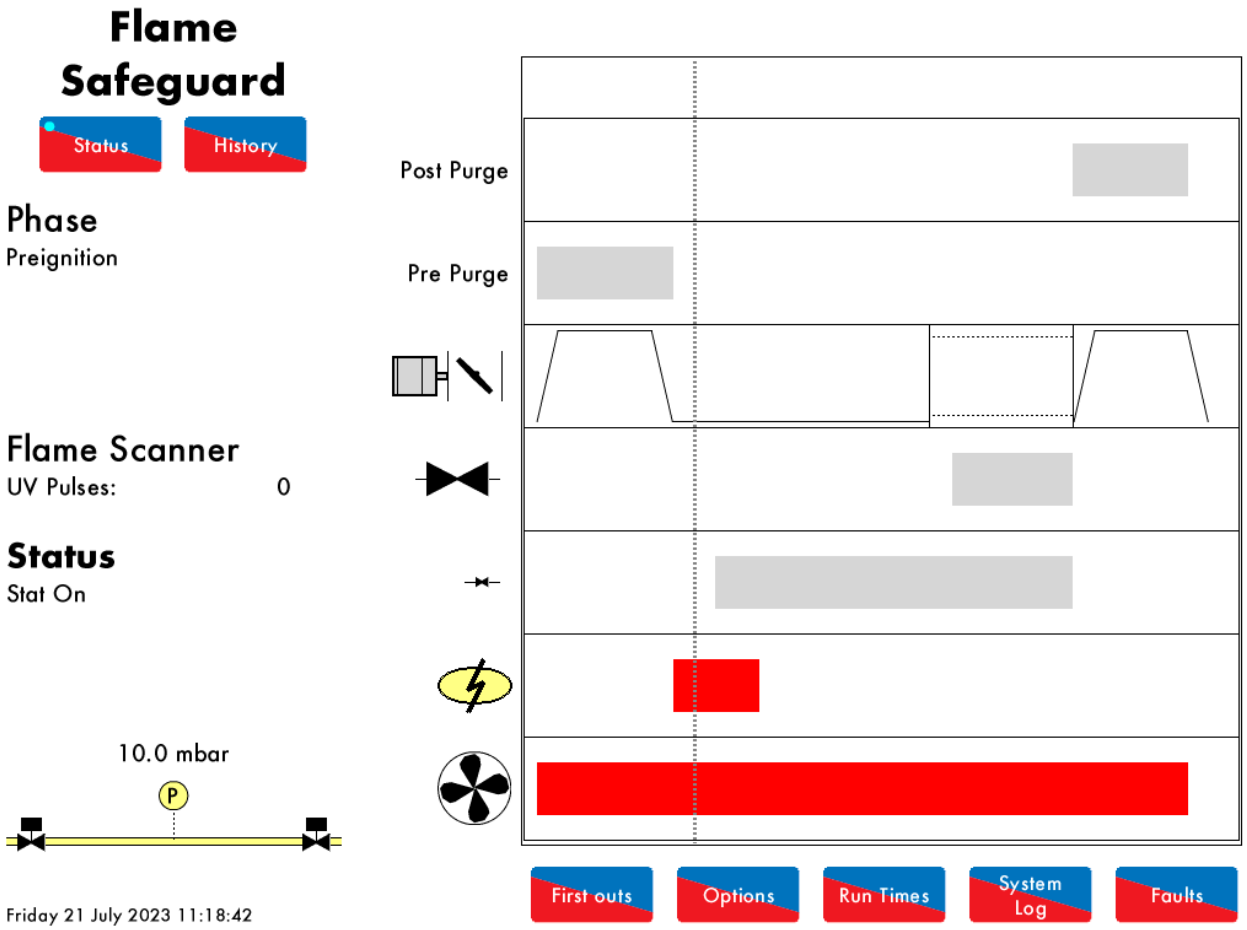


Figure 9.8.ii Pre-ignition

The ignition transformer output is switched on in the Pre-ignition phase shown in Figure 7.8.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.

9.9 Pilot

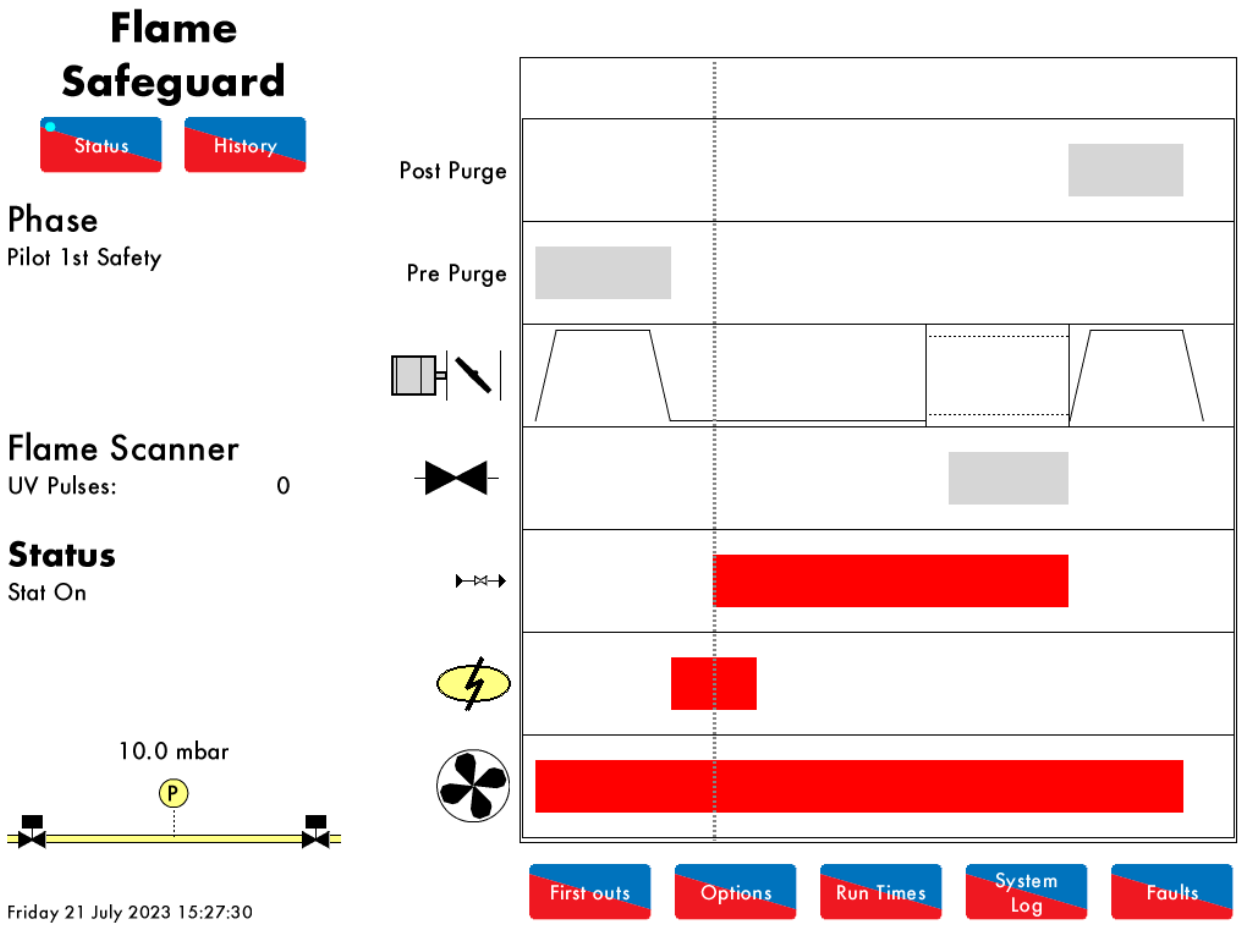


Figure 9.9.i Pilot 1st Safety

The pilot gas valve is switched on (open) in the Pilot Open phase shown in Figure 9.9.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.

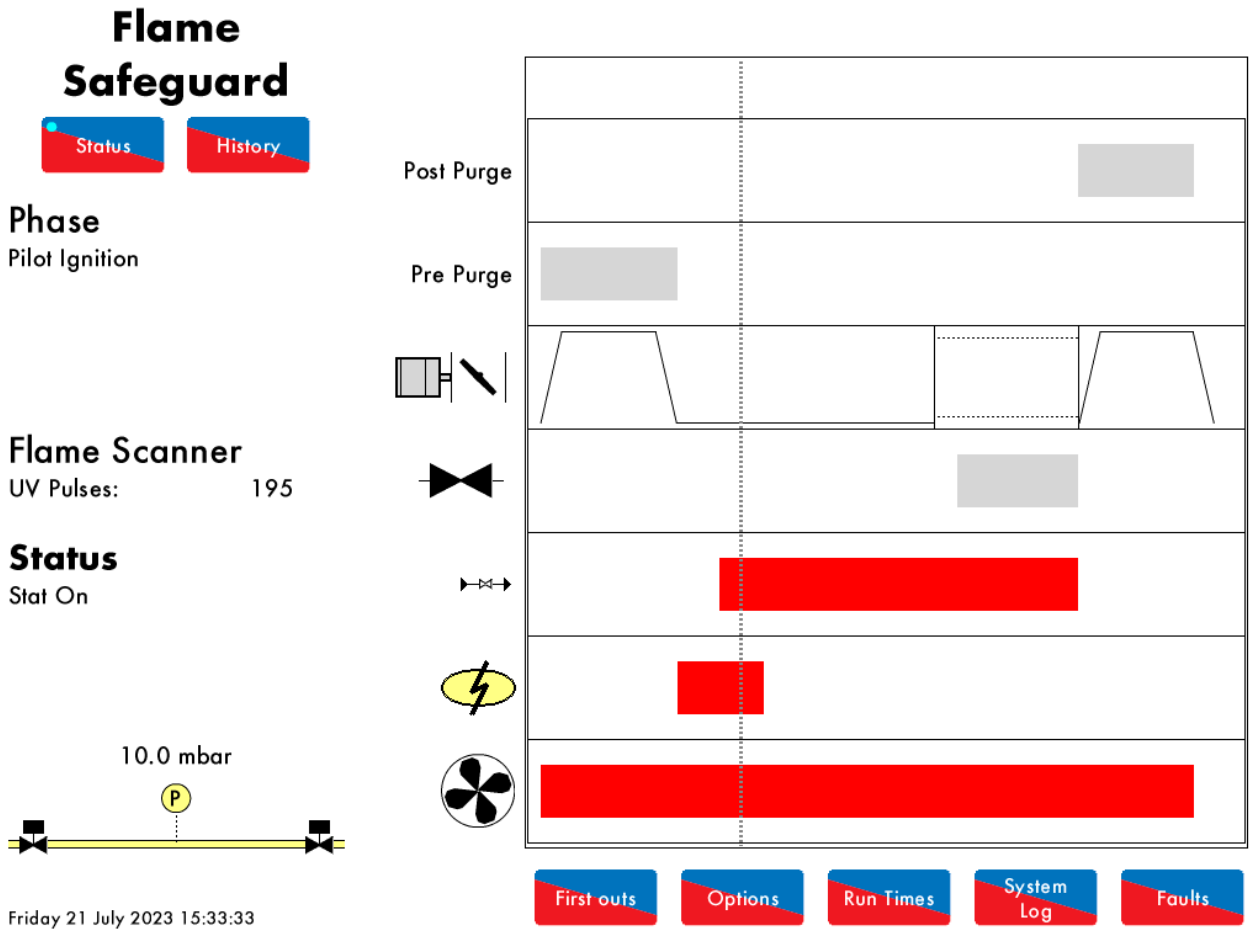


Figure 9.9.ii Pilot Ignition

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 7.9.ii. If the pilot goes out, the lockout 'No Flame Signal' will occur.

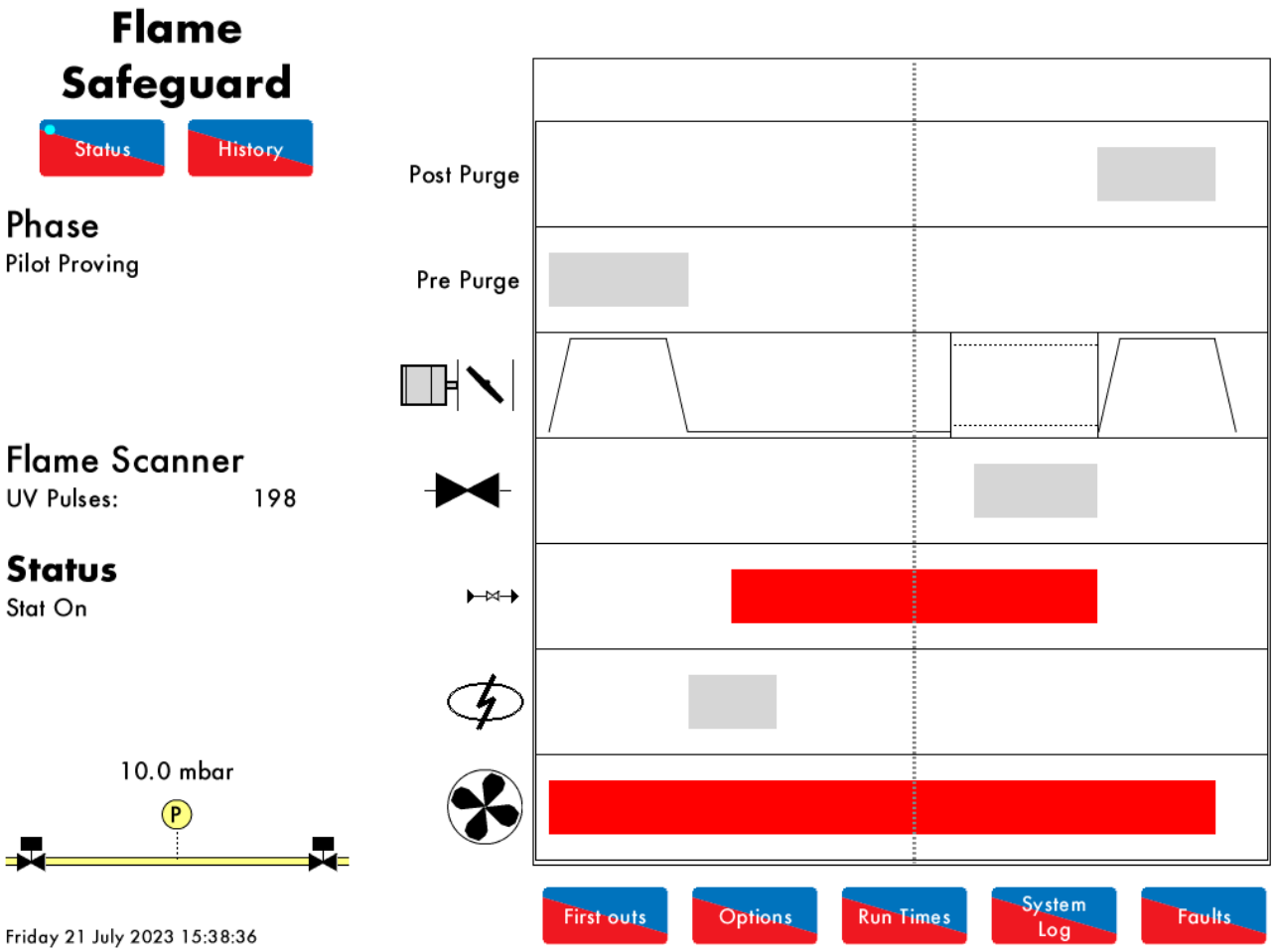


Figure 9.9.iii Pilot Proving

The ignition transformer output is switched off after the pilot ignition, in the Pilot Proving phase shown in Figure 9.9.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.

9.10 Proving

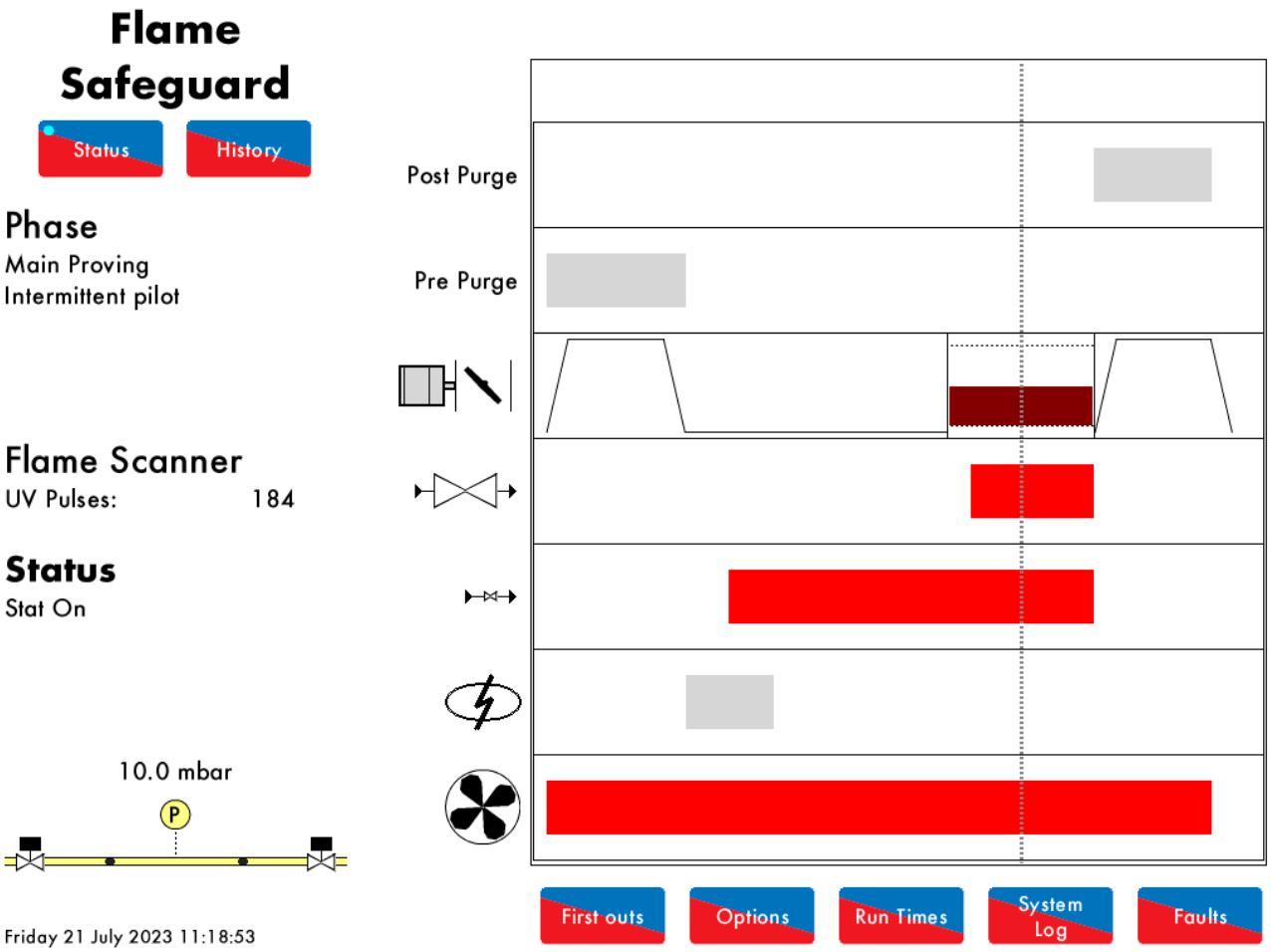


Figure 9.10.i Main Flame Proving

The 2nd safety time begins, where the flame is checked in the Intermittent Pilot 2nd Safety phase shown in Figure 7.10.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 T61 should 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.

9.11 Firing

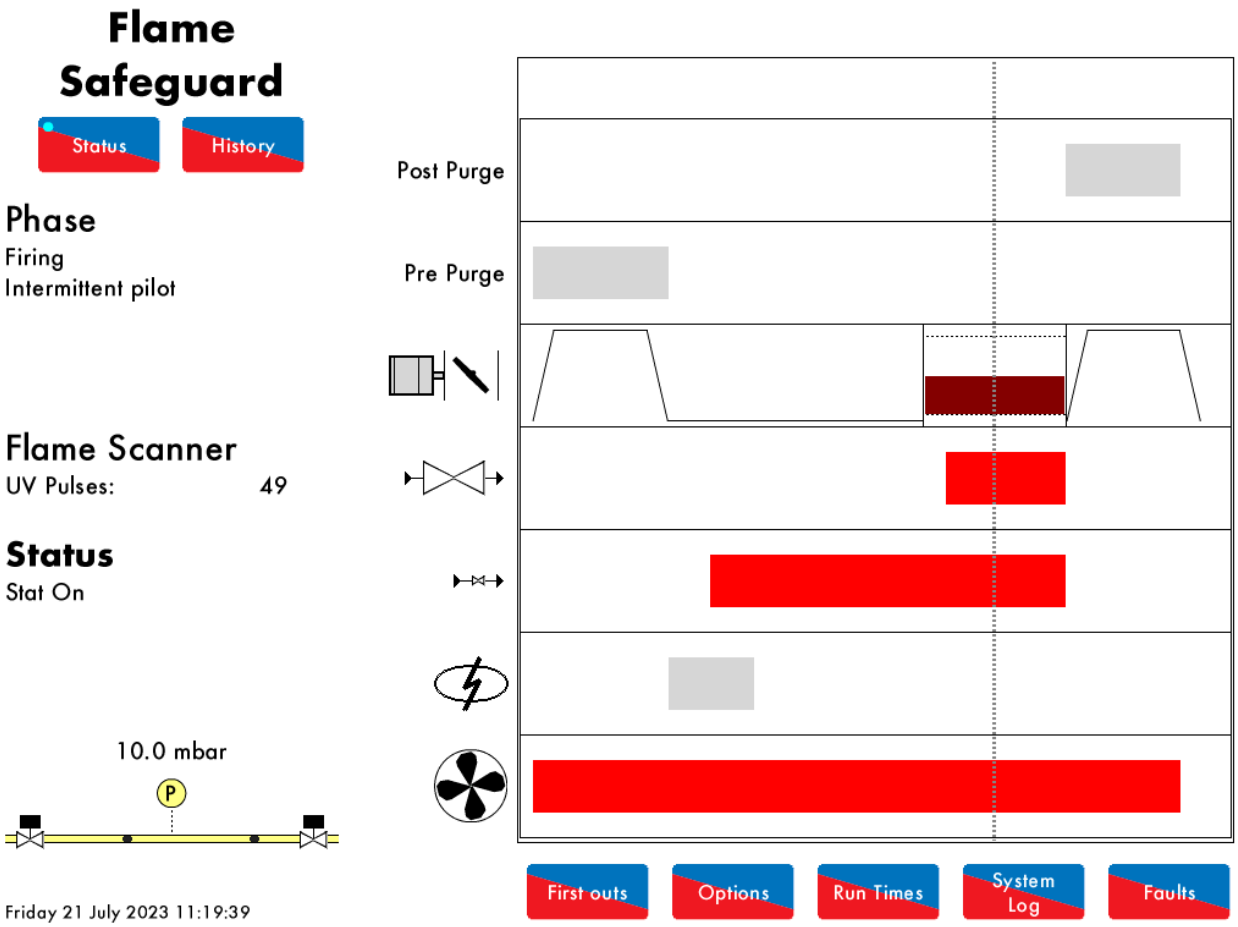


Figure 9.11.i Firing

The burner has now completed the start-up sequence.

T71 Release to modulate is activated to switch control of the servo motor to the load sensor and the burner fires normally and modulates according to this load sensor.

The Flame Safeguard controller remains in the Firing phase shown in Figure 9.11.i until the signal on T53 is removed, indicating a shutdown of the burner, or a flame detection error is seen.

With an On/Off burner, T71 is not connected and the burner just continues to fire so long as a flame is detected.

9.12 Post Purge

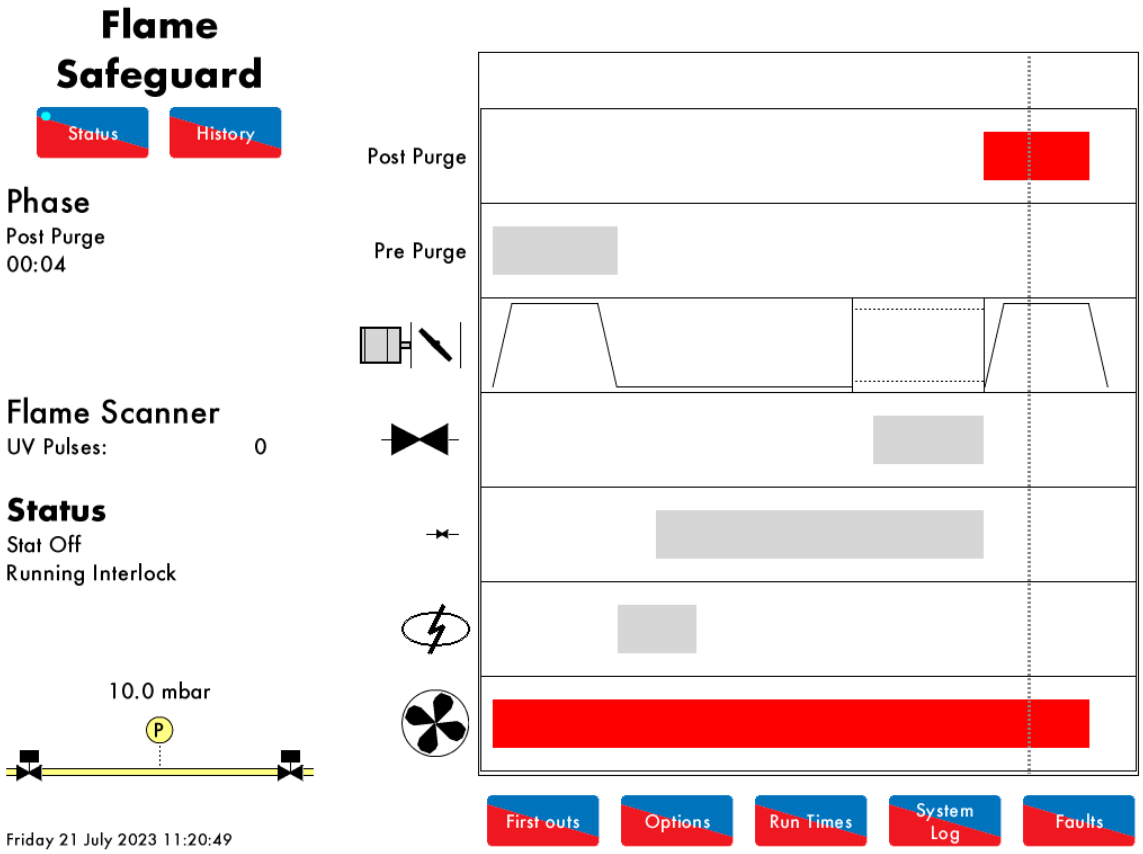


Figure 9.12.i Post Purge

The Post-Purge phase is shown in Figure 9.12.i. When T53 is switched off to turn the burner off, the Flame Safeguard controller will close the fuel valves and take back control of the servo. If a post purge is set, it will drive the servo to open, purging fresh air through the burner/boiler, when the burner shuts down in normal conditions. 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 motor has moved to their post purge positions and the purge interlock has been made on terminal 81. This does not apply to NFPA post purge.

After Post-Purge, the MM will go back to the Recycle phase and the burner start-up sequence will commence 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.

10 UNLOCKING THE AUTOFLAME FLAME SAFEGUARD UNIT TO A MK8 MM

10.1 Fully Unlocking the Autoflame Flame Safeguard Controller

A Mk8 MM, set to operate in Flame Safeguard Mode only, can be purchased under Order Code MM80001/FSG and comes pre-locked. If you want to unlock a Flame Safeguard unit, to work as a fully functional Mk8 MM, you will need to go into commission mode, and then press the Expansion features button.

An unlock code (MK8013) needs to be purchased, to be able to activate this functionality.

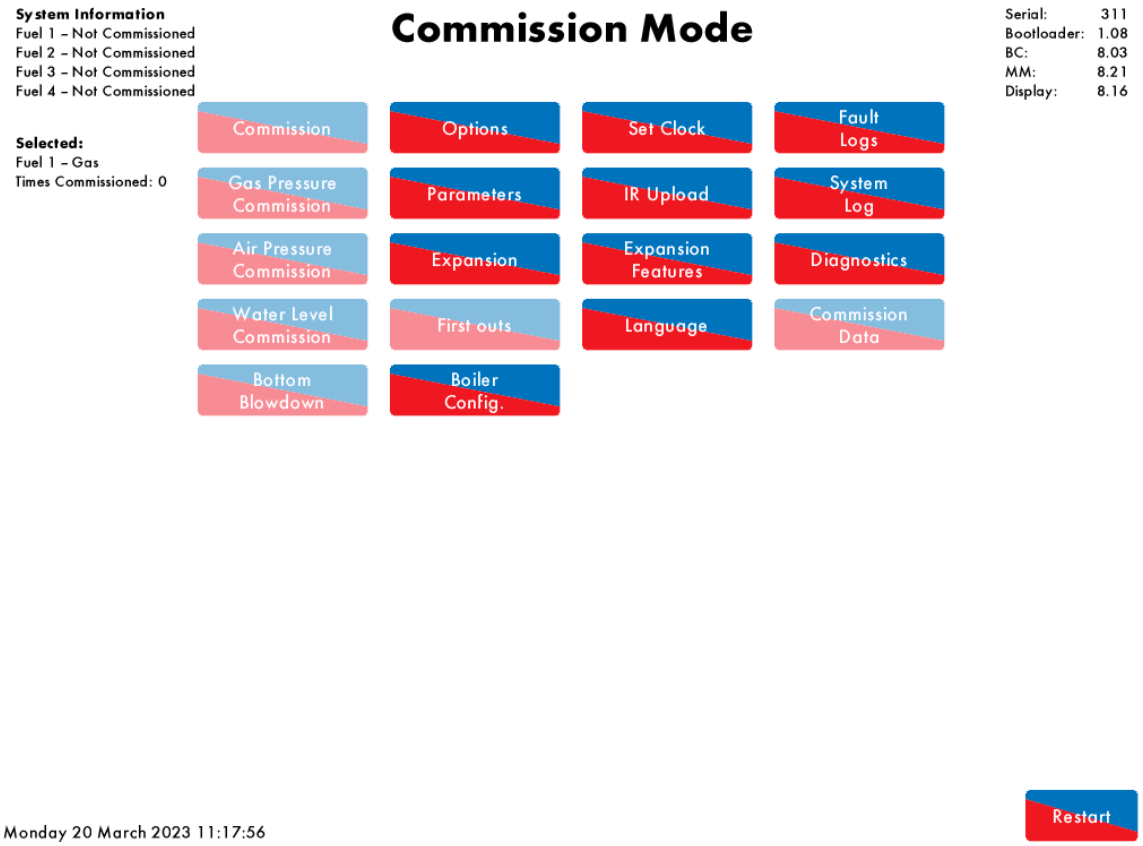


Figure 10.1.i Autoflame Flame Safeguard commission mode

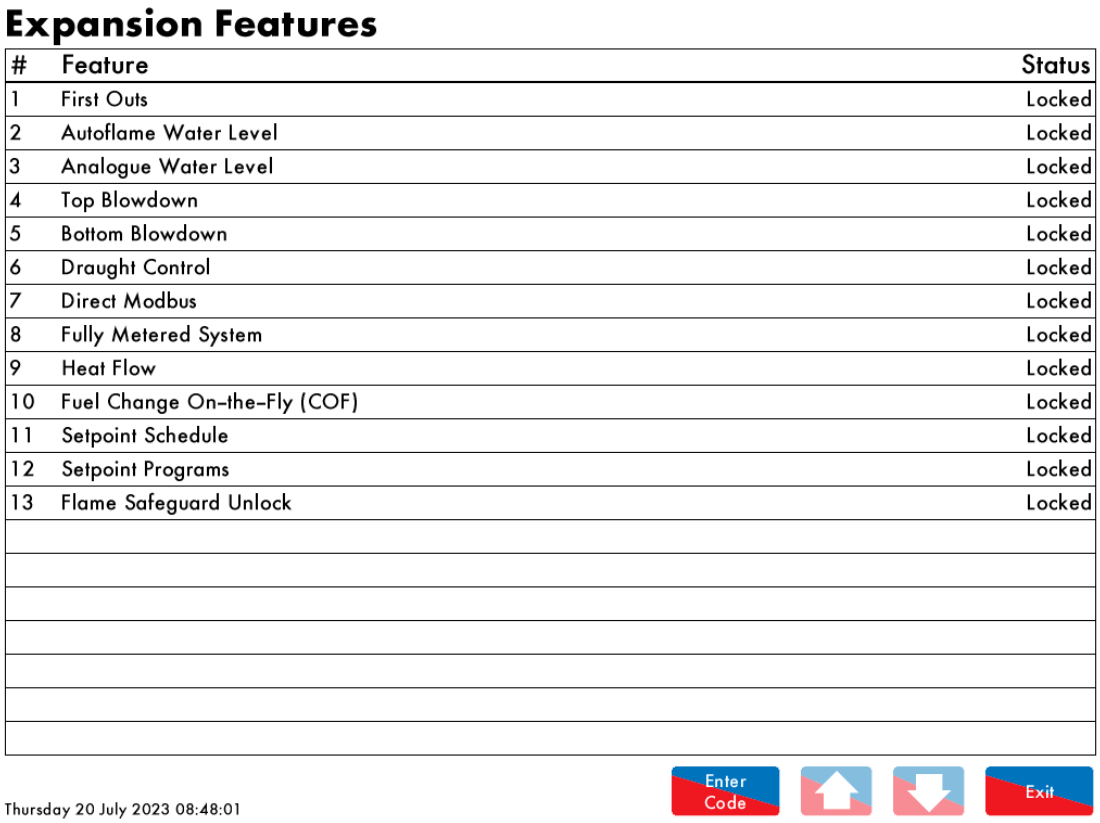


Figure 10.1.ii After pressing the Expansion features button, you can upload the unlock code via Download Manager or Enter code.

Once the Expansion features button has been pressed, you have the option of using Download Manager and an IR Lead to upload the unlock code.

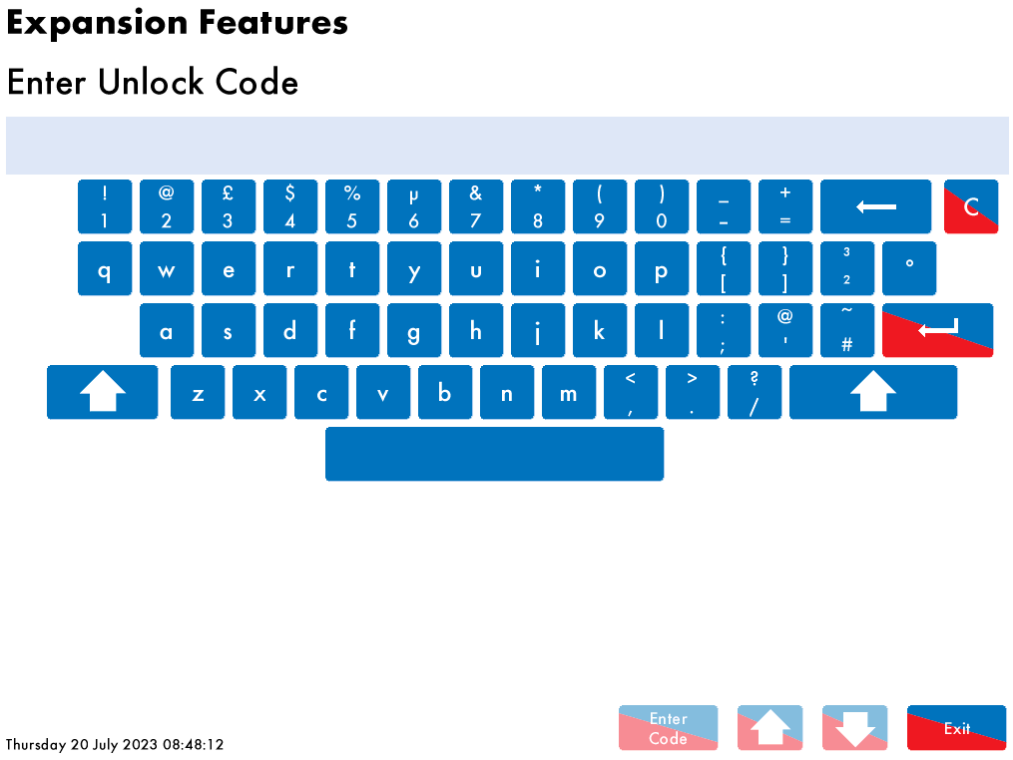


Figure 10.1.iii If you don't haven an IR Lead, then you can enter the code via the MK8 MM

Alternatively, by pressing the "Enter Code" button, you can type in the Unlock code on the keypad, if you don't have access to the Download Manager Software.

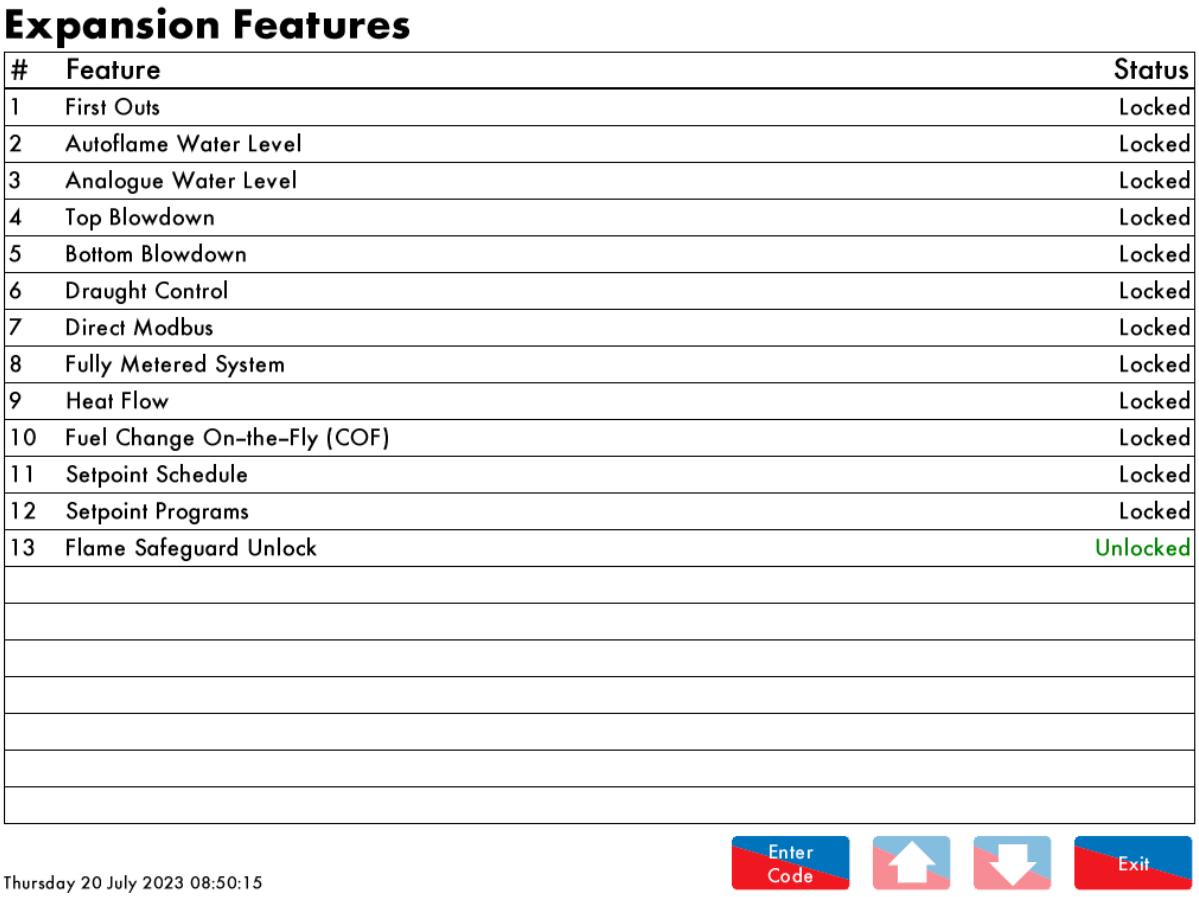


Figure 10.1.iv Flame Safeguard has been unlocked, allowing Flame Safeguard unit to be a MK8 MM

Once unlocked, the Flame Safeguard mode can be turned on/off by accessing Option 4.



Figure 10.1.v Flame Safeguard mode can be disabled, allowing the Flame Safeguard unit to be a MK8 MM

11 ERRORS AND LOCKOUTS

11.1 Errors

Errors occur when the Flame Safeguard controller detects an internal fault, component out of range, internal check failure or powersupply issue. To clear an error, the Flame Safeguard controller must be restarted.

Error	Message	Description
1	Channel 1 Positioning Error	Servomotor is outside of the commissioned range
	• Check wiring on terminals 40 – 42 • 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, 41, 43 • 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 44, 46, 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°	
4	Channel 4 Positioning Error	Servomotor is outside of the commissioned range
	• Check wiring on terminals 45 – 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 7 Positioning Error	Servomotor is outside of the commissioned range
	• Check wiring on terminals DP-, DP+, DPW • 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°	
6	Channel 1 Gain Error	Servomotor position measurement hardware error
	• Check wiring and voltages on terminals 40 – 42 and 70 – 71	
7	Channel 2 Gain Error	Servomotor position measurement hardware error
	• Check wiring and voltages on terminals 40, 41, 43 and 72 – 73	
8	Channel 3 Gain Error	Servomotor position measurement hardware error
	• Check wiring and voltages on terminals 44, 46, 47 and 74 – 75	
9	Channel 4 Gain Error	Servomotor position measurement hardware error
	• Check wiring and voltages on terminals 45 – 47 and 76 – 77	
10	Channel 7 Gain Error	Servomotor position measurement hardware error
	• Check wiring and voltages on terminals DP-, DP+, DPW and DCI, DCD	
11	Channel 1 Movement Error	Servomotor moves when not expected and vice versa
	• Check wiring and voltages on terminals 70 & 71 • Check servomotors drive in correct direction and valve is not stuck	
12	Channel 2 Movement Error	Servomotor moves when not expected and vice versa
	• Check wiring and voltages on terminals and 72 and 73 • Check servomotors drive in correct direction and damper is not stuck	

Error	Message	Description
13	Channel 3 Movement Error	Servomotor moves when not expected and vice versa
	• Check wiring and voltages on terminals and 74 and 75 • Check servomotors drive in correct direction and valve is not stack	
14	Channel 4 Movement Error	Servomotor moves when not expected and vice versa
	• Check wiring and voltages on terminals and 76 and 77 • Check servomotors drive in correct direction and valve is not stuck	
15	Channel 7 Movement Error	Servomotor moves when not expected and vice versa
	• Check wiring and voltages on terminals DCI and DCD • Check servomotor drives in correct direction and damper is not stuck	
16	Analogue Power Supply Error	ADC measured 12V supply out of range
	• Check wiring for shorts on terminals 41, 47 and 39	
17	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	
18	EEPROM Error	Fault communicating with the on board EEPROM
	• Contact Autoflame approved local tech centre	
19	ADC Error	Internal fault
	• Contact Autoflame approved local tech centre	
20	Watchdog Timeout	Internal fault
	• Contact Autoflame approved local tech centre	
21	Processor Clock Error	Internal fault
	• Contact Autoflame approved local tech centre	
22	System Error	Internal fault
	• Contact Autoflame approved local tech centre	
23	Flash Data Error	Internal fault
	• Re-install software SD card	
24	Processor Temperature Error	Internal fault
	• Check ambient temperature of unit does not exceed maximum recommended temperature	
25	Burner Control Comms Error	Internal fault
	• Contact Autoflame approved local Tech Centre	
26	Burner Control Reset	Internal fault
	• Contact Autoflame approved local Tech Centre	
27	Software Error	Internal fault
	• Contact Autoflame approved local Tech Centre	
29	Mains Input Detection Error	Mains input stuck on
	• Check wiring and voltages on terminals 89 – 92	
30	Channel 5 VSD Error	Feedback incorrect
	• Check VSD feedback against commissioned VSD and ensure the feedback is stable	
31	Channel 6 VSD Error	Feedback incorrect
	• Check VSD feedback against commissioned VSD and ensure the feedback is stable	
32	VSD Feedback Change Too Small	Feedback change detected during commissioning is too small
	• Check VSD feedback during commissioning • Check option 99 for VSD on channel 5 and option 109 for VSD on channel 6 • Check wiring on terminals 1 – 3, 4 – 6, 10 – 12 and 13 – 15	
33	Missing Commissioning Data	Internal fault
	• Check there is commissioning data for all options servomotors/VSD	

Error	Message	Description
34	FAR Execution Speed	Internal fault
• Contact Autoflame approved local Tech Centre		
35	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
36	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
37	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
38	Software Error	Internal fault
• Contact Autoflame approved local Tech Centre		
39	VSD Sampling Error	VSD feedback current/ voltage too high on channel 5/6
• Check wiring on terminals 1 – 3, 4 – 6, 10 – 12 and 13 – 15		
40	VSD Feedback Too Low	VSD feedback value is too low during commissioning on channel 5/6
• Check VSD feedback while commissioning		
41	APS Commission Data Fault	No air pressure trim data for a point with EGA trim
• Check EGA trim and air pressure trim in fuel-air curve		
42	Comm VPS Gas Pressure Low	Commissioned gas pressure during VPS below option/ parameter 133 threshold
• Check option/ parameter 133 and check gas pressure • Re-commission gas pressure sensor		
43	Comm Running Gas Pressure Low	Commissioned gas pressure during running below option/ parameter 136
• Check option/ parameter 136 and check gas pressure • Re-commission gas pressure sensor		
44	Comm Air Pressure Low	Commissioned air pressure during running below option/ parameter s 147 and 149
• Check option/parameters 147 and 149 • Re-commission air pressure sensor		
45	Software Error	Internal fault
• Contact Autoflame approved local tech centre		
46	Software Error	Internal fault
• Contact Autoflame approved local tech centre		
47	Expansion PF Output (Check F5)	Internal fault
• Check wiring on terminal PF • Check fuse 5 (2A) on expansion board		
48	WL Alarm Output Internal Fault	Internal fault
• Check expansion option 5 • Check wiring and voltages on terminals HAI, 1AI, 2AI		
49	Expansion Servo Hardware Fault	Internal fault
• Contact Autoflame approved local tech centre		
50	Triac Power Supply Error (Check F2)	Internal fault
• Check wiring on terminal 69 • Check fuse 2 (2A T)		
51	Fused 12V Supply Error (CheckF4)	Internal fault
• Check gas/air pressure sensor wiring on terminals 31 – 34, and load detector on 37 – 39 • Check fuse 4 (500mA)		

Error	Message	Description
52	Fused 13.5V Supply Error (Check F3)	Internal fault
• Check IR scanner wiring on terminals 29, 30, 48, 49 and oil pressure sensor on 48, 49 • Check fuse 3 (500mA)		
53	Air Pressure Zeroing Fault	Commissioned air zero pressure is more than 5mbar from sensor's zero value
• Check air pressure sensor value during VPS		
54	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
55	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
56	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
57	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
58	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
59	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
60	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
61	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
62	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
63	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
64	ADC Reference Voltage Error	Hardware fault
• Contact Autoflame approved local Tech Centre		
65	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
66	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		
67	Software error	Internal fault
• Contact Autoflame approved local Tech Centre		

11.2 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 F1)	Voltage detected when output is off (and vice versa)
	• Check wiring and voltage on terminal 57 • Check fuse 1 (6.3A T) and wiring on terminals 50 – 64	
10	Simulated Flame	Flame is present when it shouldn't 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 Air Proving Fail	Leak detected during 'air proving' part of VPS
	• Check main fuel valve • Call a certified Commissioning Engineer to investigate	
12	VPS Gas 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	
15	NO CPI Reset	Proof of closure switch not made after valves closed
	• Check wiring on terminal 55 and check proof of closure switches	

Lockout	Message	Description
16	Prolonged Lockout Reset	Prolonged voltage detected on terminal 56/ lockout resetbutton permanently pressed
• Check lockout reset button is not pressed • Check wiring on terminal 56		
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 – 63		
22	FSR Test 2A	Internal relay test failed
• Check wiring and voltages on terminals 50 – 63		
23	FSR Test 1B	Internal relay test failed
• Check wiring and voltages on terminals 50 – 63		
24	FSR Test 2B	Internal relay test failed
• Check wiring and voltages on terminals 50 – 63		
25	Watchdog Fail 2A	Internal check failed
• Contact Autoflame approved local tech centre		
26	Watchdog Fail 2B	Internal check failed
• Contact Autoflame approved local tech centre		
27	Watchdog Fail 2C	Internal check failed
• Contact Autoflame approved local tech centre		
28	Watchdog Fail 2D	Internal check failed
• Contact Autoflame		
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 sensor value • Check option/parameter 136		
33	VPS Air Zeroing	Gas pressure sensor cannot be zeroed at VPS venting
• Check gas pressure is within zero range (see Autoflame Sensors Guide) • Check vent valve		
36	Oil Pressure Too Low	Oil pressure below offset lower limit during running
• Check option/parameter 139 • Check oil pressure sensor		
37	Oil Pressure Too High	Oil pressure above offset upper limit during running
• Check option/parameter 140 • Check oil pressure sensor		
39	Freeze Timeout	MM kept in Phase Hold for more than 10minutes
• MM kept in Phase Hold during commissioning for more than 10 minutes		
40	Purge Air Pressure Low	Insufficient air pressure during purge
• Check option/parameter 141 • Check air pressure sensor/ air pressure switch		

Lockout	Message	Description
42	Terminal 86 Inverse	Input detected on both terminals 85,86 where there shouldnot be, and vice versa
• Check option/parameter 122 • Check wiring and voltages on terminals 85, 86		
43	Terminal 85/86 Fault	Hardware fault on terminals 85/86
• Check wiring and voltages on terminals 85, 86 and contact Autoflame		
44	Proving Circuit Fail T52	Loss of input on terminal 52; MM must see input at all times from position to purge to post-purge
• Check wiring on terminal 52		
45	No Proving Circuit Set	Secondary proving timeout elapsed
• Check option/parameter 157 • Check wiring on terminal 52		
46	Proving Interlock Timeout	Purge interlock timeout elapsed
• Check option/ parameters 155 and 158 • Check wiring on terminal 81		
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		
54	Watchdog Long X A	Internal check failed
• Contact Autoflame approved local tech centre		
55	Watchdog Long Y A	Internal check failed
• Contact Autoflame approved local tech centre		
56	Watchdog Off A	Internal check failed
• Contact Autoflame approved local tech centre		
57	Watchdog Short X B	Internal check failed
• Contact Autoflame approved local tech centre		
58	Watchdog Short Y B	Internal check failed
• Contact Autoflame approved local tech centre		
59	Watchdog Long X B	Internal check failed
• Contact Autoflame approved local tech centre		
60	Watchdog Long Y B	Internal check failed
• Contact Autoflame approved local tech centre		
61	Watchdog Off B	Internal check failed
• Contact Autoflame approved local tech centre		
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 – 63		
66	FSR B	Internal check failed
• Check wiring and voltages on terminals 50 – 63		

Lockout	Message	Description
67	Gas Sensor Comms	Signal lost from gas pressure sensor
• Check wiring and screen on terminals 31 – 34		
68	Gas Sensor Type	Internal fault
• Contact Autoflame approved local tech centre		
69	Gas Sensor Fault	Internal pressure sensor fault
• Contact Autoflame approved local tech centre		
70	UV Pot Fault	Internal UV scanner fault
• Contact Autoflame approved local tech centre		
71	Air Sensor Comms	Signal lost from air pressure sensor
• Check wiring and screen on terminals 31 – 34		
72	Air Sensor Type	Internal fault
• Contact Autoflame approved local tech centre		
73	Air Sensor Fault	Internal pressure sensor fault
• Contact Autoflame approved local tech centre		
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 is above 400mbar
• Check 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		
81	Oil Pressure Sensor Fault	No comms received from oil pressure sensor
• Check wiring and screen on terminals 48, 49		
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.		
83	Main Gas 3 Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 64		
84	Main Gas 4 Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 83		
85	Vent Valve 2 Output Fault	Voltage detected when output is off (and vice versa)
• Check wiring and voltage on terminal 84		
86	Gas Sensor 2 Comms	Signal lost from gas pressure sensor
• Check wiring and screen on terminals DT+, DT-, DP- and DP+ on the MM expansion board		

Lockout	Message	Description
87	Gas Sensor 2 Fault	Internal pressure sensor fault
• Contact Autoflame approved local tech centre		
88	VPS Air Proving Fail (Fuel 2)	Leak detected during ‘air proving’ part of VPS
• Check fuel 2 valve 1 • Call a certified Commissioning Engineer to investigate		
89	Gas Pressure Low Limit (Fuel 2)	Gas pressure lower than commissioned VPS value
• Check gas pressure sensor value • Check option/parameter 136		
90	VPS Gas Proving Fail (Fuel 2)	Leak detected during ‘gas proving’ part of VPS
• Check option/parameter 133 • Check fuel 2 gas valve 1 and vent valve • Check pilot valve if using single valve pilot • Isolate gas and call a certified Commissioning Engineer to investigate		
91	Gas Proving Fail High (Fuel 2)	Gas pressure too high during VPS
• Isolate gas • Check fuel 2 valve 1 and vent valve • Check option/ parameters 133 and 134 • Call a certified Commissioning Engineer to investigate		
92	Oil Pressure Too Low (Fuel 2)	Internal fault
• Check option/parameter 139 • Check oil pressure sensor		
93	Gas Pressure Low (Fuel 2)	Gas pressure low limit exceeded while firing (gas sensor)
• Check gas pressure • Check option/ parameter 136		
94	Oil Pressure Too High (Fuel 2)	Oil pressure above offset upper limit during running
• Check option/parameter 140 • Check oil pressure sensor		
95	Gas Pressure High (Fuel 2)	Gas pressure high limit exceeded while firing (gas sensor)
• Check gas pressure • Check option/ parameter 137		
96	NO CPI Reset	Proof of closure switch not made after valves closed
• Check wiring on terminal 55 and check proof of closure switches		
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	Power up CPU Test Fail	Internal check failed
• Contact Autoflame approved local tech centre		
202	Power up EEPROM Test Fail	Internal check failed
• Contact Autoflame approved local tech centre		

11.3 Alarms and Warnings

Alarms and warnings are faults detected with the system operation. If an alarm occurs, the burner will stop running, and if a warning occurs, the burner will continue to run. The following options/parameters set whether system operation faults are set as alarms or warnings:

Option 13	EGA Fault Response
Option 14	Warning Response
Expansion Option 9	Burner Operation at High Water
Expansion Option 20	Burner Operation on Feedwater Control Fault
Expansion Option 88	Action on Pressure Sensor Fault

Fault	Message	Description
1	EGA Internal Error	Fault on EGA
	• Alarm or warning depending on option 13 • Check EGA for fault description	
2	No EGA Communications	MM has lost communications with EGA
	• Alarm or warning based on option 13 (warning if option 12 is set to monitoring only) • 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	O_2 value is above upper limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 19	
4	O_2 Absolute Limit	O_2 value is below absolute limit*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 25	
5	O_2 Lower Limit	O_2 value is below lower limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 22	
6	CO_2 Upper Limit	CO_2 value is above upper limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 20	
7	CO_2 Absolute Limit	CO_2 value is above absolute limit*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 26	
8	CO_2 Lower Limit	CO_2 value is below lower limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 23	
9	CO Upper Limit	CO value is above upper limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 21	
10	CO Absolute Limit	CO value is above absolute limit*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and option 27	
11	NO Upper Limit	NO value is above upper limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and parameter 94	
12	Exhaust Temperature Upper Limit	Exhaust temperature is above upper limit offset of commissioned value*
	• Alarm or warning depending on option 13 • Check exhaust gas readings and parameter 96	

Fault	Message	Description
13	Exhaust Temperature Absolute Limit	Exhaust temperature is above absolute limit*
• Alarm or warning depending on option 13 • Check exhaust gas readings and parameter 97		
50	Load Sensor Fault	Incorrect/no load sensor detected
• Alarm • Check option 1 • Check wiring on terminals 37 – 39		
51	Auxiliary Input Low	3mA or lower received from 4-20mA external modulation/external setpoint
• Alarm • Check parameter 69 • Check feedback from external modulation/ external setpoint controller • Check wiring on terminals 7 – 9		
52	Zero Crossing Detection	Irregular mains power
• Warning • Check mains supply to the MM is within acceptable voltage range		
63	Zero Crossing Detection	Internal fault in the MM's main board
• Alarm • Check all fuses on the MM's main board • Check the mains supply to the MM is within acceptable voltage range		
64	Zero Crossing Detection	Internal fault in the MM's expansion board
• Alarm • Check all fuses on the MM's expansion board • Check the mains supply to the MM is within acceptable voltage range		
80	Oil Pressure Sensor Fault	No comms received from oil pressure sensor
• Warning (lockout 81 if oil pressure limits set in option/parameters 139 and 140) • Check wiring and screen on terminals 48, 49		
100	Cap Probe 1 Communications Fault	No comms with capacitance probe 1
• Alarm • Check wiring and screen on terminals 1P+, 1P-, 1T+ and 1T-		
101	Cap Probe 2 Communications Fault	No comms with capacitance probe 2
• Alarm • Check wiring and screen on terminals 2P+, 2P-, 2T+ and 2T-		
102	Cap Probe 1 Short Circuit	Hz reading is below 10kHz
• Alarm • Check water level Hz reading • Check wiring on terminals 1P+, 1P-, 1T+ and 1T-		
103	Cap Probe 2 Short Circuit	Hz reading is below 10kHz
• Alarm • Check water level Hz reading • Check wiring on terminals 2P+, 2P-, 2T+ and 2T-		
104	Cap Probe 1 Temp Compensation Error	Temperature corrected probe reference is not as expected
• Alarm • Re-commission capacitance probes at temperature		
105	Cap Probe 2 Temp Compensation Error	Temperature corrected probe reference is not as expected
• Alarm • Re-commission capacitance probes at temperature		

Fault	Message	Description
106	Cap Probe 1 Still Water Detected	Wave signature high to low peak distance is less than still water threshold
	• Alarm • Check still water threshold in expansion option 28 • Check capacitance probe 1 reading history	
107	Cap Probe 2 Still Water Detected	Wave signature high to low peak distance is less than still water threshold
	• Alarm • Check still water threshold in expansion option 28 • Check capacitance probe 2 reading history	
108	Cap Probe 1 Serial Number Mismatch	Probe serial number detected is not the commissioned probe serial number
	• Alarm • If changing capacitance probe 1, re-commission is required	
109	Cap Probe 2 Serial Number Mismatch	Probe serial number detected is not the commissioned probe serial number
	• Alarm • If changing capacitance probe 2, re-commission is required	
110	Cap Probe 1 Detected But Not Optioned	Probe connected but not optioned
	• Alarm • Check expansion options 1 and 3 • Check wiring on terminals 1P+, 1P-, 1T+ and 1T-	
111	Cap Probe 2 Detected But Not Optioned	Probe connected but not optioned
	• Alarm • Check expansion options 1 and 3 • Check wiring on terminals 2P+, 2P-, 2T+ and 2T-	
112	External Level Sensor InputLow	3mA or lower received from 4-20mA external level sensor
	• Alarm • Check feedback from external level sensor • Check wiring on terminals EX- and EX+	
113	Probe Reading Mismatch	Reading of one of the probes/sensor is less than or equal to its end-of-probe value or the difference between probes/sensor readings is greater than the mismatch threshold
	• Alarm • Check expansion option 27 • Check capacitance probes and sensor readings	
114	Probe Serial Numbers are the Same	One capacitance probe detected on both capacitance probe terminals
	• Alarm • If using two capacitance probes, then two individual probes must be connected • Check wiring on terminals 1P+, 1P-, 1T+, 1T-, 2P+, 2P-, 2T+ and 2T-	
120	Aux WL Inputs Mismatch	High water and 1st or 2nd low auxiliary level inputs detected simultaneously
	• Alarm • Check wiring on terminals HAI, 1AI and 2AI	
121	Water Levels Diverse	Probes/ sensor detects 1st or 2nd low and high water simultaneously
	• Alarm • Check water level readings for probes and sensor if optioned • Re-commission probes/sensor	
122	Permanent Alarm Reset Input	Input held on alarm reset terminal for more than 10 seconds
	• Alarm • Check input on terminal M/R	

Fault	Message	Description
123	Second Low Probe Communications Fault	No comms with second low probe
	• Alarm • Check wiring and screen on terminals 5T+, 5T-, 4P- and 4P+	
124	Second Low Probe Hardware Fault	Internal check failed
	• Alarm • Contact Autoflame approved local tech centre	
125	Permanent Test Input	Input held on test terminal for more than 60 seconds
	• Alarm • Check input on terminal TST	
126	Second Low Probe Detected But Not Optioned	Second low probe connected but not optioned
	• Alarm • Check expansion option 6 • Check wiring on terminals 5T+, 5T-, 4P- and 4P+	
127	Aux WL Inputs Detect But Not Optioned	Mains detected on auxiliary WL inputs but not optioned
	• Alarm • Check expansion option 5 • Check wiring on terminals HAI, 1AI and 2AI	
130	Feed Water Servo Position Error	Servomotor is outside of the commissioned range
	• Alarm or warning or depending on expansion option 20 (if set to warning, feed water pump will continue to operate as normal) • Check wiring on terminals P-, FW and P+ • Check signal cable form the MM to the servomotor is screened at one end • Check that the servomotor is zeroed correctly	
131	Feed Water Servo Movement Error	Servomotor moves when not expected and vice versa
	• Alarm or warning depending on expansion option 20 • Check wiring and voltages on terminals MVI and MVD • Check servomotor drives in correct direction • Check feed water valve is not stuck	
150	High Water	Probes/sensor detect water level above commissioned highwater
	• Alarm or warning depending on expansion option 9 • Check water level reading	
151	Pre-High Water	Probes/sensor detect water level above set pre-high water
	• Warning • Check water level reading • Check expansion option 7	
152	Pre-1st Low	Probes/sensor detect water level below set pre-1st low
	• Warning • Check water level reading • Check expansion option 8	
153	1st Low	Probes/sensor detect water level below commissioned 1st low
	• Alarm • Check water level reading • 1st low alarm will automatically clear if water level increases above 1st low	
154	2nd Low	Probes/sensor detect water level below 2nd low
	• Alarm • Check water level reading • 2nd low alarm requires manual reset	

Fault	Message	Description
155	Shunt Switch Time Expired	Once shunt switch time expires, system goes to normally running
	• Warning • If water drops after shunt switch time expires, system will generate 1st or 2nd low as relevant	
200	Top Blowdown Sensor Communications Fault	No comms with the top blowdown sensor
	• Warning • Check wiring and screen on terminals 3P+, 3P-, 3T+ and 3T-	
201	Top Blowdown Servo Position Error	Servomotor is outside of the commissioned range
	• Warning • Check wiring on terminals P-, TW, P+ and TBI, TBD • Check signal cable form the MM to the servomotor is screened at one end • Check that the servomotor is zeroed correctly	
202	Top Blowdown Servo Movement Error	Servomotor moves when not expected and vice versa
	• Warning • Check wiring on terminals TBI and TBD • Check servomotor drives in correct direction • Check top blowdown valve is not stuck	
250	Top Blowdown Reading High	TDS value detected too high
	• Warning • Check expansion option 46 and TDS value	
300	Bottom Blowdown Controller Comms	No comms with bottom blowdown controller
	• Warning • Check bottom blowdown controller is powered on and enabled • Check wiring and screen on terminals 5T+ and 5T-	
301	Bottom Blowdown Controller Software Fault	Internal check failed
	• Warning • Contact Autoflame approved local tech centre	
302	Bottom Blowdown Servo Closing Fault	No movement detected when bottom blowdown valve goes to close
	• Warning • Check wiring on terminals 5T+ and 5T- • Check bottom blowdown valve is not stuck	
303	Bottom Blowdown Servo Opening Fault	No movement detected when bottom blowdown valve goes to open
	• Warning • Check wiring on terminals 5T+ and 5T- • Check bottom blowdown valve is not stuck	
304	Bottom Blowdown ServoBattery Drive Fault	Battery has failed on bottom blowdown controller
	• Warning • Contact Autoflame approved local tech centre	
305	Bottom Blowdown Controller Main Power Fault	Main power has failed on bottom blowdown controller
	• Warning • Contact Autoflame approved local tech centre	
350	Bottom Blowdown Servo Not Commissioned	Bottom blowdown controller has not been requested to drive servomotor to closed since it was powered on
	• Warning • Commission bottom blowdown servomotor	
400	Draught Pressure Sensor Timeout	No comms within 2 seconds from draught pressure sensor
	• Alarm or warning depending on option 88 • Check wiring and screen on terminals DT+, DT-, DP- and DP+	

Fault	Message	Description
410	Draught Pressure Outside Tolerance	Pressure is outside of set tolerance
• Alarm or warning depending on option 88 • Check expansion option 87		
420	Fuel flow Feedback Input Low	3mA or lower received from 4-20mA external fuel flow input
• Warning • Check feedback from external fuel flow input • Check wiring on terminals EX- and EX+		
430	Fuel flow Feedback Below Tolerance	Fuel flow signal below fuel flow feedback fault tolerance
• Warning • Check feedback from external fuel flow input • Check option 60		
431	Fuel flow Feedback Above Tolerance	Fuel flow signal above fuel flow feedback fault tolerance
• Warning • Check feedback from external fuel flow input • Check option 60		
440	Temperature Sensor T1 Fault	Fault or no comms with T1 sensor
• Warning • Check wiring and screen on terminals –and T1		
441	Temperature Sensor T2 Fault	Fault or no comms with T2 sensor
• Warning • Check wiring and screen on terminals – and T2		
442	Temperature Sensor T3 Fault	Fault or no comms with T3 sensor
• Warning • Check wiring and screen on terminals – and T3		
443	Make Up Flow Meter Fault	Fault or no comms with make up flow meter
• Warning • Check wiring and screen on terminals F- and MF		
444	Condensate Flow Meter Fault	Fault or no comms with condensate flow meter
• Warning • Check wiring and screen on terminals F- and CF		
445	Deaerator IO Comms Fault	Fault or no comms with deaerator IO
• Warning • Check wiring and screen on terminals 6T+ and 6T-		
500	Multi-Burner Communications Fault	Loss of comms between MMs in multi-burner loop
• Alarm • Check wiring on terminals 23 and 24 on all MMs in multi-burner loop		
501	Multi-Burner Version Mismatch	Software versions of MMs in multi-burner loop do not match
• Alarm • Check that software versions of MMs in multi-burner loop match		
502	Multi-Burner Not Polled	MM in multi-burner loop has been detected but not polled
• Alarm • Check option 51 on master MM • Check wiring on terminals 23 and 24		
503	Multi-Burner Config (Multi-Burner Mode)	Multi-burner mode is not the same for all MMs in loop
• Alarm • Check option 43 on all MMs in multi-burner loop		

Fault	Message	Description
504	Multi-Burner Config (Fuel Index)	Same fuel number must be selected on all MMs in multi-burner loop
• Alarm • Check which fuel is selected on all MMs in multi-burner loop • Check wiring on terminals 89, 90, 91 and 92		
505	Multi-Burner Config (Fuel Type)	Fuel type is not the same for all MMs in multi-burner loop
• Alarm • Check option/parameters 150 – 153 on all MMs in multi-burner loop		
506	Multi-Burner Config (Pilot Type)	Pilot type not the same for all MMs multi-burner loop
• Alarm • Check option/parameter 111 on all MMs in multi-burner loop		
507	Multi-Burner Config (Load Sensor)	Load sensor not set the same for all MMs in multi-burner loop
• Alarm • Check option 1 on all MMs in multi-burner loop		
510	Multi-Burner Differential Firing Rate	Slave MM firing rate differs from the Master MM firing rate by1.5x the Differential Firing Rate Limit (Option 52) value
• Alarm • Check modulation speed of the slave MMs		
550	Fuel Flow Meter Fault	Less than 3mA signal received from fuel flow meter
• Alarm or warning depending on expansion option 152 (if set to warning, the MM will use the commissioned value without any fuel or air servomotor adjustment) • Check wiring and screen on terminal MF and F-		
551	Air Flow Meter Fault	Less than 3mA signal received from air flow meter
• Alarm or warning depending on expansion option 152 (if set to warning, the MM will use the commissioned value without any fuel or air servomotor adjustment) • Check wiring and screen on terminal EX+ and EX-		
552	Fuel Temperature Sensor Fault (T2)	Fault or no comms with T2 sensor
• Warning (MM will use commissioned temperature) • Check wiring and screen on terminals – and T2		
553	Air Temp Sensor Fault (T3)	Fault or no comms with T3 sensor
• Warning (MM will use commissioned temperature) • Check wiring and screen on terminals – and T3		
554	Fuel Pressure Sensor Fault	Fault or no comms with fuel pressure sensor
• Warning or lockout if VPS and/or pressure limits enabled in option/parameters 125 – 128 (if warning, MM uses commissioned pressure) • Check wiring and screen on terminals 31 – 34		
555	Air Pressure Sensor Fault	Fault or no comms with air pressure sensor
• Warning/Lockout –option 148 • Check wiring and screen on terminals 31 – 34 • Lockout if option 148 is set for air pressure sensor in flame safeguard		
560	Fully Metered Air Adjustment Failure	Air adjustment has reached limit and fuel-air ratio still not met
• Alarm/Warning – exp option 151 • Check for changes affecting combustion including fuel/air pressure, temperature etc. • Warning if expansion option 151 is set to 1 • Warning and air adjustment is disabled if expansion option 151 is set to 2		
580	Servo Control I/O Unit Communications Fault	Fault or no comms with the servo control IO module
• Alarm • Check for wiring on terminals 6T+ and 6T-		

Fault	Message	Description
581	Servo Control I/O Unit Channel 1 Output Fault	4-20mA output detects open circuit
	• Alarm • Check wiring on output 1 on I/O module	
582	Servo Control I/O Unit Channel 2 Output Fault	4-20mA output detects open circuit
	• Alarm • Check wiring on output 2 on I/O module	
583	Servo Control I/O Unit Channel 3 Output Fault	4-20mA output detects open circuit
	• Alarm • Check wiring on output 3 on I/O module	
584	Servo Control I/O Unit Channel 4 Output Fault	4-20mA output detects open circuit
	• Alarm • Check wiring on output 4 on I/O module	
585	Servo Control I/O Unit Channel 7 Output Fault	4-20mA output detects open circuit
	• Alarm • Check wiring on output 5 on I/O module	
586	Servo Control I/O UnitChannel 1 Input Fault	4-20mA input less than 3mA
	• Alarm • Check wiring on input 1 on I/O module	
587	Servo Control I/O UnitChannel 2 Input Fault	4-20mA input less than 3mA
	• Alarm • Check wiring on input 2 on I/O module	
588	Servo Control I/O UnitChannel 3 Input Fault	4-20mA input less than 3mA
	• Alarm • Check wiring on input 3 on I/O module	
589	Servo Control I/O UnitChannel 4 Input Fault	4-20mA input less than 3mA
	• Alarm • Check wiring on input 4 on I/O module	
590	Servo Control I/O UnitChannel 7 Input Fault	4-20mA input less than 3mA
	• Alarm • Check wiring on input 5 on I/O module	
600	Low gas pressure before fuel changeover	Selected fuel gas pressure is too low and therefore not ready to run
	• Warning • Check selected Fuel Gas Pressure • Check gas pressure sensor wiring	
601	Selected fuel cannot be run	Selected fuel is not fully commissioned
	• Warning • Check that selected fuel is properly commissioned for Dual Fuel Output Mode • Check if FGR and/or Golden Start points are optioned but not commissioned	

*****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).

11.4 Settings Conflicts

Some of the options, parameters and expansion options may require another option, parameter or expansion option to be set. Please see the below table for these settings conflicts. A setting conflict will result in the MM being forced into Commission mode.

Setting Conflict Message
(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) (154) Flame Safeguard Mode requires Start position Interlock • If Flame Safeguard mode is enabled. Start position interlock must be enabled. • Check Option/Parameter 154
(4) (155) Flame Safeguard Mode requires Purge position Interlock • If Flame Safeguard mode is enabled. Start position interlock must be enabled. • Check Option/Parameter 155
(4) (43) Multi-burner cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Multi-burner cannot be used. • Check options 4 & 43
(4) (148) Air Pressure Sensor cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, an Air pressure sensor cannot be used. Only an Air switch is used. • Check option 4 & 148
(4) (E1) Water Level cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Water Level features cannot be used. • Check option 4 & Expansion option 1
(4) (E40) TDS cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, TDS features cannot be used. • Check option 4 & Expansion option 40
(4) (E60) Bottom Blowdown cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Bottom Blowdown features cannot be used. • Check option 4 & Expansion option 60
(4) (E80) Draught Servo cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Draught Servo features cannot be used. • Check option 4 & Expansion option 80
(4) (E120) Heat Flow cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Heat flow features cannot be used. • Check options 4 & Expansion option 120
(4) (E130) Spare Temperature Sensor cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Spare Temperature sensor cannot be used. • Check options 4 & Expansion option 130
(4) (E140) Fully Metered cannot be used with Flame Safeguard mode • If Flame Safeguard is enabled, Fully Metered features cannot be used. • Check options 4 & Expansion option 140
(9) (45) Internal stat must be disabled if load sensor not present • If external modulation is enabled without a load sensor, the internal stat must always be closed. • Check options 9 and 45.

Setting Conflict Message
(30) (31) Invalid remote setpoint configuration • The Minimum Remote Setpoint (DTI/Modbus/External) cannot be set higher than the Maximum RemoteSetpoint (DTI/Modbus/External) and vice versa. • Check options 30 and 31.
(43) (44) (E1) Water level control only be on the multi-burner master • Water level control should only be enabled on the master (multi-burner ID 1 set in option 44), when using the multi-burner function. • Check options 43, 44 and expansion option 1.
(43) (44) (16) Sequencing only be only the multi-burner master • Only the master (multi-burner ID 1 set in option 44) can be set for sequencing. • Check options 16, 43 and 44.
(43) (44) (12) EGA and trim can only be on the multi-burner master • Only the master (multi-burner ID 1 set in option 44) can be optioned with an EGA. • Check options 12, 43 and 44.
(43) (44) (E110) First Outs can only be on the multi-burner master • Only the master (multi-burner ID 1 set in option 44) can have first outs enabled. • Check options 43, 44 and expansion option 110.
(43) (44) (E120) Heat-flow can only be on the multi-burner master • Only the master (multi-burner ID 1 set in option 44) can have heat flow function enabled. • Check options 43, 44 and expansion option 120.
(43) (44) (45) External modulation can only be on the multi-burner master • Only the master (multi-burner ID 1 set in option 4) can be set for external modulation. • Check options 43 – 45.
(43) (44) (E82) Draught control can only be on the multi-burner master. • Only the master (multi-burner ID 1 set in option 44) can be set for draught control. • Check options 43, 44 and expansion option 82.
(43) (44) (47) Cold Start should only be optioned on the Multi-Burner Master • Only the master (multi-burner ID 1 set in option 44) can be se for cold start. • Check options 43, 44 and 47
(43) (52) Differential Firing Rate Limit requires Fully-Linked Multi-Burner • Differential Firing Rate Limit requires Fully- Linked Multi-Burner operation • Check options 43 and 52
(43) (57) Fuel flow metering must be enabled for multi-burner • The multi-burner function requires fuel flow metering. • Check options 43 and 57.
(43) (111) Continuous Pilot is not supported for Fully-Linked Multi-Burner • Continuous pilot cannot be used in Fully-Linked Multi-Burner operation • Check options 43 and 111
(43) (135) NFPA Post Purge cannot be optioned with multi-burner • The multi-burner function can only use standard, not NFA post-purge. • Check option 43 and option/parameter 135.
(43) (P100) Assured Low-Fire Shut Off not supported for Fully-Linked Multi-Burner • Assure Low-Fire Shut Off cannot be used with Fully-Linked Multi-Burner operation • Check option 43 and parameter 100
(44) (52) Differential Firing Rate Limit should only be set on the Multi-Burner master • Only the Multi-Burner master (multi-burner ID 1 set on option 44) can have Differential Firing Rate Limit enabled • Check options 44 and 52
(45) (55) External modulation option conflict • Switched T88 external modulation is not set with permanent external modulation. • Check options 45 and 55.

Setting Conflict Message
(45/55) (16) External modulation cannot be used with sequencing • External modulation cannot be used on any MMs in sequencing. • Check options 16, 45 and 55
(45) (P72) External modulation and external setpoint both optioned • External modulation and external setpoint cannot be used simultaneously. • Check option 45 and parameter 72.
(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.
(112, 135) (158) Purge pressure proving timeout shorter than pre-purge time. • Purge pressure proving timeout must be longer than the pre-purge time • Check option/parameters 112, 135 and 158.
(118, 135) (158) Purge pressure proving timeout shorter than post-purge time. • Purge pressure proving timeout must be longer than the post-purge time • Check option/parameters 118, 135 and 158.
(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
(125) (150) Valve proving cannot be optioned when fuel type is oil (fuel 1) • Valve proving 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 can only be used for gas • Check option/parameters 126 and 151
(127) (152) Valve proving cannot be optioned when fuel type is oil (fuel 3) • Valve proving can only be used for gas • Check option/parameters 127 and 152
(128) (153) Valve proving cannot be optioned when fuel type is oil (fuel 4) • Valve proving can only be used for gas • Check option/parameters 128 and 153
(125, 126, 127, 128) (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, 127, 128, 129 and 135.
(145) (E110) First Out Interlock requires First Outs to be enabled • To use First Out Interlock, First Outs functionality has to be enabled in expansion option 110 • Check option 145 and expansion option 110
(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.

Setting Conflict Message
(E1) (1) Water level control requires a boiler pressure sensor. • Water level control cannot be used with a hot water boiler (load/external temperature detector). • Check expansion option 1 and option 1.
(E1) (E3, E4) At least one analogue level sensor required. • If water level is enabled with one capacitance probe, then an external level sensor is required. • Check expansion options 1, 3 and 4.
(E1) (E3, E4, E5, E6) Sensor enabled but water level control disabled. • Water level control enabled must be enabled if capacitance probes, external level sensor, 2nd low probe or auxiliary water level alarm inputs are set. • Check expansion options 1, 3, 4, 5 and 6.
(E3, E4, E5, E6) At least two level sensing elements are required. • A minimum of two of the following level sensing elements is required: capacitance probe, external level sensor, auxiliary water level alarm input or second low probe. • Check expansion options 3, 4, 5 and 6.
(E4) (E30) External level sensor without scaling requires a capacitance probe. • Check expansion options 4 & 30
(E4) (57) External level sensor cannot be optioned with fuel flow feedback • External level sensor cannot be used with fuel flow feedback, as they use same terminals. • Check expansion option 4 and option 57.
(E11) (E12) Pump turn off point must be above pump turn on point. • Pump turn off point cannot be set lower than pump turn on point. • Check expansion options 11 and 12.
(E17) (E40) Bypass valve cannot be optioned with solenoid top blowdown. • Bypass and solenoid top blowdown cannot be used together, as they use same terminals. • Check expansion options 17 and 40.
(E28) (E3) External level sensor without scaling requires a capacitance probe. • If external level sensor does not have a scale to indicate what level the 4-20mA signal represents, a capacitance probe is required. • Check expansion options 3 and 38.
(E30) External probe scaling must be less than 8 inches/mA. • Check expansion option 30
(E40) (1) Top blowdown requires a boiler pressure sensor. • Top blowdown cannot be used with a hot water boiler (load/external temperature detector). • Check expansion option 40 and option 1.
(E42) (E46) TDS warning level less than TDS target. • TDS warning level cannot be set lower than the TDS target value. • Check expansion options 42 and 46.
(E60) (1) Bottom blowdown requires a boiler pressure sensor. • Bottom blowdown cannot be used with a hot water boiler (load/external temperature detector).
(E62) (E64) Bottom blowdown reduction boiler steam production rating not set. • If bottom blowdown reduction is enabled, then steam production rating must be set. • Check expansion options 62 and 64.
(E62) (E120) Bottom blowdown reduction requires steam flow to be enabled. • If bottom blowdown reduction is enabled, then steam flow metering must be enabled. • Check expansion options 62 and 120.
(E80) (E82) Draught control enabled but draught servo disabled. • Draught servomotor must be enabled for draught control. • Check expansion options 80 and 82.
(E80) (E115) Draught Servo configured as commissioned servo and for temperature PID • Check expansion options 80 and 115

Setting Conflict Message
(E115) (E118, E119) Draught Servo configured for temperature PID but PID not configured • Check expansion options 115, 118 & 119
(E115) (E120) Sensor Selected for Draught Servo temperature PID is not available • Check expansion options 115 & 120
(E120) (57) Heat flow requires fuel flow to be optioned and commissioned. • If heat flow function is set, fuel flow metering must be optioned and commissioned. • Check expansion 120 and option 57.
(E120) (1) Steam flow requires a boiler pressure sensor. • A boiler load/external pressure detector must be set for steam flow metering. • Check expansion option 120 and option 1.
(E120) (1) Water flow requires a boiler temperature sensor. • A boiler load/external temperature detector must be set for hot water flow metering. • Check expansion option 120 and 1.
(E127) (E128) Steam flow start pressure offset must be less than stop offset. • The steam flow start pressure offset cannot be set higher than the steam flow stop pressure offset. • Check expansion options 127 and 128.
(E140) (12) Fully metered cannot be optioned with EGA trim. • Fully metered control can be used with the EGA set as monitoring only, but not 3-parameter trim. • Check expansion option 140 and option 12.
(E140) (E4) Fully metered cannot be optioned with external water level probe. • Fully metered control cannot be used with external water level probe (terminals EX- and EX+ are required for both features). • Check expansion options 140 and 4.
(E140) (E120, E129) Fully metered cannot be optioned with local heat flow. • Fully metered control cannot be used with steam or hot water flow metering. • Check expansion options 140, 120 and 129.
(E140) (E141, E145) Fuel temperature cannot be optioned with mass flow meter. • Fuel temperature sensor cannot be used with a fuel mass flow meter in fully metered control. • Check expansion options 140, 141 and 145.
(E140) (E141, E147) Fuel pressure cannot be optioned with mass flow meter. • Fuel pressure sensor cannot be used with a fuel mass flow meter in fully metered control. • Check expansion options 140, 141 and 147.
(E140) (E143, E146) Air temperature cannot be optioned with mass flow meter. • Air temperature sensor cannot be used with an air mass flow meter in fully metered control. • Check expansion options 140, 142 and 146.
(E140) (E143, E148) Air pressure cannot be optioned with mass flow meter. • Air pressure sensor cannot be used with an air mass flow meter in fully metered control. • Check expansion options 140, 142 and 148.
(E140) (150, E154) Fully metered requires gas fuel 1 to have non-zero density. • Density must be set for gas in fully metered control. • Check option 150 and expansion options 140 and 154.
(E140) (151, E155) Fully metered requires gas fuel 2 to have non-zero density. • Density must be set for gas in fully metered control. • Check option 151 and expansion options 140 and 155.
(E140) (152, E156) Fully metered requires gas fuel 3 to have non-zero density. • Density must be set for gas in fully metered control. • Check option 152 and expansion options 150 and 156.

Setting Conflict Message
(E140) (153, E157) Fully metered requires gas fuel 4 to have non-zero density. • Density must be set for gas in fully metered control. • Check option 153 and expansion options 140 and 157.
(E140) (E142) Fully metered requires non-zero fuel flow meter scaling. • Fuel flow meter must be scaled in fully metered control. • Check expansion options 140 and 142.
(E140) (E144) Fully metered requires non-zero air flow meter scaling. • Air flow meter must be scaled in fully metered control. • Check expansion options 140 and 144.
(E140) (60) Fully metered does not function with fuel flow feedback tolerance. • Fully metered control cannot be used with fuel flow feedback tolerance (terminals EX- and EX+ are required for both features). • Check option 60 and expansion 140.
(E140) (57) Fully metered requires fuel flow metering to be enabled (1). • Fuel flow metering must be enabled when using fully metered control. • Check option 57 and expansion option 140.
(E140) (76) Fully metered cannot use air trim on channel 5 (VSD). • Air trim cannot be used on channel 5 VSD in fully metered control. • Check option 76 and expansion option 140.
(86) (E129) Servo channel 1 via I/O unit cannot be optioned with heat flow sensors via I/O unit. • Heat flow sensors from the I/O unit cannot be optioned with servo channel via I/O unit. • Check option 86 and expansion 129.
(87) (E129) Servo channel 2 via I/O unit cannot be optioned with heat flow sensors via I/O unit. • Heat flow sensors from the I/O unit cannot be optioned with servo channel via I/O unit. • Check option 87 and expansion 129.
(88) (E129) Servo channel 3 via I/O unit cannot be optioned with heat flow sensors via I/O unit. • Heat flow sensors from the I/O unit cannot be optioned with servo channel via I/O unit. • Check option 88 and expansion 129.
(89) (E129) Servo channel 4 via I/O unit cannot be optioned with heat flow sensors via I/O unit. • Heat flow sensors from the I/O unit cannot be optioned with servo channel via I/O unit. • Check option 89 and expansion 129.
(E81) (E129) Servo channel 7 via I/O unit cannot be optioned with heat flow sensors via I/O unit. • Heat flow sensors from the I/O unit cannot be optioned with servo channel via I/O unit. • Check expansion options 81 and 129.

AUTOFLAME MK8
FLAME SAFEGUARD
CONTROLLER MANUAL
MM80001/FSG
08 FEB 2024

Autoflame Engineering Ltd.
Unit 1-2 Concorde Business Centre
Airport Industrial Estate, Wireless Road
Biggin Hill, Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Website: www.autoflame.com

AUTOFLAME®
Combustion Management Systems