

AutoFlame

Mk7 D.T.I. Set-Up Guide

AUTOFLAME[®]



Mk7 D.T.I. Set-Up Guide



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Important Notes

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

Short Form - General Terms and Conditions

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

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

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

Autoflame's warranty from point of sale is two years on all electronic systems and components.

One year on all mechanical systems, components and sensors.

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

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1 MK7 DATA TRANSFER INTERFACE MODULE

1 Overview of the Mk7 D.T.I.

1.1.1 Introduction to the Mk7 D.T.I.

The Autoflame Data Transfer Interface (D.T.I.) is the gateway for communications between the M.M. and E.G.A. range of products. All of the M.M. operational data, of up to ten M.M.s in one location, can be collected by the D.T.I. The information gathered is available for transmission to an external source via RS422 and Ethernet data links. The data gathered by the Mk7 D.T.I. can be collected and viewed using the included CEMS Audit software, which allows data collection over a Local Area Network (LAN), or over the internet.

Up to a maximum of ten M.M. modules, can be connected to one D.T.I. module. This can be a combination of Mk7 M.M. modules and Mini Mk8 M.M. modules. It is also possible to receive data from up to 10 E.G.A.s for emissions data. To accommodate the status information from other plant related equipment, the D.T.I. can communicate with up to ten Mk6 Analogue and ten Mk6 Digital Input/ Output Modules, or ten Mk7 Universal Input/ Output modules. The information gathered by the D.T.I. from each system is then available for transmission to the Building Management System or Energy Management System (BMS or EMS). This is done through the RS422 link or Ethernet to send data via Modbus communications. Typical remote B.M.S. information and operational facilities are subject to the particular site and management system requirements.

The Autoflame network operates using a two core screened cable and features dedicated data ports for RS422 and Ethernet connections. The Mk7 D.T.I. polls each item on the network periodically, storing up-to-date information every 2 seconds. The D.T.I. then outputs to defined Modbus addresses, which are then available to third party systems like a B.M.S. The 10.4" touch-screen displays the operational status of the D.T.I.'s communications, with corresponding error conditions in the event of a communication failure.

1.1.2 Information Available from Mk7 D.T.I.

The Mk7 D.T.I. displays information from the Mk7 M.M., Mini Mk8 M.M., Mk8 E.G.A., and the Water Level control. Remote on/off control of the burners can also be achieved as well as the adjustment of the temperature or pressure setpoints and the sequence order. Through the D.T.I. touch screen, CEMS Audit software and via Modbus, the following information is available:

Mk7 D.T.I. Input Values

- Enable/disable burner
- Change individual required setpoint
- Change global required setpoint
- Select lead boiler
- Shuffle sequencing (not Modbus)
- Set load index (firing rate)
- Label and control input/outputs (not Modbus)

Mk7 M.M.

- Actual boiler temperature (deg. C/F) or pressure (Bar/PSI)
- Required setpoint i.e. required boiler temperature (deg. C/F) or pressure (Bar/PSI)
- Burner on/off status
- Burner firing rate (%)
- Fuel selected
- Burner rating

- Fuel flow metering values
- Load detector type (temperature/pressure)
- 16 lockout and error history with date and conditions
- Auto/hand/low flame hold operation
- Number of channels used
- Channel 1, 2, 3, 4, 7, servomotor angle
- Channel 5, 6 output and input signals to VFD with feedback history
- Burner firing status phase (off, standby, purge, ignition, firing etc.)
- Lead/lag boiler status
- Sequence order
- Sequence status (on, standby warming, off)
- Enabled/disabled status
- Total hours run
- Number of start-ups per fuel
- Online and commissioned gas/ oil pressure
- Online and commissioned air pressure
- UV scanner signal history

Mk8 E.G.A.

- E.G.A. operation optioned
- Standalone/M.M. operation
- Flue gas O₂ present value
- Flue gas CO₂ present value
- Flue gas CO present value
- Flue gas NO present value
- Flue gas NO₂ present value (if optioned)
- Flue gas SO₂ present value (if optioned)
- Flue gas O₂ commissioned value
- Flue gas CO₂ commissioned value
- Flue gas CO commissioned value
- Flue gas NO commissioned value
- Flue gas NO₂ commissioned value (if optioned)
- Flue gas SO₂ commissioned value (if optioned)
- Flue gas exhaust temperature
- Ambient temperature
- Flue gas delta temperature
- E.G.A. errors
- Chiller condition
- Current emissions by weight and volume (O₂, CO₂, CO, NO, SO₃, H₂O, N₂, Total)
- Totalised emissions by weight and volume (O₂, CO₂, CO, NO, SO₃, H₂O, N₂, Total)
- Heat input, heat loss and net useful heat
- Net efficiency, gross efficiency and delta temperature
- Fuel flow rates, instantaneous and totalised for up to 2 years
- Fuel consumption, fuel costs instantaneous and totalise for up to 2 years

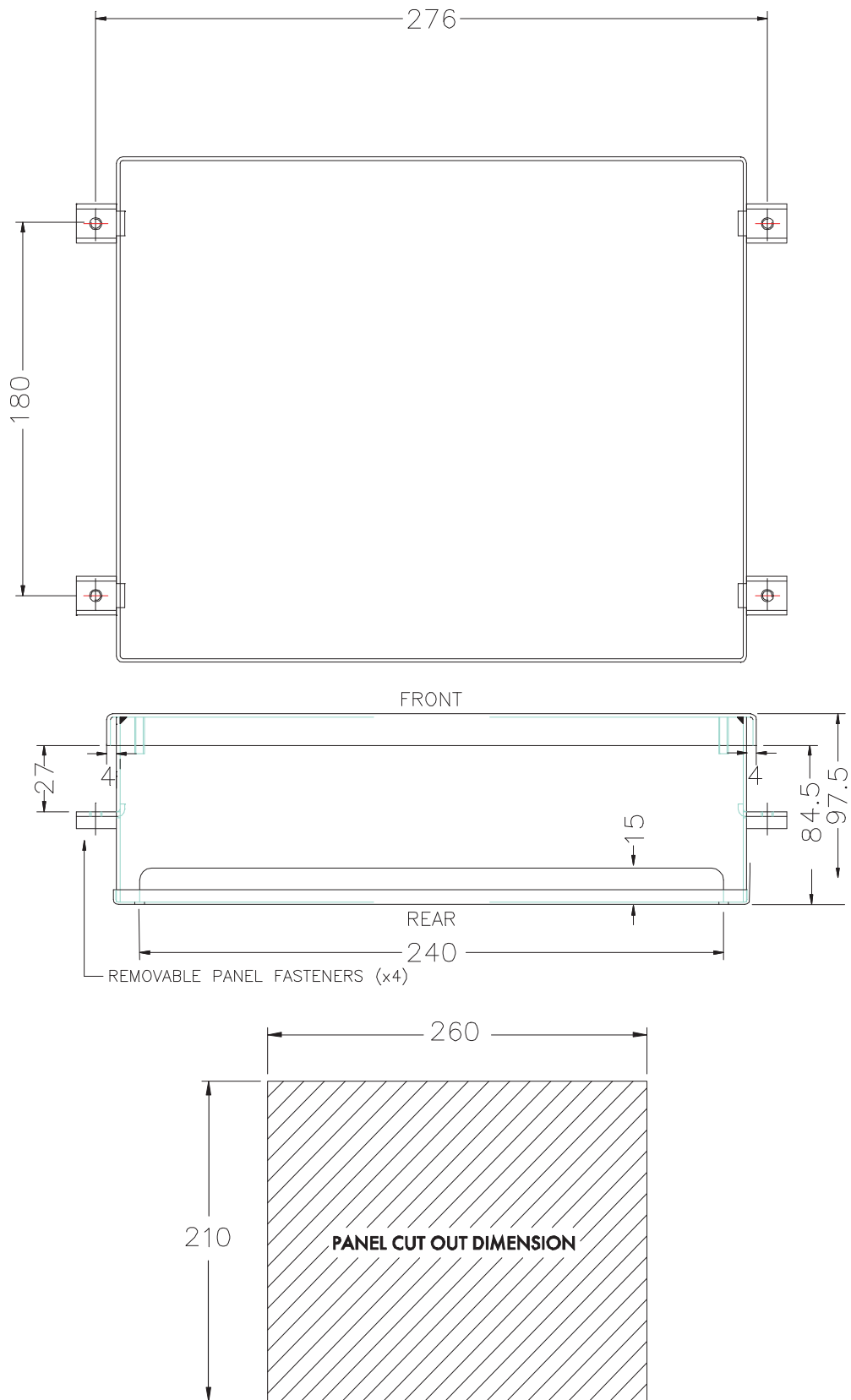
Mini Mk 8 M.M.

- Actual boiler temperature (deg. C/F) or pressure (Bar/PSI)
- Required setpoint i.e. required boiler temperature (deg. C/F) or pressure (Bar/PSI)
- Burner on/off status
- Burner firing rate (%)
- Fuel selected
- Burner rating
- Fuel flow metering values
- Load detector type (temperature/pressure)
- 16 lockout and error history with date and conditions
- Auto/hand/low flame hold operation
- Number of channels used
- Channel 1, 2, 3 servomotor angle
- Channel 4 output and input signals to VFD with feedback history
- Burner firing status phase (off, standby, purge, ignition, firing etc.)
- Lead/lag boiler status
- Sequence order
- Sequence status (on, standby warming, off)
- Enabled/disabled status
- Total hours run
- Number of start-ups per fuel

Water Level Control

- Actual water level signal value for probe 1 and 2
- Average water level signal of probes
- Commissioned end of probe position
- Commissioned 2nd low position
- Commissioned 1st low position
- Commissioned 1st low pre-alarm position
- Commissioned control point position
- Commissioned pump on/ pump off positions
- Commissioned high water pre-alarm position
- Commissioned high water position
- 15 First out annunciation inputs status
- Instantaneous and totalised steam flow metering
- Feedwater temperature
- Feedwater valve position
- Feedwater pump status
- Feedwater VSD output
- Steam temperature and pressure
- Top blow down status and operation
- TDS actual value
- TDS valve position
- TDS target value
- 16 Water level/ Expansion alarms conditions and date
- Bottom blowdown operation

1.2 Fixing Holes and Dimensions



2 SET-UP AND CONNECTIONS

2.1 Wiring

2.1.1 Mk7 D.T.I. Wiring Diagram

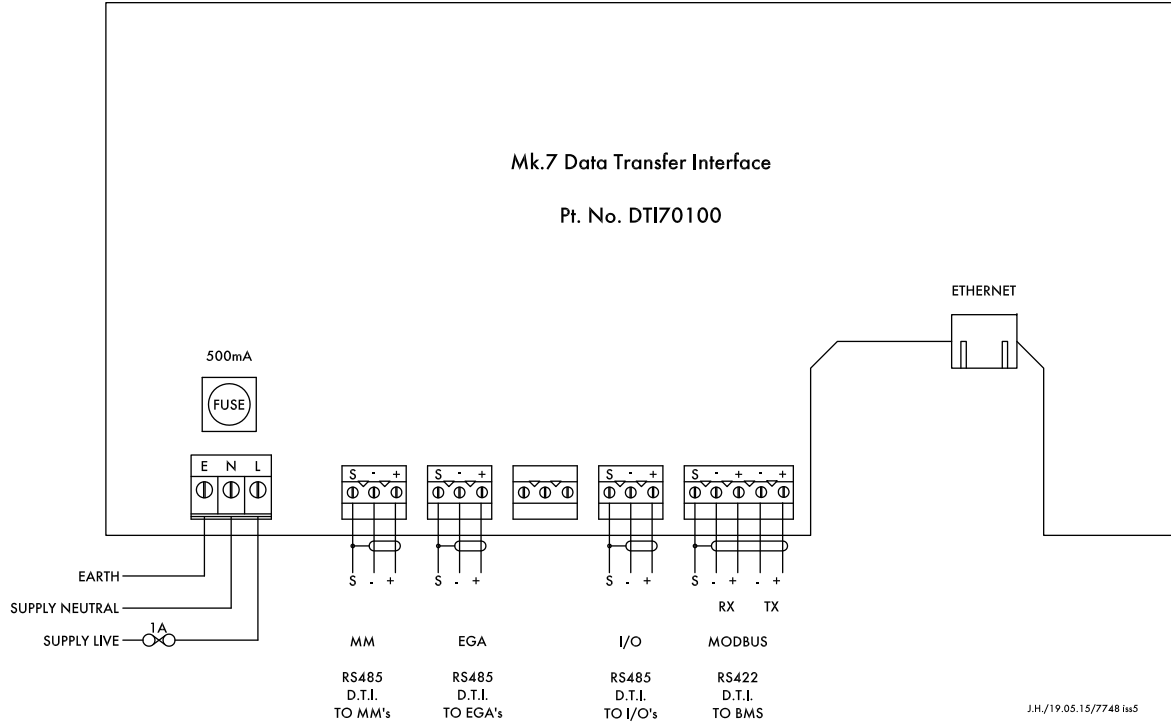


Figure 2.1.1.i Mk7 D.T.I. Wiring Diagram

Electrical Specifications:

Max power for the Mk7 D.T.I. power supply is 184W.

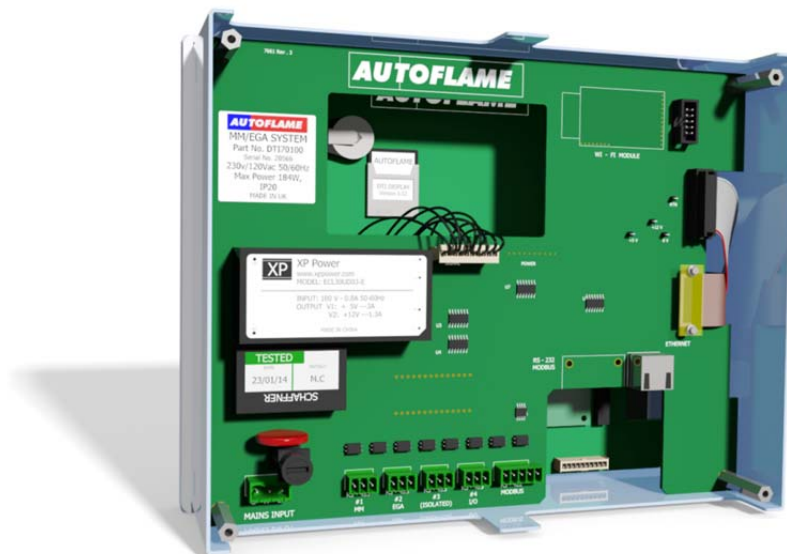
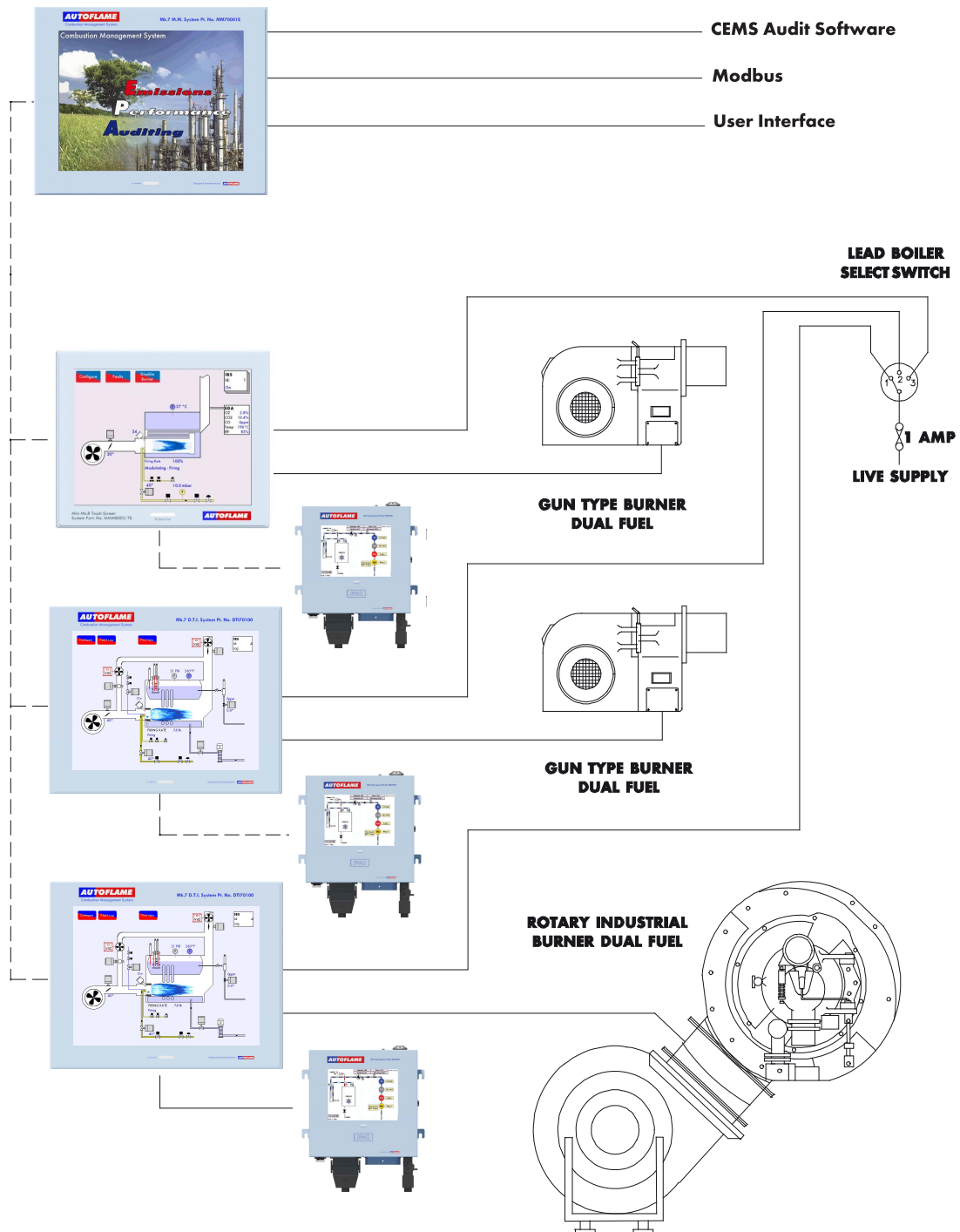


Figure 2.1.1.ii Mk7 D.T.I. Board

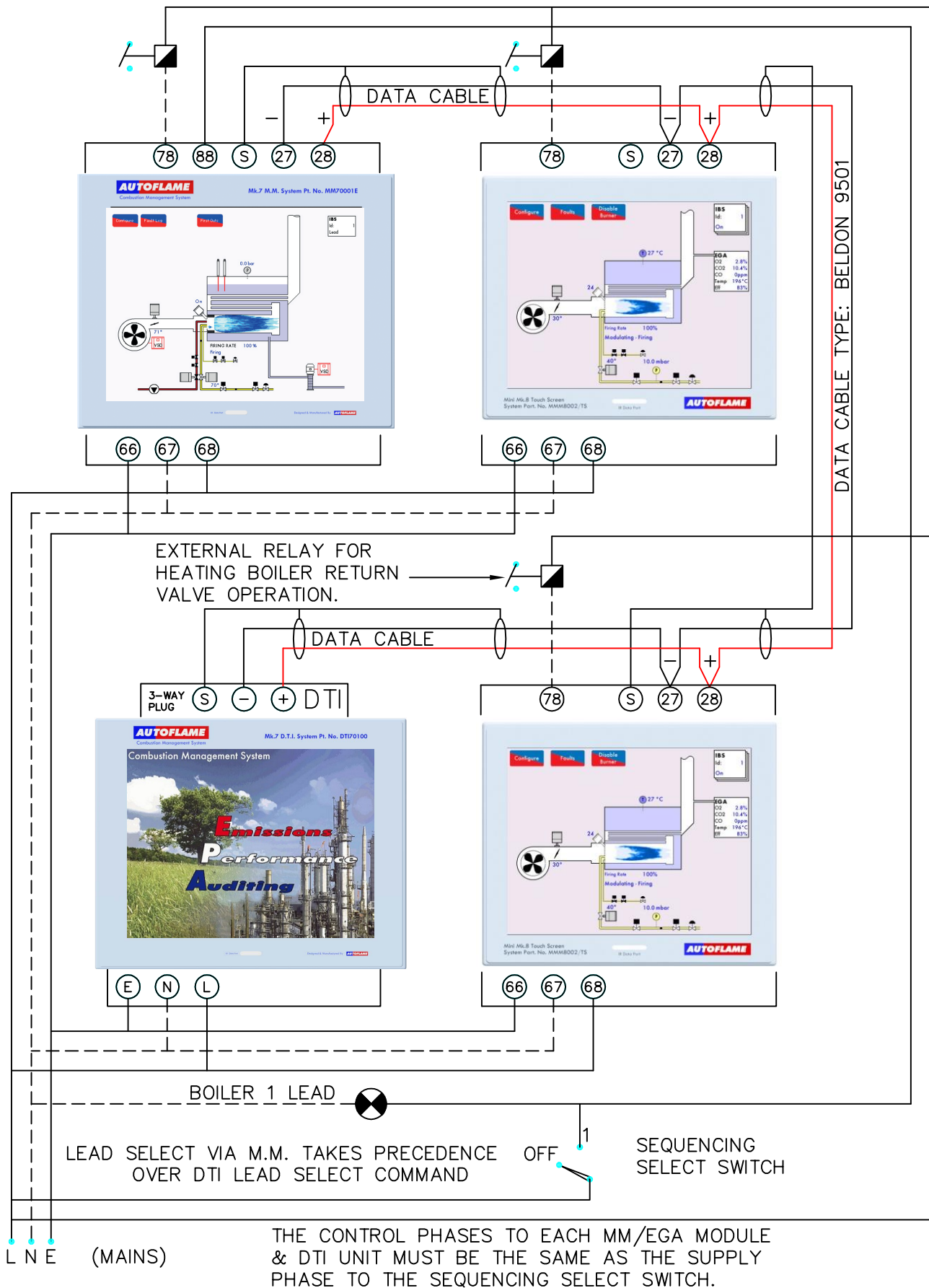
2 Set-Up and Connections

2.1.2 System Schematic



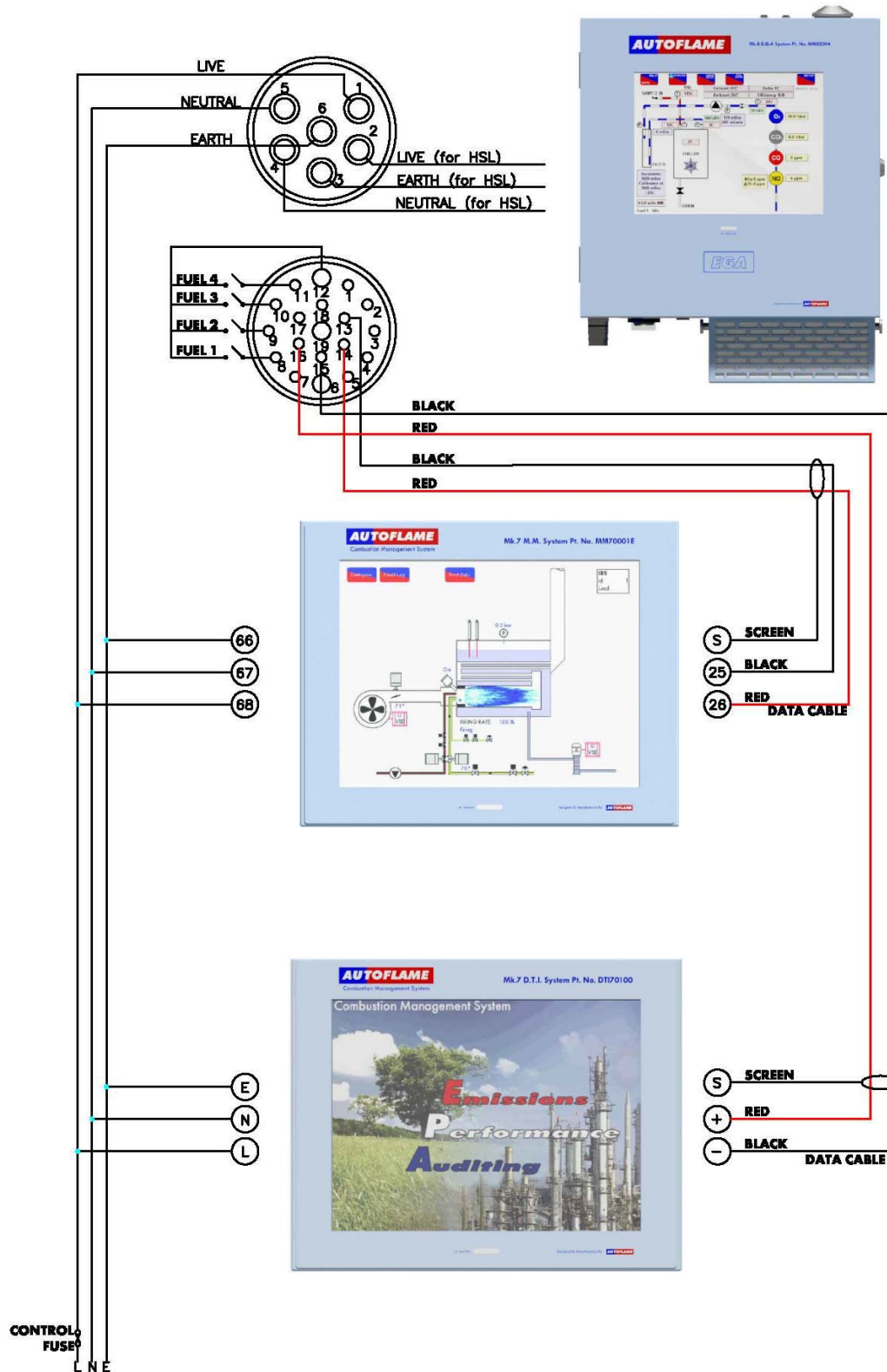
2 Set-Up and Connections

2.1.3 M.M. Modules Connection



2 Set-Up and Connections

2.1.4 Mk7 M.M. and Mk8 E.G.A. with Mk7 D.T.I.



2.2 Mk7 D.T.I. Set-Up

2.2.1 Mk7 M.M. Options and Parameters

To get the Mk7 D.T.I. to communicate with the Mk7 M.M., the right communication settings need to be set on the Mk7 M.M. The following options and parameters need to be set.

2 Set-Up and Connections

Option No.	Factory Setting	Option Value	Description
3	0	0 1	DTI Comms Mode Mk6 DTI - 9600bps Mk7 DTI - 19200bps
16	0	0 1 2 3	Lead/Lag (IBS) and DTI: A lead boiler can be selected by connecting a line voltage to terminal 88 on the appropriate MM. Only 1 MM may be selected as lead boiler at a time, or the sequencing will not operate. The lead boiler can be selected via the DTI. However, for this to be effective all the MM units on the system must have Terminal 88 volt free. Line voltage on Terminal 88 overrides the DTI command. 0 No sequencing - MM units still communicate and can be seen on the DTI. 1 Sequencing enabled - MM units will respond to sequencing commands. Lead boiler is selected by a line voltage on terminal 88. 2 Setpoint & enable/disable commands accepted from DTI. 3 Both 1 and 2. <i>Note: Accurate fuel flow metering must be entered for sequencing to operate. An RS485 data cable (Belden 9501) must be connected between each MM unit (see section 2.17.3.4 for correct connection).</i>
30	50	5 - 9990 0.5 - 999.0	DTI Required Setpoint Minimum Limit: If the system is being used with a DTI a maximum and minimum limit for the required setpoint must be set. If a value is received from the DTI that is outside these limits, it will be ignored and the system uses its previous required setpoint. Practical range is limited to range of sensor selected. If Centigrade, Fahrenheit or PSI units effective. If Bar units effective.
31	100	5 - 9990 0.5 - 999.0	DTI Required Setpoint Maximum Limit: If Centigrade, Fahrenheit or PSI units effective. If Bar units effective.
33	1		MM Identification: The identification number must be set on all MM Units in the boiler house. If not, then problems will occur with sequencing/twin burner and with the DTI communications. Each unit must have a different identification number.
34	5	1 - 999	Rating of Burner: See Option 77 for units.
77	0	0 1 2 3 4 5 6 7 8 9	Burner rating units: Display purposes only for fuel flow metering. KW x 100 /hr Kg x 100 /hr MW /hr Btu x 100 /hr Hp x 100 /hr lbs x 100 /hr Btu x 1000 /hr Hp x 10 /hr lbs x 1000 /hr Btu x 1000 000 /hr

2 Set-Up and Connections

Parameter No.	Factory Setting	Option Value	Description
57	0	0 - 10	Sequencing: Highest MM ID. This parameter speeds up communications between MM's when sequencing.
101	0		Shuffle sequencing:
		0	Disabled
		1	Sequence order changed from DTI.

2.2.2 Mini Mk8 M.M. Options and Parameters

To get the Mk7 D.T.I. to communicate with the Mini Mk8 M.M., the right communication settings need to be set on the Mini Mk8 M.M. The following options and parameters need to be set.

2 Set-Up and Connections

Option No.	Factory Setting	Option Value	Description
16	0		Sequencing and D.T.I Enable: A lead boiler can be selected by press Lead Boiler in the IBS screen or via the D.T.I. if optioned. Only 1 M.M. may be selected as lead boiler at a time, or the sequencing will not operate. The Lead Boiler button on the M.M. overrides the D.T.I. Lead Boiler Select. 0 Sequencing disabled. 1 Sequencing enabled. 2 D.T.I. enabled. 3 Sequencing and D.T.I. Note: Accurate fuel flow metering must be entered for sequencing of different burner ratings, as fuel flow metering high fire point sets the burner rating.
30	50		Minimum Remote Setpoint (D.T.I./Modbus): If the system is being used with a D.T.I. maximum and minimum limits for the required setpoint must be set. If a value is received from the D.T.I. that is outside of these limits, it will coerced into this range. Practical range is limited to the range of sensor selected. 5 - 9990 If Centigrade, Fahrenheit or PSI units effective. 0.5 - 999.0 If Bar units effective.
31	100		Maximum Remote Setpoint (D.T.I./ Modbus): 5 - 9990 If Centigrade, Fahrenheit or PSI units effective. 0.5 - 999.0 If Bar units effective.
33	1		M.M. Identification: Each M.M. within a sequence loop must have an individual ID. Communication problems will occur within an IBS loop if incorrect or same IDs are set for the M.M.s 1 -10 Identification number
100	0		Sequencing/ D.T.I. or Modbus operation: 0 M.M./ D.T.I. Sequencing 1 Modbus.

2 Set-Up and Connections

Parameter No.	Factory Setting	Parameter Value	Description
57	10	1 - 10	Sequencing - Highest M.M. ID: This sets the number of M.M.s in that sequencing loop for improved comms.
101	0	0 1	Shuffle Sequencing: This allows the sequence order to be changed remotely through the D.T.I. or Modbus. Disabled. Enabled.

2.2.3 Configuring the Boiler Room

The Mk7 D.T.I. is a gateway for communicating with the Autoflame range of products. Through the D.T.I. touchscreen, you can configure the boiler room with the following features:

- Modbus Read/Write ability
- D.T.I. site name
- Pressure/Temperature
- Password protection
- Ancillary Input/Output modules
- C.E.M.S. configuration
- Metric/Imperial units
- Individual/Global setpoint ranges
- Add, edit, delete boilers
- Add, edit, delete E.G.As
- Add, edit, delete Input/Output modules
- Restart D.T.I. without cycling panel power
- Global time for Mk 7 M.M.s and Mini Mk8 M.M.s

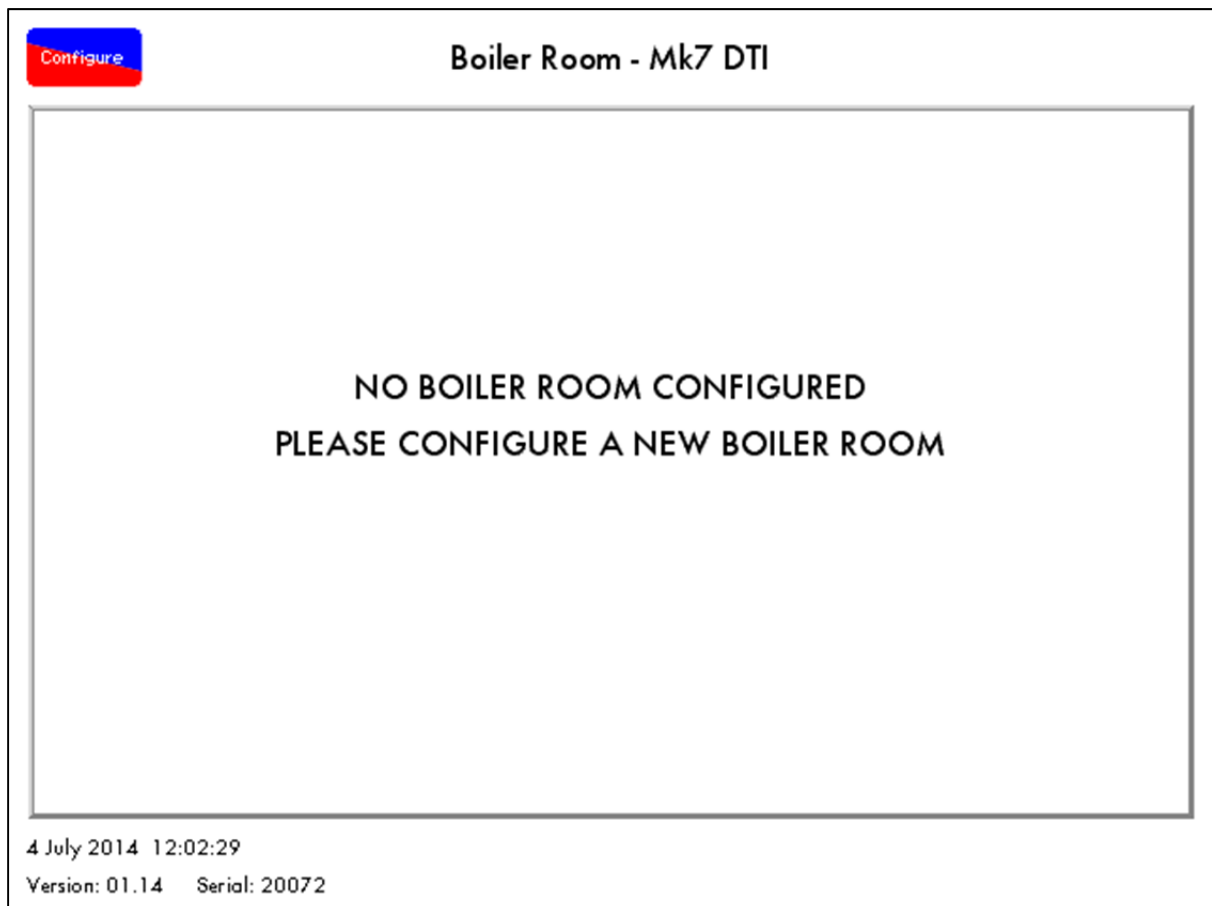


Figure 2.2.3.i Configure Mk7 D.T.I. Screen

Once the options and parameters have been set and the screened cable wired between the M.M.s and the D.T.I., the D.T.I. can be powered on for the first time. You will be presented with a boiler room

which is not yet configured. To configure the boiler room, you simply press the  in the top left hand corner of the screen.

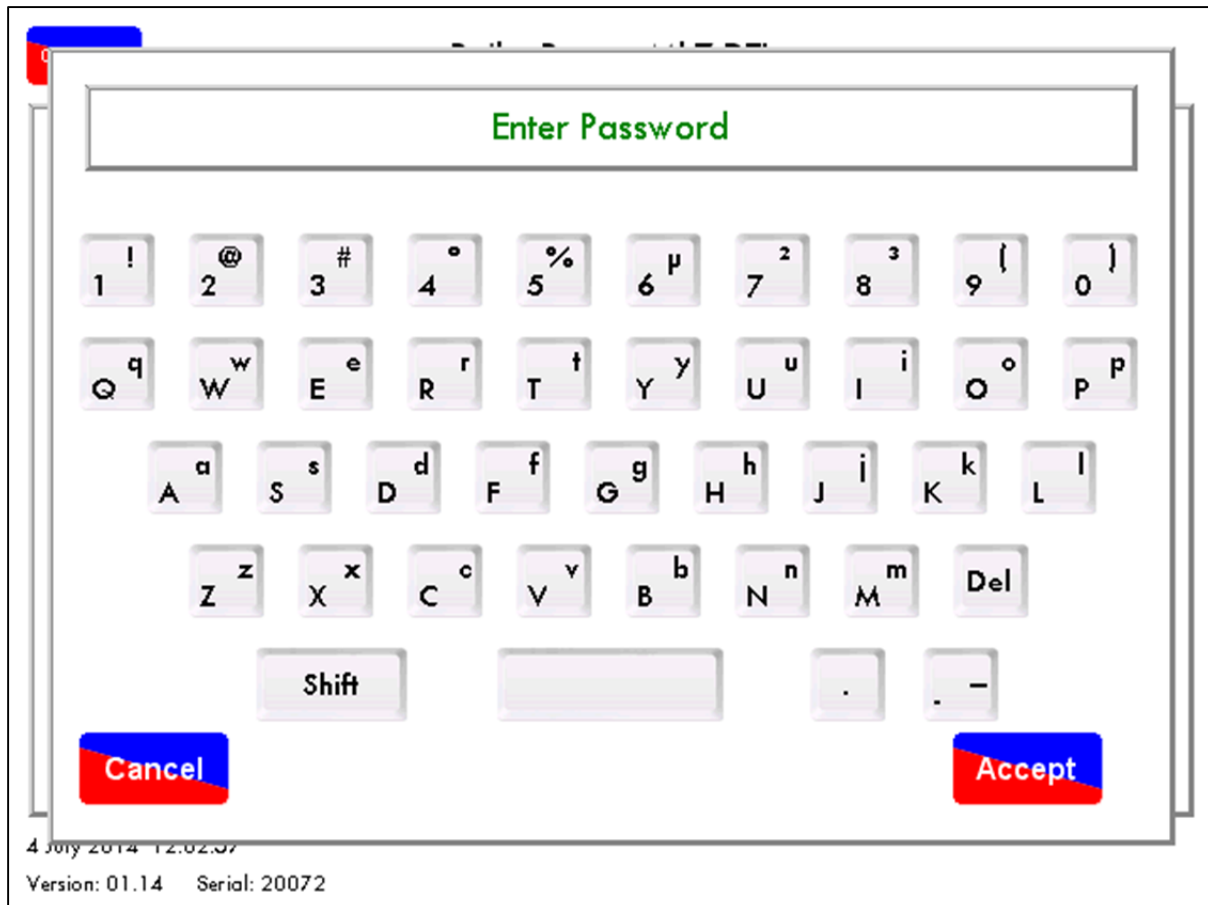


Figure 2.2.3.ii Password Screen

You will be presented with a password screen. The same password that is used on the D.T.I. is used to connect to that D.T.I. through the CEMS Audit Software. Once the password is entered you can now configure the boilers, D.T.I. and the IP settings.

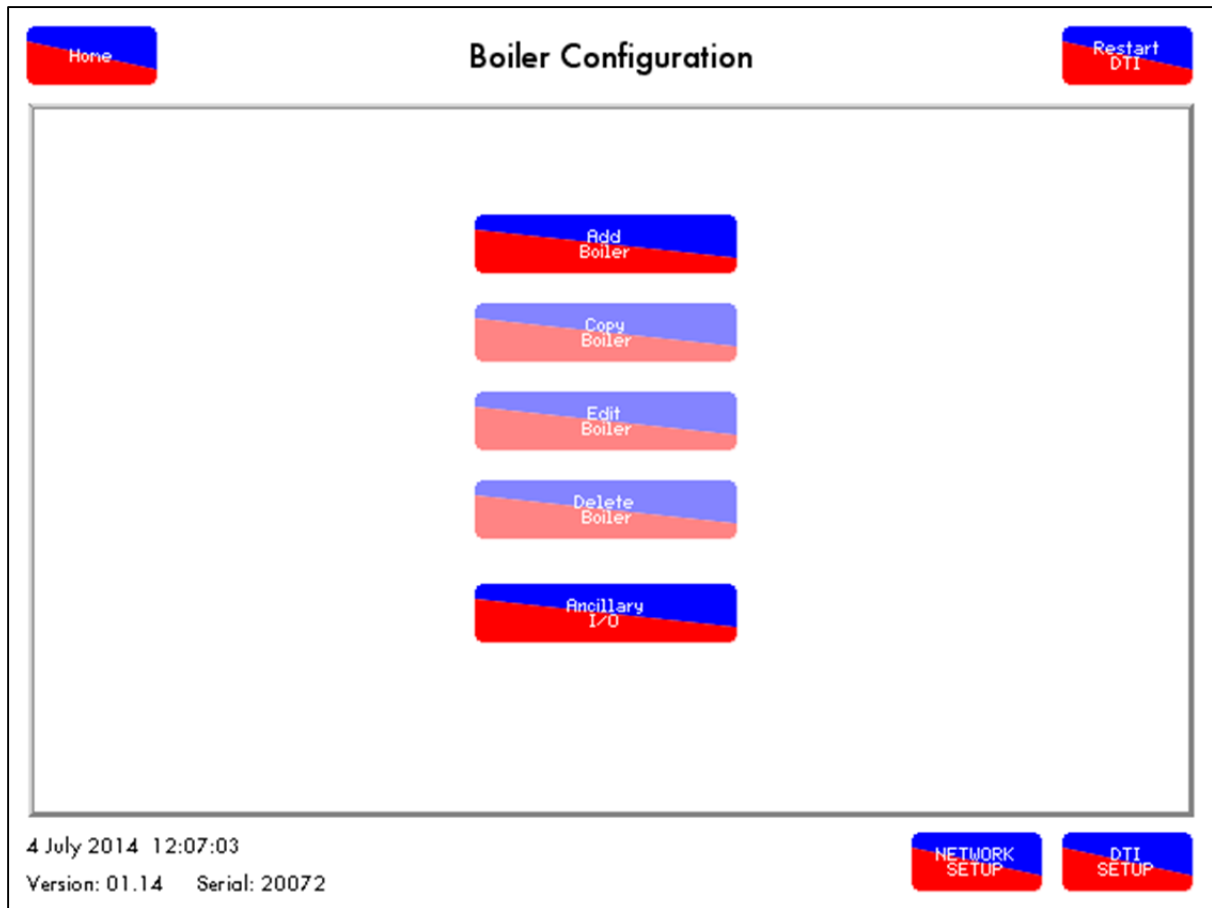


Figure 2.2.3.iii

From the Boiler Configuration, boilers can be added or deleted; up to 10 boilers can be configured for communication with the Mk7 D.T.I.

To add a boiler, press .

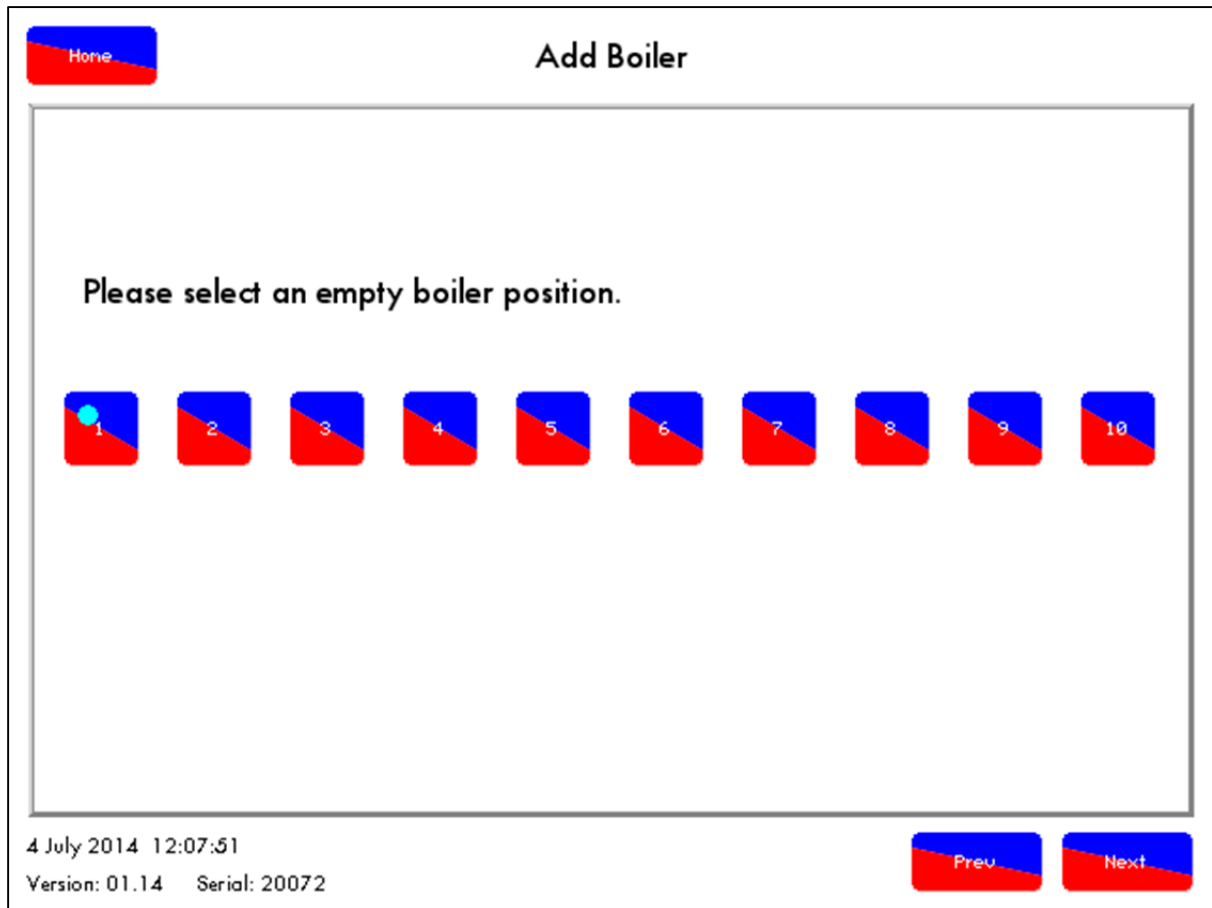


Figure 2.2.3.iv Add Boiler

Select an empty boiler position to add a boiler, and then press .

Boiler Setup

Burner Selection

- ☒ Linpsfield
- ☐ Nuway
- ☐ Powerflame
- ☐ Riello
- ☐ Webster
- ☐ Weishaupt

MM Options

- ☒ MM Fitted
- ☐ MM Not Fitted

EGA Options

- ☒ EGA Not Fitted
- ☐ EGA Through MM
- ☐ EGA Direct

4 July 2014 14:21:04
Version: 01.14 Serial: 20072

Prev **Save**

Figure 2.2.3.v Boiler Setup

In the Boiler Setup screen, the type of burner can be configured, whether it is a standalone D.T.I. or with the M.M., and also if it taking data from the E.G.A.

If an E.G.A. is being used together with the M.M., then the D.T.I. will receive the E.G.A. data from the M.M. For Mk8 E.G.A.'s, the D.T.I. must be set to 'EGA Direct'.

Once the Boiler Setup has been configured press



To copy a boiler configuration, enter the Boiler Configuration screen, and press



Note: For the Mk8 E.G.A.'s with the M.M.'s, the E.G.A. must be wired to both the M.M. and the D.T.I., see section 2.1.4 for the wiring diagram.

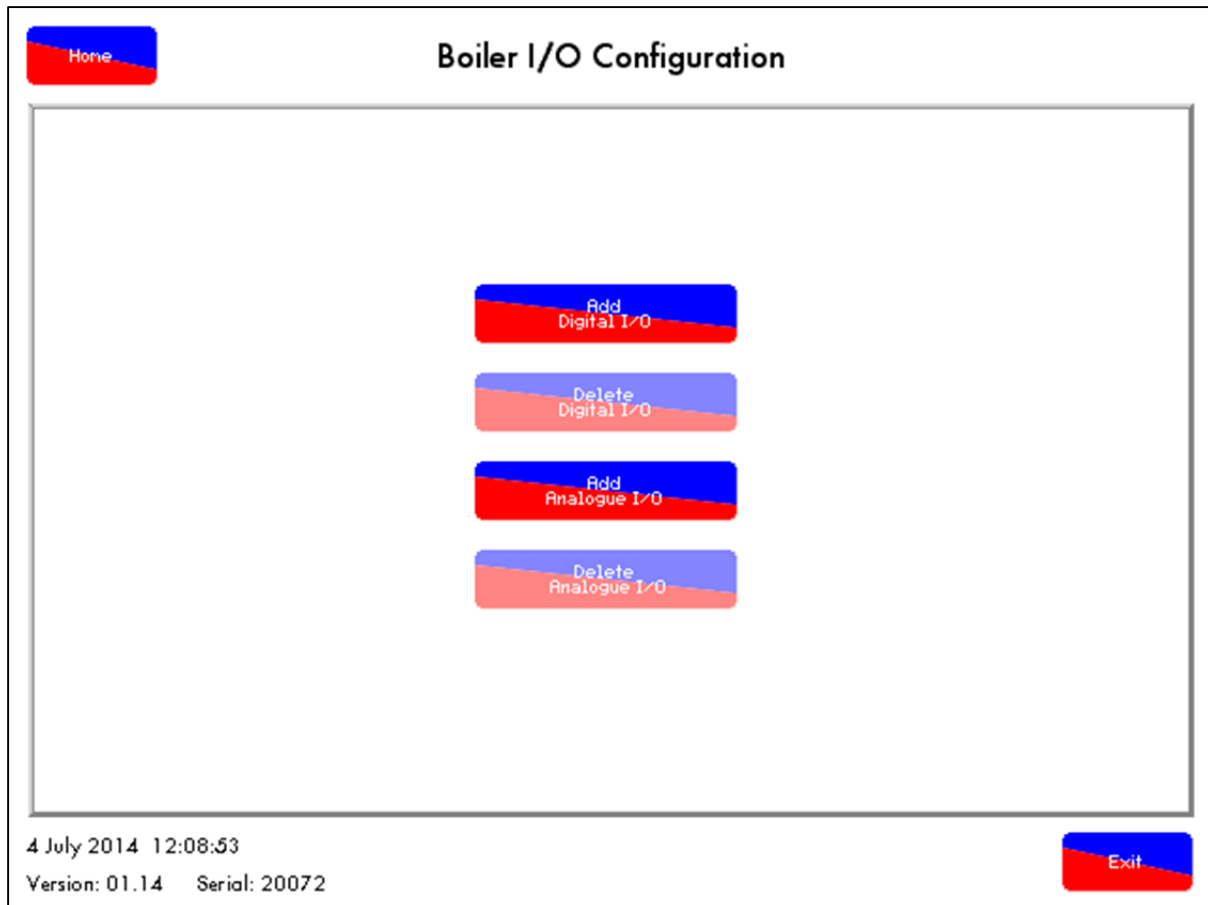


Figure 2.2.3.vi Boiler I/O Configuration

Once the Boiler Setup has been saved, press



or



to add an analogue or digital I/O module for that boiler.

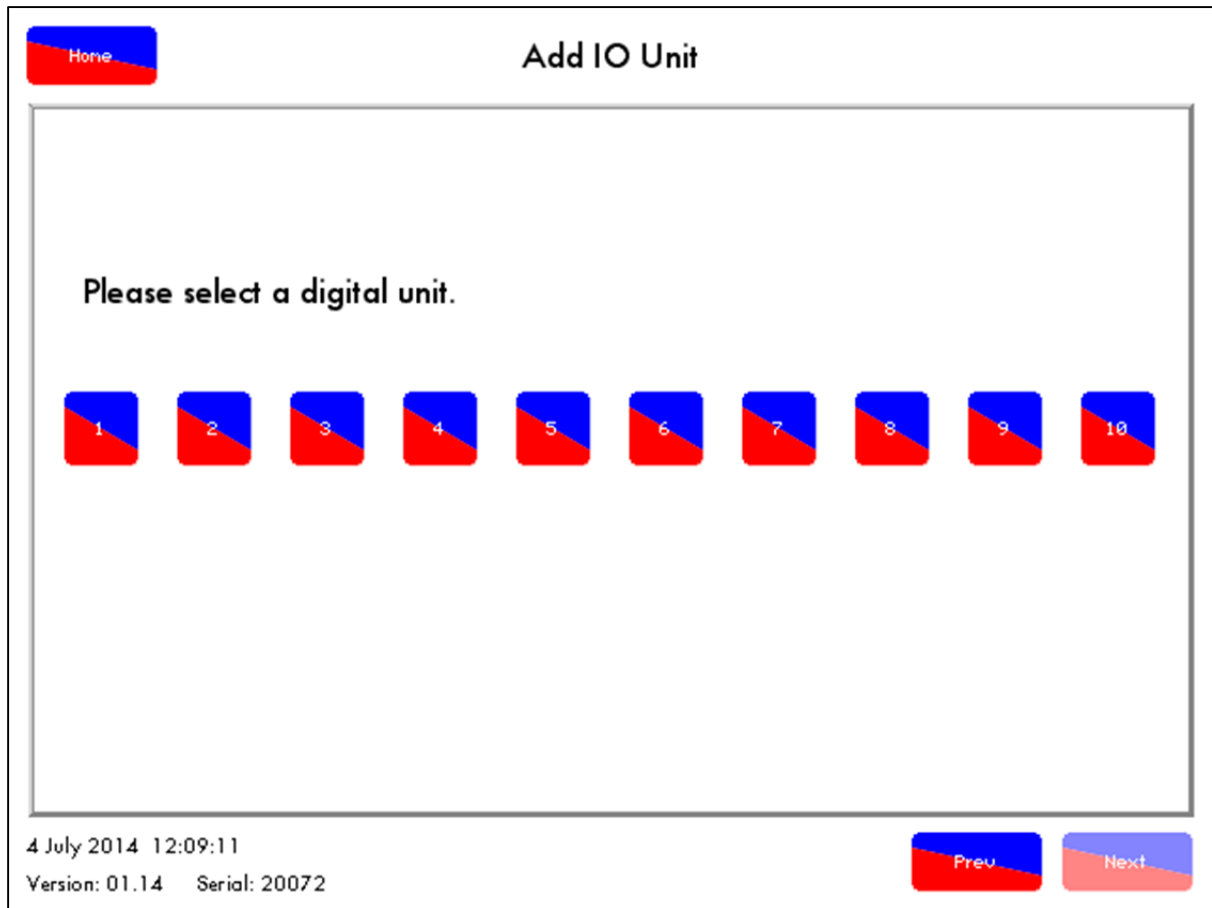


Figure 2.2.3.vii Add IO Unit

Select the ID number required for the analogue or digital I/O module and press . Once the I/O modules have been added, please see section 3 for full configuration.

2.2.4 D.T.I. Setup

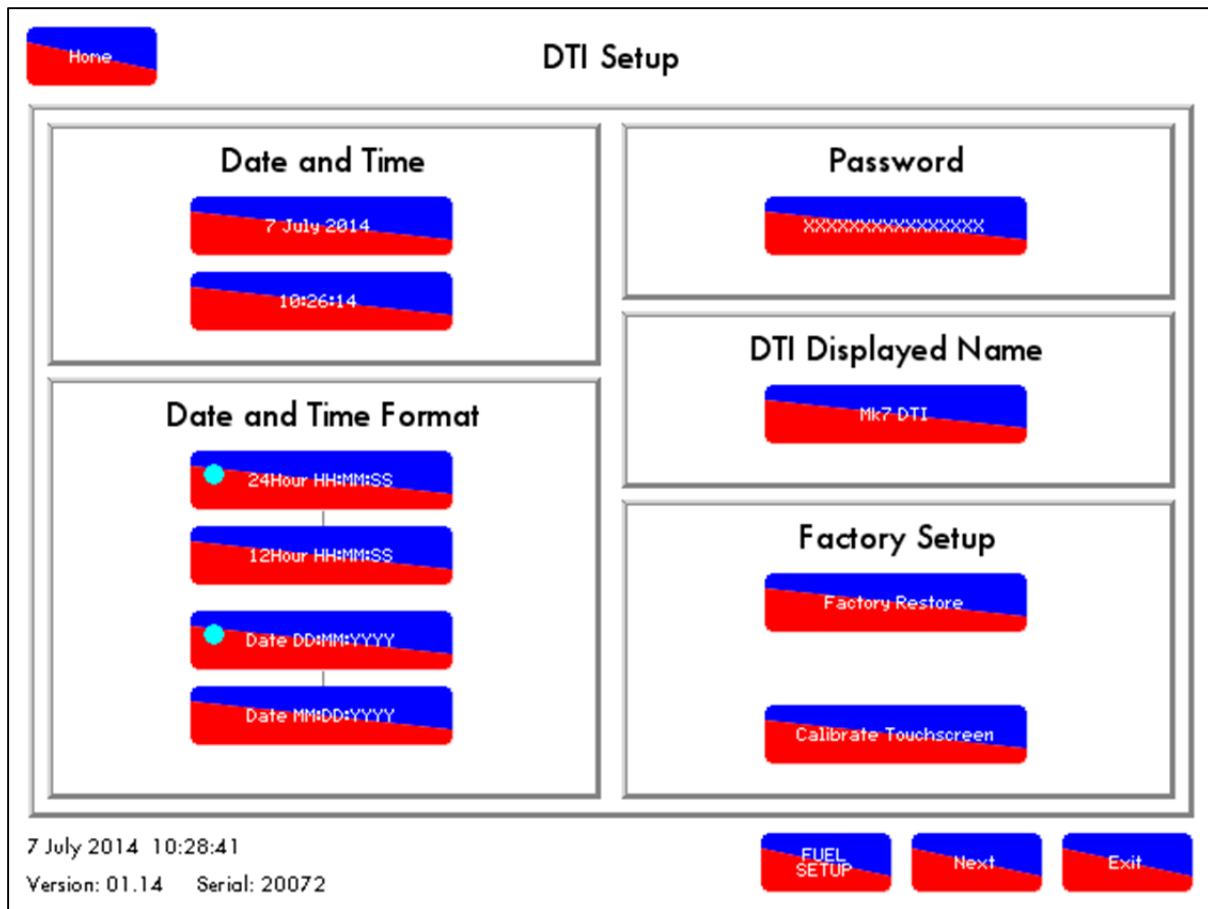


Figure 2.2.4.i D.T.I. Setup Screen 1

To set up the D.T.I., press the  button in the Boiler Configuration screen. On the first screen you are able to change the date, time and time formats, as well as the D.T.I. password and display name.

- To change the date and time, press on the 'Date and Time Format' buttons on the screen.
- To change the configuration and remote access passwords on the D.T.I., press the 'Password' button on the right hand side of the screen.
- To change the name displayed on the home screen of the 'DTI Displayed Name' on the D.T.I. setup screen.
- To restore the D.T.I. back to its factory default settings, please press the 'Factory Restore' button on this D.T.I. setup screen.
- To re-calibrate the D.T.I. press Calibrate Touchscreen.

The image shows a 'DTI Setup' screen with a 'Home' button in the top left. The screen is divided into four main sections:

- Units System:** Contains two buttons, 'Metric' and 'Imperial'. The 'Metric' button has a small blue dot next to it, indicating it is the selected option.
- Global Setpoint:** Contains two buttons. The top button is 'Global Setpoint Maximum' with the value '100 C' to its right. The bottom button is 'Global Setpoint Minimum' with the value '5 C' to its right.
- Global Boiler Type:** Contains three buttons: 'Heating Boiler', 'Steam Boiler', and 'Low Pressure Steam Boiler'. The 'Heating Boiler' button has a small blue dot next to it, indicating it is the selected option.
- Modbus Settings:** Contains two buttons. The top button is 'Read Only' with a small blue dot next to it, indicating it is the selected option. The bottom button is 'Read/Write'. Below these buttons is a 'Modbus RTU Address' field with the value '1'.

At the bottom left, the date and time '7 July 2014 10:29:16' and the version/serial numbers 'Version: 01.14 Serial: 20072' are displayed. At the bottom right, there are 'Prev' and 'Exit' buttons.

Figure 2.2.4.ii D.T.I Setup Screen 2

Pressing the  button on the screen in figure 2.2.4.i will take you to the next screen to set up the D.T.I. shown in figure 2.2.4.ii.

- To set the units, press on the 'Metric' or 'Imperial' button as appropriate.
- To select steam plant or hot water plant for the boiler room, please press 'Heating Boiler' or 'Steam Boiler.' The correct units will be displayed correctly for all boilers on the D.T.I.
- To set D.T.I.'s global setpoint range, press the 'Global Setpoint Maximum' and 'Global Setpoint Minimum' and change the values as required.
- To set whether the D.T.I. will only accept read Modbus commands or both read and write Modbus commands, chose 'Read Only' or 'Read/Write'. The 'Modbus RTU Address' is the device address Building/ Energy Management System.

Note: The units system/ global boiler type needs to be set up correct on the D.T.I., and should match with the unit settings on the E.G.A. and the M.M.

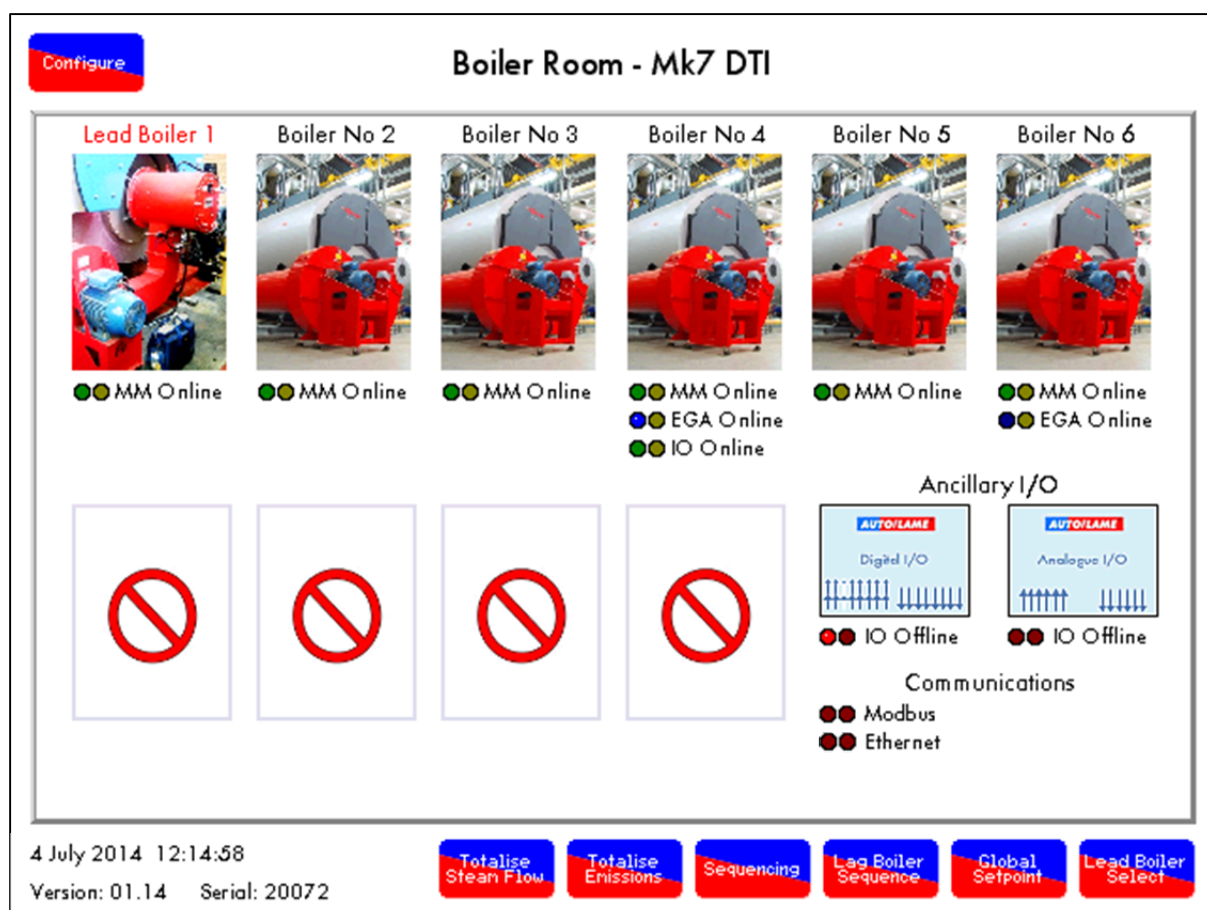


Figure 2.2.4.iii Home Screen

Once the D.T.I. has been set up press . To enter the D.T.I. setup screen once the D.T.I. has been fully configured, press  on the Home screen.

2.2.5 Deleting Boilers and I/O Modules

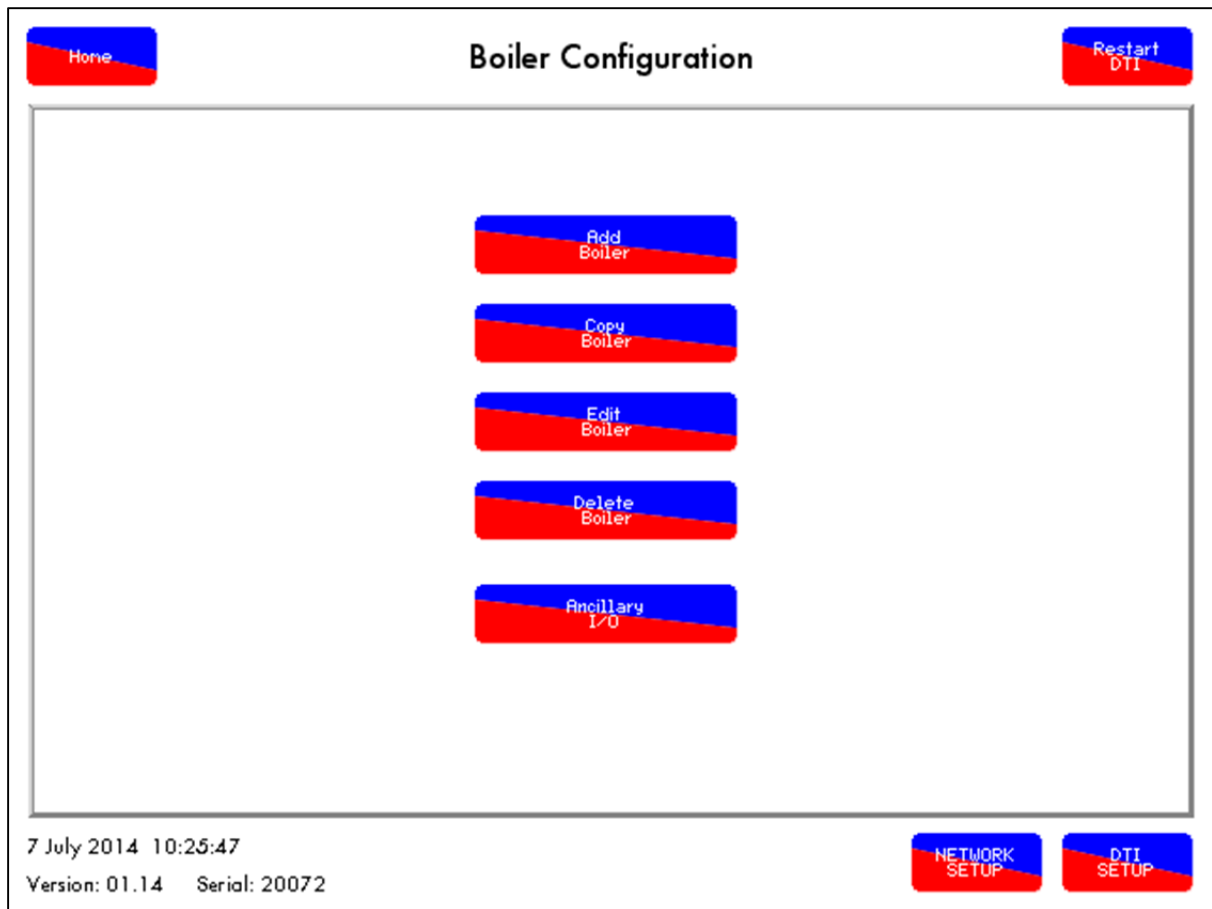


Figure 2.2.5.i Edit/Delete Boiler

To edit or delete a boiler, press  on the Home screen and then  or  as required.

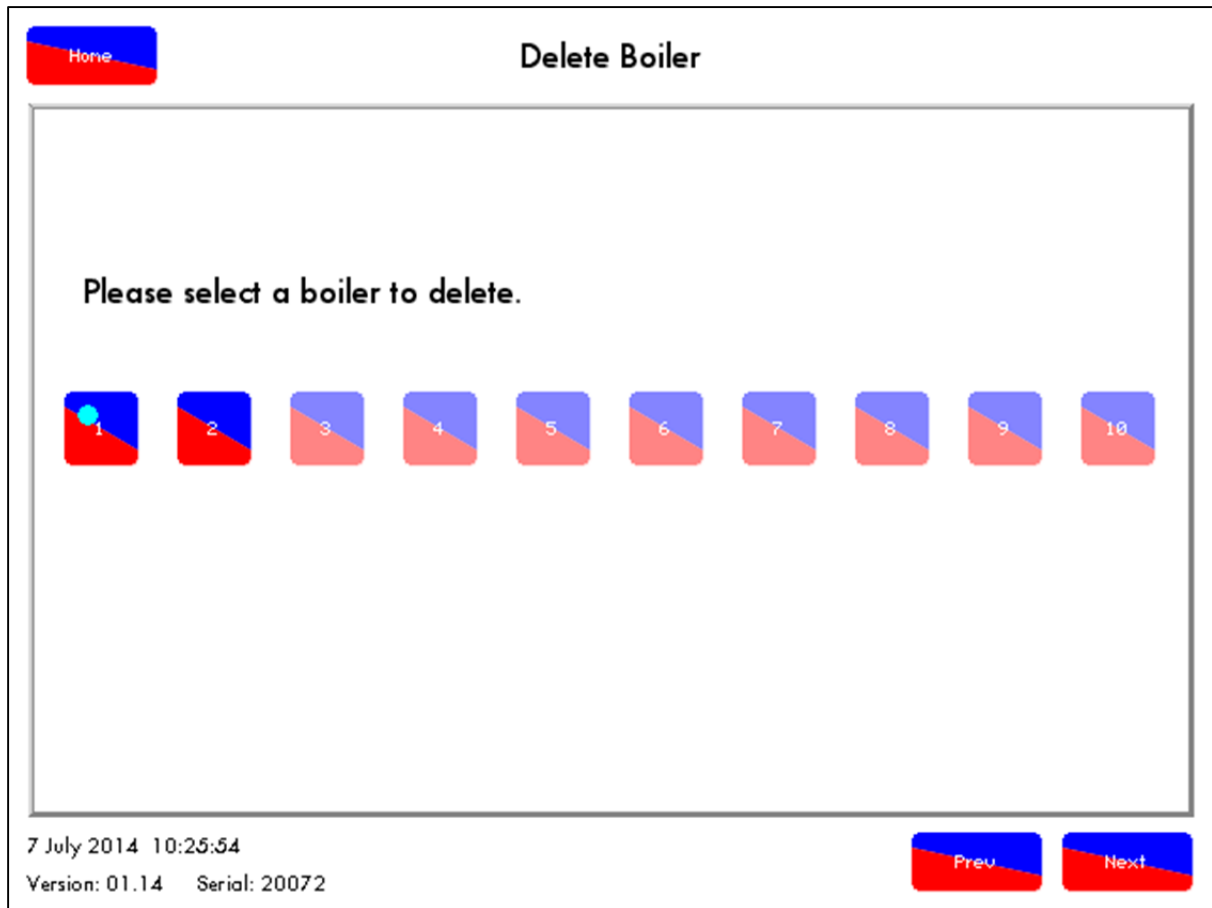


Figure 2.2.5.ii Delete Boiler

Select the boiler to delete, and then press



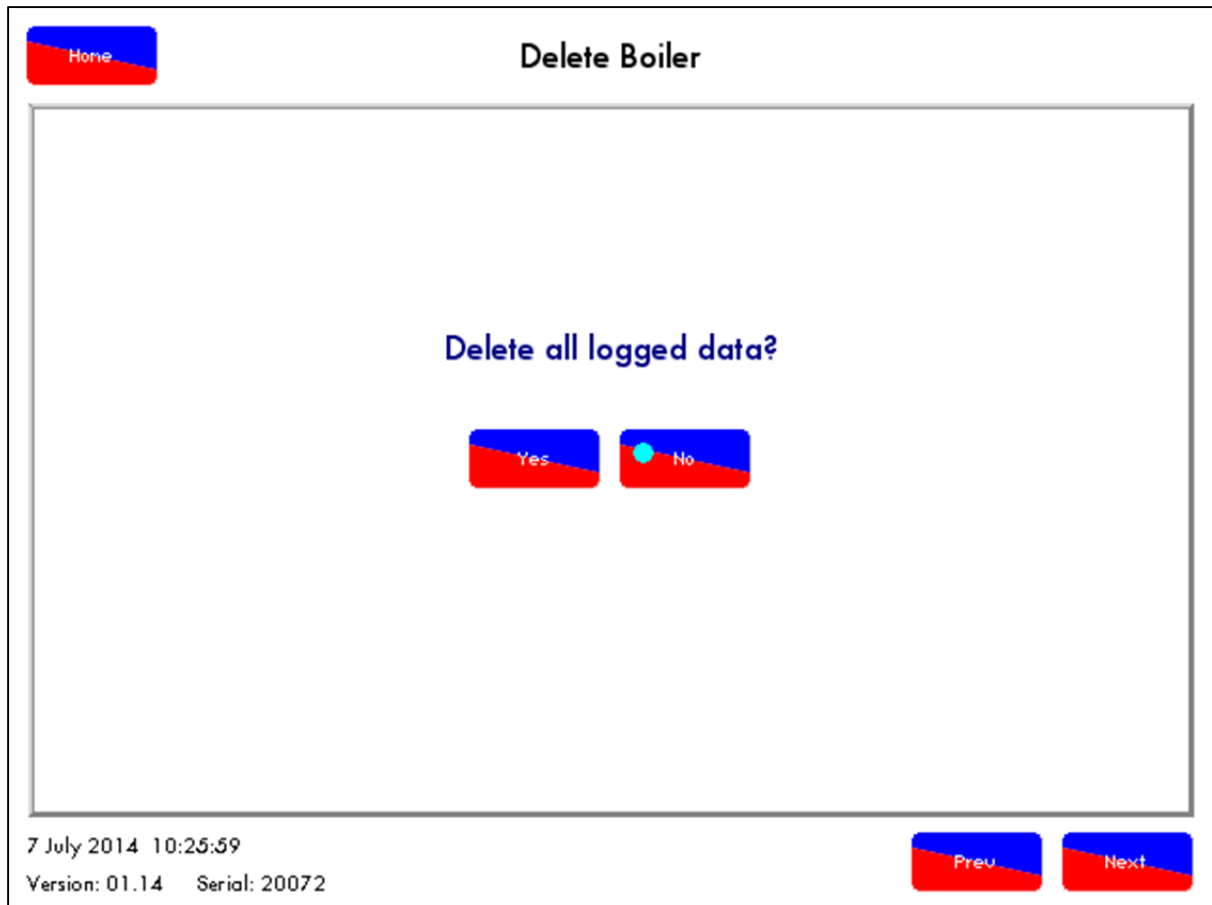


Figure 2.2.5.iii Delete Boiler

The next screen will display an option to delete or keep the stored logged data for that boiler. Once the required selection has been made, press .

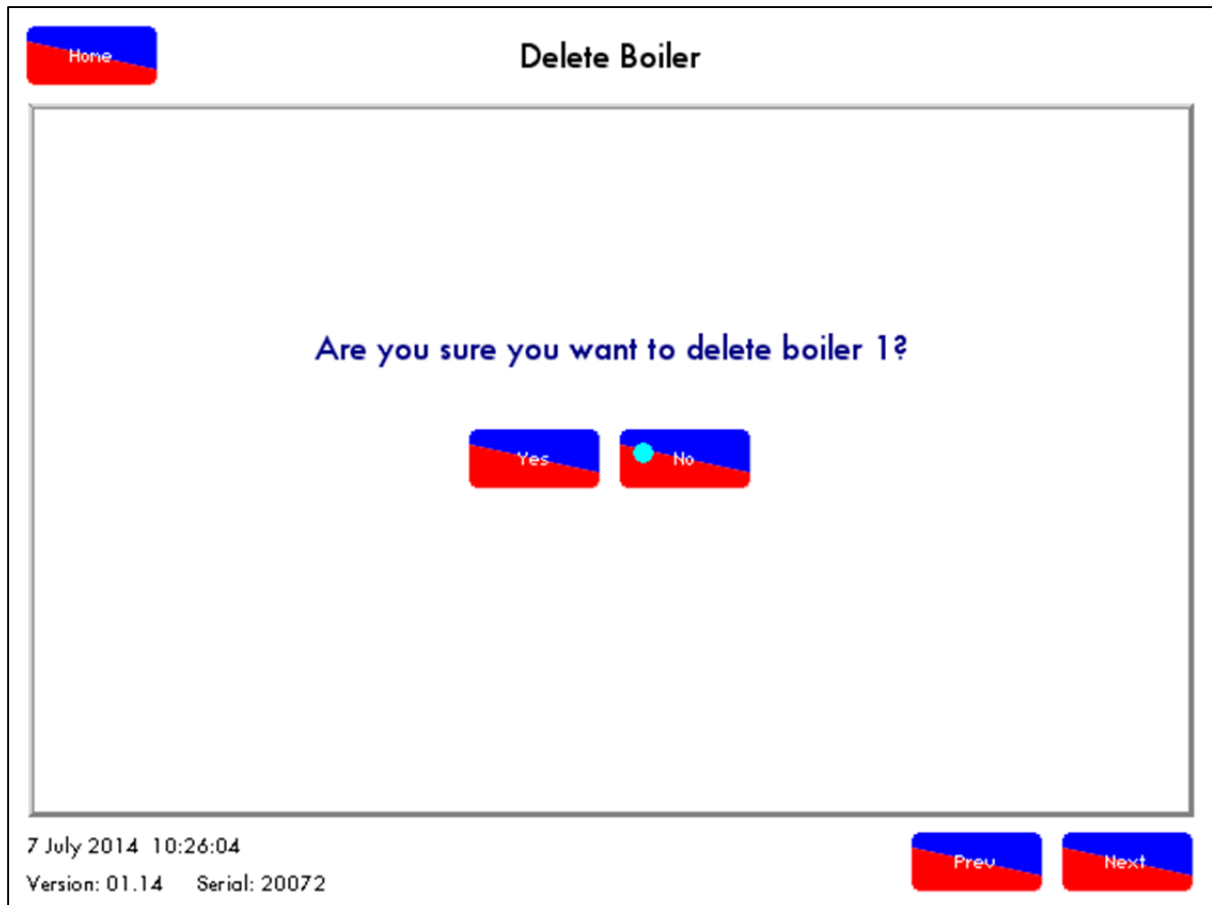


Figure 2.2.5.iv Delete Boiler

Press Yes or No to confirm whether or not to delete that boiler, and press . Once the boiler (and its data) has been deleted, the D.T.I. will go back to the Boiler Configuration screen.

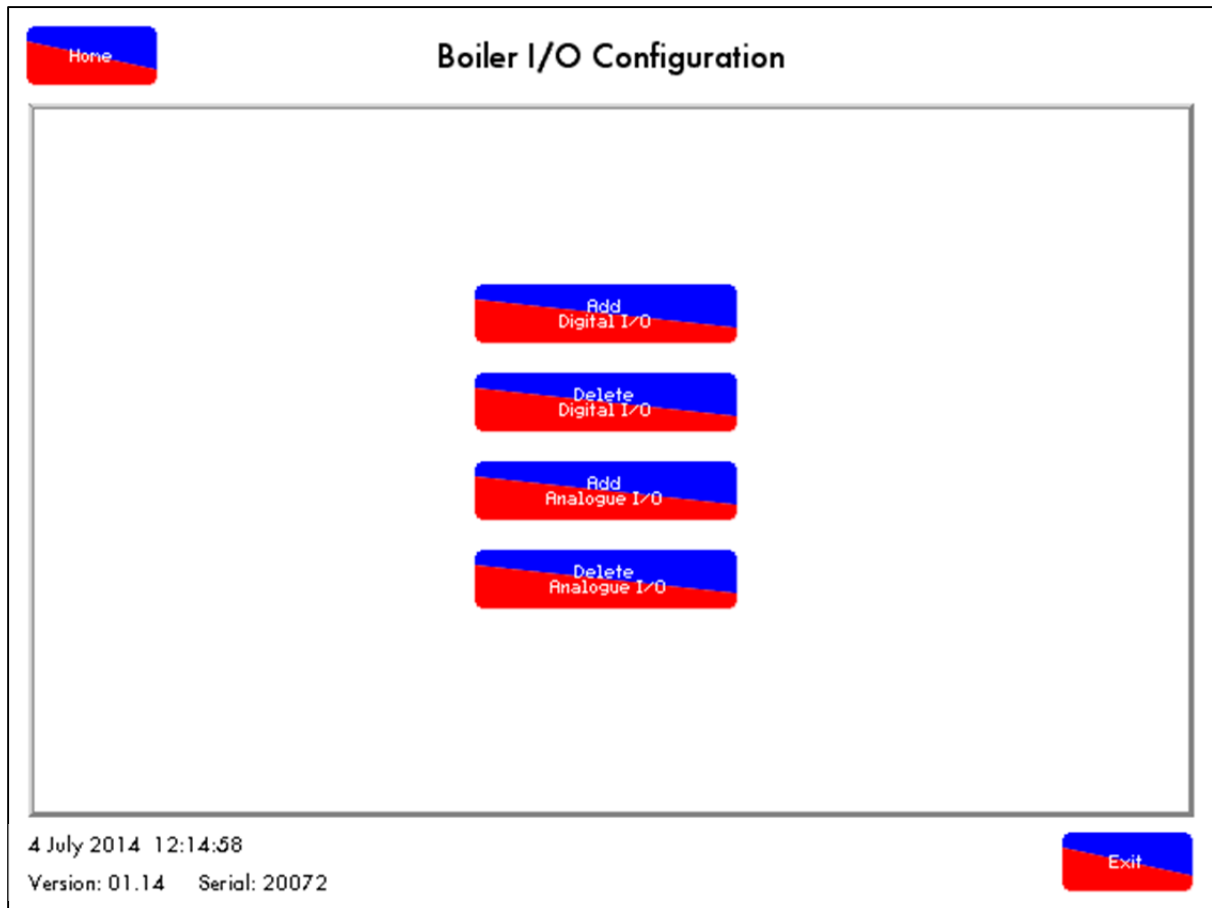


Figure 2.2.5.v Delete I/O Module 1

To delete an analogue or digital I/O module once it has been added, go to the Boiler I/O Configuration screen in Figure 2.2.5.i and press . Press either  or  as required. Similar to deleting a boiler from the D.T.I., the next screen gives an option to delete or keep the stored logged data for that I/O module.

2.2.6 Network Set-Up

The Mk7 D.T.I. is a gateway for communications between the Autoflame system and PC or Building Management System. Enter the Network setup screen by pressing 'Configure' on the DTI home screen, and then 'Network Setup.'

Figure 2.2.6.i Network Setup Screen

DHCP

The following settings change when the Dynamic Host Configuration Protocol (DHCP) is set to on or off. By turning the 'DHCP off' it is possible to assign a static configuration for external routing, which is recommended, whereas 'DHCP on' allows the D.T.I. to obtain an IP address, subnet mask, and default gateway from a DHCP server or configured router. By enabling this on the Mk7 D.T.I., minimal network configuration is needed, however the IP address is dynamic which may result in connection issues.

	DHCP OFF	DHCP ON
IP Address	An available IP address can be manually assigned to the DTI. This IP address should not be used by any other devices on the network. To test this IP address, a 'ping' command can be run on any workstation to test the connectivity, see section 2.3.3.	Obtained from the server or DHCP configured router.
Default Gateway	The Default Gateway is the IP address of the router providing an external connection i.e. the network router.	Obtained from the server or DHCP configured router.
Subnet Mask	The Subnet Mask should be configured the same as the network the DTI sits on, as connections issues will arise if incorrect.	Obtained from the server or DHCP configured router.

2 Set-Up and Connections

DNS Servers

'DTI Name on Network' allows a label to be given for the DTI device on the network the DTI sits on.

DNS Servers:

- Primary. This is the IP address of the primary Domain Name Server (DNS) on the network.
- Secondary. This is the IP address of the secondary Domain Name Server (DNS) on the network.
- Domain Name. If DHCP is enabled, and a dynamic IP address is assigned to the DTI, a remote connection can be achieved by connecting to the Domain Name Server (DNS) that may be configured in this Network Setup screen. [For example, if the DNS name is set to 'demo,' and is connected to the Autoflame network, a connection to the DTI may be established by connecting to 'demo.autoflame.com.']

Port Number

A default port number of 80 is used for the DTI (default webserver port). This may be changed by pressing the 'HTTP Port No.' button and entering a new value.

Re-entering DTI MAC Key

If there are issues whilst connecting to the Mk7 D.T.I. and an IP issue has been ruled out, check that the DTI has retained its MAC address. This can be found on the bottom of the network setup page.

To re-enter the DTI's MAC address, select 'DHCP Off' and press the 'IP Address' button. On this screen, enter in the MAC address that can be found on the card engineer on the reverse of the DTI e.g. 00.08.EE.01.B5.08.



Figure 2.2.5.ii MAC Address

2.3 Mk7 D.T.I. Connections

The Mk7 D.T.I. can be connected remotely or locally; the following connections are available:

Ethernet

- Direct connection from D.T.I. to PC. Direct connection to the D.T.I. can be achieved by using either the CEMS Software, or Modbus communications.
- Local Area Network (Local Area Network). A LAN connection can be achieved by plugging in the DTI to a computer network. If DHCP is enabled, an address will automatically be allocated to the DTI. If DHCP is disabled, a non-conflicting address will have to be manually assigned to the DTI for it to be able to communicate with other computers on the network.
- Internet connection. For the D.T.I. to be available from the internet, routing will need to be configured from an external IP address to a static IP address within the LAN. The Mk7 D.T.I.'s port number can be changed for custom routing.

RS422

- Modbus. The D.T.I. can communicate with external systems through the Modbus protocol, and accepts read and read/write commands.

2.3.1 PC Connection

The DTI can be connected directly to a PC through the Ethernet. The Autoflame CEMS Audit software displays information on all the boilers in the boiler room, just as on the Mk7 D.T.I. This monitoring and control software can be customised with uploaded boiler images, electrical and mechanical drawings, and site names. Please see section 6 for more information on the CEMS Audit software and C.E.M.S. software capabilities. As well communicating with the CEMS Audit software, the Mk7 D.T.I. can communicate under the Modbus protocol with external communication systems. This allows remote control, and existing building controls to control aspects of the burner operation. Through Modbus, information can be transferred and the data logged.

Direct Connection to PC via Ethernet

1. Connect the D.T.I. to the PC via an Ethernet cable (see wiring diagram in Section 2.1.1).
2. Check that communications can be established by verifying that the green and orange LEDs are flashing/ illuminated.
3. Go into the Configuration screens on the Mk7 D.T.I., go to 'Network Setup.'
4. Set the DHCP Off and select the following:

IP Address	Choose an IP Address for the Mk7 D.T.I.
Subnet Mask	Choose a useable range for IP Addresses
Default Gateway	Choose address of router in range of subnet mask
Primary DNS	Choose server address on network that deals with computer/ device in range of subnet mask

5. Press 'Save and Apply Settings' and go back to the home screen.
6. To set up the IP configuration on the PC, go to the 'Control Panel'.
7. Go to 'Network,' then 'Network and Sharing Center,' and go to 'Change Adapter Settings.'
- (Note: this path may be slightly different depending on the version of Windows etc.)
8. Go to 'Local Area Connection' and right click on 'Properties.'
9. Double click on 'Internet Protocol Version 4 (TCP/IPv4).'
10. Click on 'Use the following IP Address' – this is a way of setting the IP address manually.
11. In the IP address box, type in an address in the same range as the D.T.I. i.e. if the D.T.I.'s address has been set to 10.0.1.80, type in 10.0.1.81.
12. In the Subnet Mask box, type the same Subnet Mask that was set on the D.T.I.

13. Save these settings and close the dialogue box.
14. Install the CEMS Audit software given with the D.T.I.; if the D.T.I. has software 1.XX, the version of CEMS Audit software you use should also be 1.XX.
15. Go to 'Site' in the taskbar and then 'Edit' and 'Add' to add a new site. The Plant Supervisor version of this CEMS Audit software will allow only 1 site to be added, whereas the Plant Manager version will allow multiple sites to be added.
16. Type a in a D.T.I. reference name e.g. DTI 20012 or Main Boiler Room DTI.
17. In the IP Address box, type in the D.T.I.'s IP Address set in 4.
18. Select Port and type 80.
19. Type in the Access Code provided with that D.T.I., and close the dialogue box. This site has now been added. To connect to this site, click 'Site' and then 'Connect,' you will be asked to enter a password which will be the same password used on the D.T.I.
20. If you using Plant Manager version of the PC DTI software, to activate the software, go to the 'Help' tab on the taskbar and select 'Licence...' Then contact Autoflame Sales on + 44 (0) 845 872 2000, with the licence code and we will you send you an activation key to be typed into this dialogue box. This will then allow the CEMS Audit software to connect to multiple D.T.I.s.

2.3.2 Network Connection

Connection to a Network (LAN)

1. Plug the D.T.I. to a computer network via an Ethernet cable.
2. Check that communications can be established by verifying that the green and orange LEDs are flashing/ illuminated.
3. Go into the Configuration screens on the Mk7 D.T.I., go to 'Network Setup.'
4. If using 'DHCP On,' check if the D.T.I. has automatically received an IP address from the network.
5. If using 'DHCP Off,' make sure that the IP address is within the network subnet mask, and set the following:

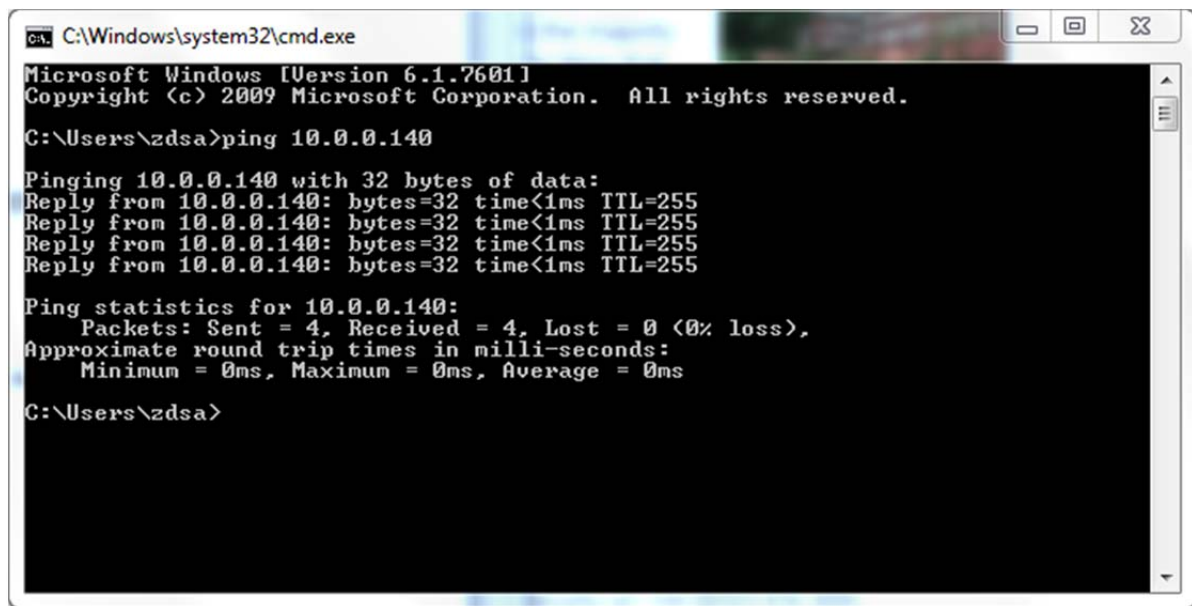
IP Address	Choose an IP Address for the Mk7 D.T.I.
Subnet Mask	Choose a useable range for IP Addresses
Default Gateway	Choose address of router in range of subnet mask
Primary DNS	Choose server address on network that deals with computer/ device in range of subnet mask

6. Take note of these above settings and connect the computer to the network.
7. Install the CEMS Audit software given with the D.T.I.; if the D.T.I. has software 1.XX, the version of CEMS Audit software you use should also be 1.XX.
8. Go to 'Site' in the taskbar and then 'Edit' and 'Add' to add a new site. The Plant Supervisor version of this CEMS Audit software will allow only 1 site to be added, whereas the Plant Manager version will allow multiple sites to be added.
9. Type a in a D.T.I. reference name e.g. DTI 20012 or Main Boiler Room DTI.
10. In the IP Address box, type in the D.T.I.'s IP Address set in 4.
11. Select Port and type 80.
12. Type in the Access Code provided with that D.T.I., and close the dialogue box. This site has now been added. To connect to this site, click 'Site' and then 'Connect,' you will be asked to enter a password which will be the same password used on the D.T.I.

2.3.3 Pinging the D.T.I.

To determine the cause of communication failure, pinging the D.T.I. checks that a connection has definitely been established between the computer and the D.T.I.

1. Go to the 'Start Menu' on the computer.
2. Go to 'Run' (Windows XP) or in the white search tool box at the bottom (Windows Vista, 7 or 8), type 'cmd' and press enter.
3. In the black command box, type 'ping xxx.xxx.xxx.xxx' where the xxx.xxx.xxx.xxx is the IP address set for the Mk7 D.T.I. on the Network Setup screen.
4. If there is successful communications with the Mk7 D.T.I., the following information or similar will be seen.



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\zdsa>ping 10.0.0.140

Pinging 10.0.0.140 with 32 bytes of data:
Reply from 10.0.0.140: bytes=32 time<1ms TTL=255
Reply from 10.0.0.140: bytes=32 time<1ms TTL=255
Reply from 10.0.0.140: bytes=32 time<1ms TTL=255
Reply from 10.0.0.140: bytes=32 time<1ms TTL=255

Ping statistics for 10.0.0.140:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\zdsa>
```

5. If there is unsuccessful communications with the Mk7 D.T.I. the screen above will not show, and instead an error message will appear such as 'Response Timed Out.' Check that the IP configuration on the CEMS Audit software is correct, as this error is usually caused by incorrect individual configurations.
6. if there is unsuccessful communications with the D.T.I. and are using 'DHCP Off,' check that the IP address which has been set is available on the network. To set a static IP address that hasn't been used already, set 'DHCP On,' check the IP address that has been issued to the D.T.I. Next, set 'DHCP Off' and set that issued IP address as the static IP address. If still unsuccessful and using 'DHCP On,' check that an IP address has been issued, and that the PC is on the same subnet mask as the D.T.I.

2.3.4 RS422 Connection

The supports the Modbus RTU protocol; with a RS422 connection, the D.T.I. can be connected to the PC and communicate with each other through a Building Management System. To establish this connection, the D.T.I. must be set to Read/Write or Read on the DTI Setup screens.

The following settings must be selected for the D.T.I. to communicate with the external system:

Baud Rate	9600 bps	The data transmission rate.
Data Bits	8	The data units.
Parity	None	The bit that shows whether the number of bits is even or odd.
Stop Bits	2	The bits that do not contain data.
Comms	RTU	The Remote Terminal Unit.
Slave Response Timeout	2000msecs	The time allowed for response before there is an error.
Scan Rate	500msecs	The rate the system pulls data from the D.T.I.

Once this has been set on the BMS, communications will be established with the D.T.I. If this doesn't connect, please request Modscan 32 software from Autoflame Technical Support, to check that the comms from the D.T.I. For a full list of Modbus addresses, please Section 4.

For M.M. read/write function, option 3 must be to 1, and 16 set to 2 or 3 on the M.M.

3 ANALOGUE AND DIGITAL INPUTS/OUTPUTS

3.1 Mk7 Universal Input/ Output Module

3.1.1 Introduction

The Mk7 Universal Input/ Output Module (Mk7 I/O) enables 3rd party additional equipment in the boiler plant to be monitored by the Mk7 D.T.I. Each Mk7 I/O unit has 16 digital line inputs, 8 volt free contacts, 6 analogue inputs and 6 analogue outputs. The analogue inputs and outputs can be configured for 0-10V, 0-20mA, or 4-20mA.

The Mk7 I/O module is capable of totalising the input data internally, allowing to the unit to run as a standalone unit. The ranges of the analogue inputs and outputs can be then set via the I/O Board Configurator (see section 3.1.3). Coupled together with the Mk7 D.T.I. the Mk7 Universal I/O module gives detailed logging of the inputs and outputs, as well as configurable alarms. The Mk7 D.T.I. can control the analogue and digital outputs, for a maximum of 10 Mk7 I/O modules. The data gathered by the AutoFlame Mk7 D.T.I. for the Mk7 I/O modules is logged for 2 years, and can be viewed using the CEMS Audit Software.

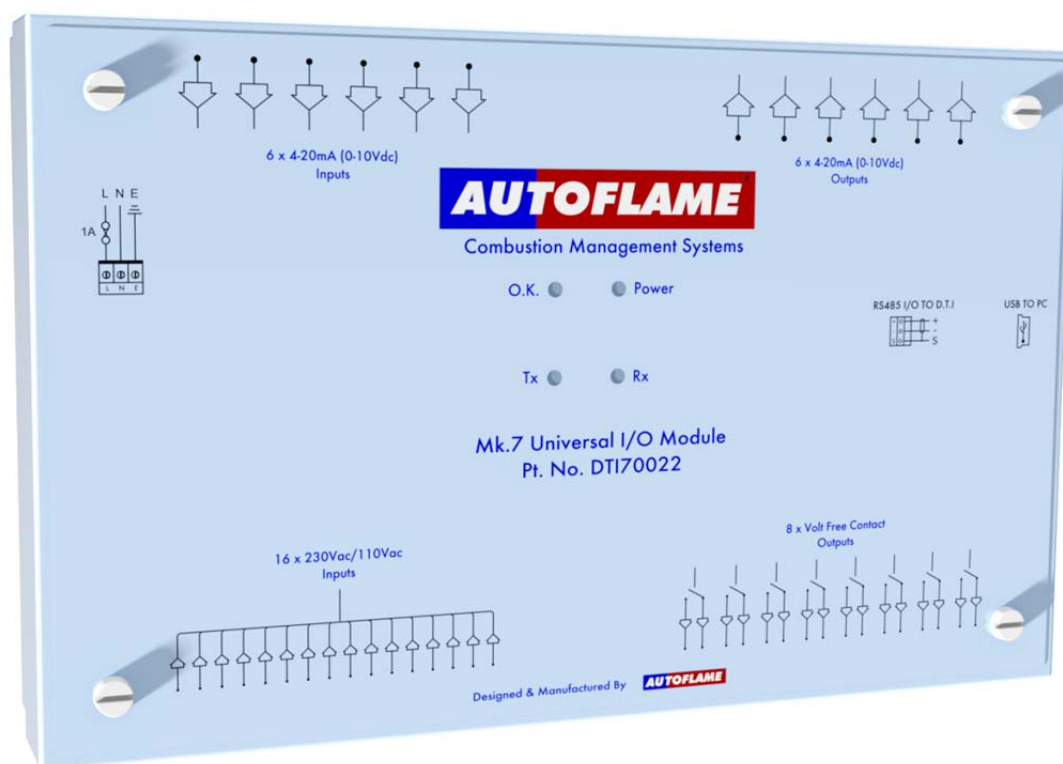


Figure 3.1.1.i Mk7 Universal I/O Module

3.1.2 Wiring and Dimensions

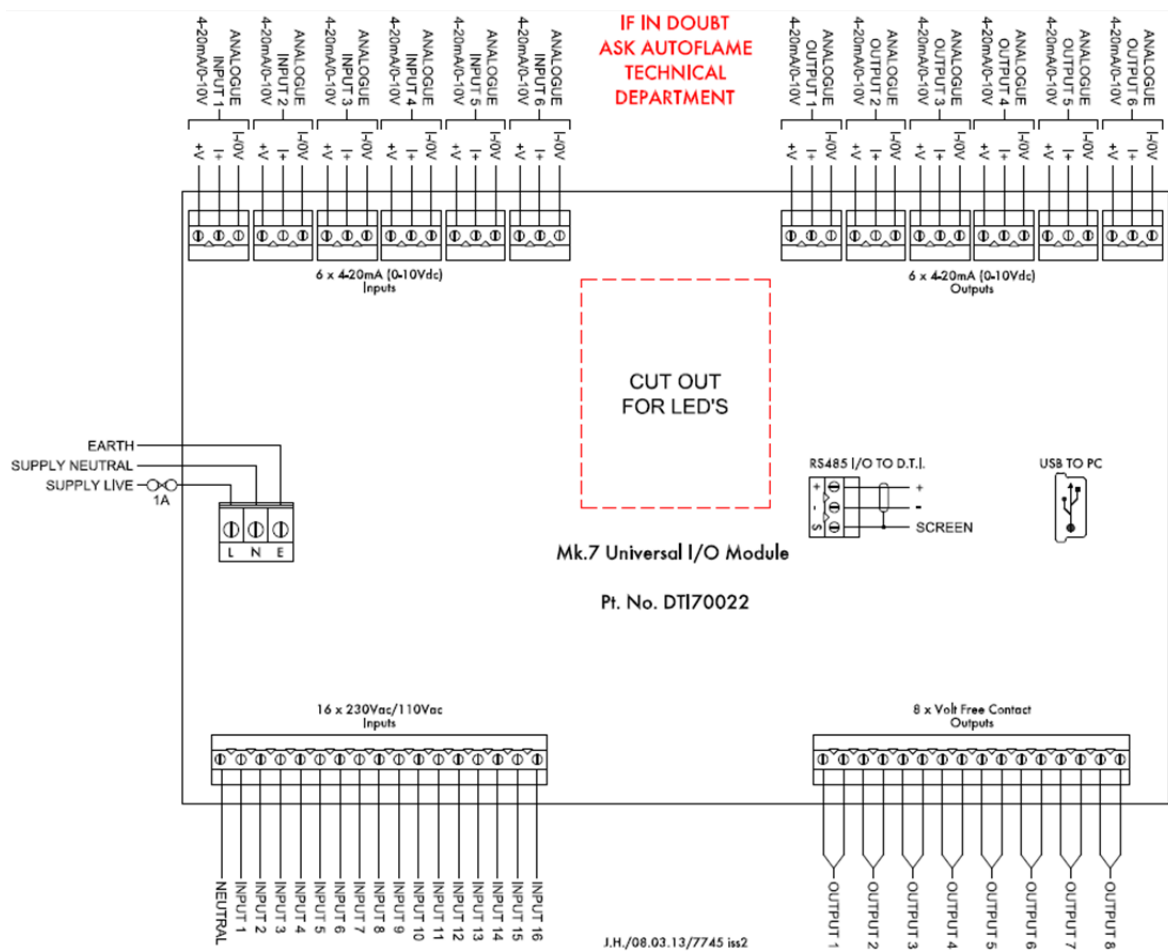


Figure 3.1.2.i Wiring

Mk7 Universal I/O Module Dimensions

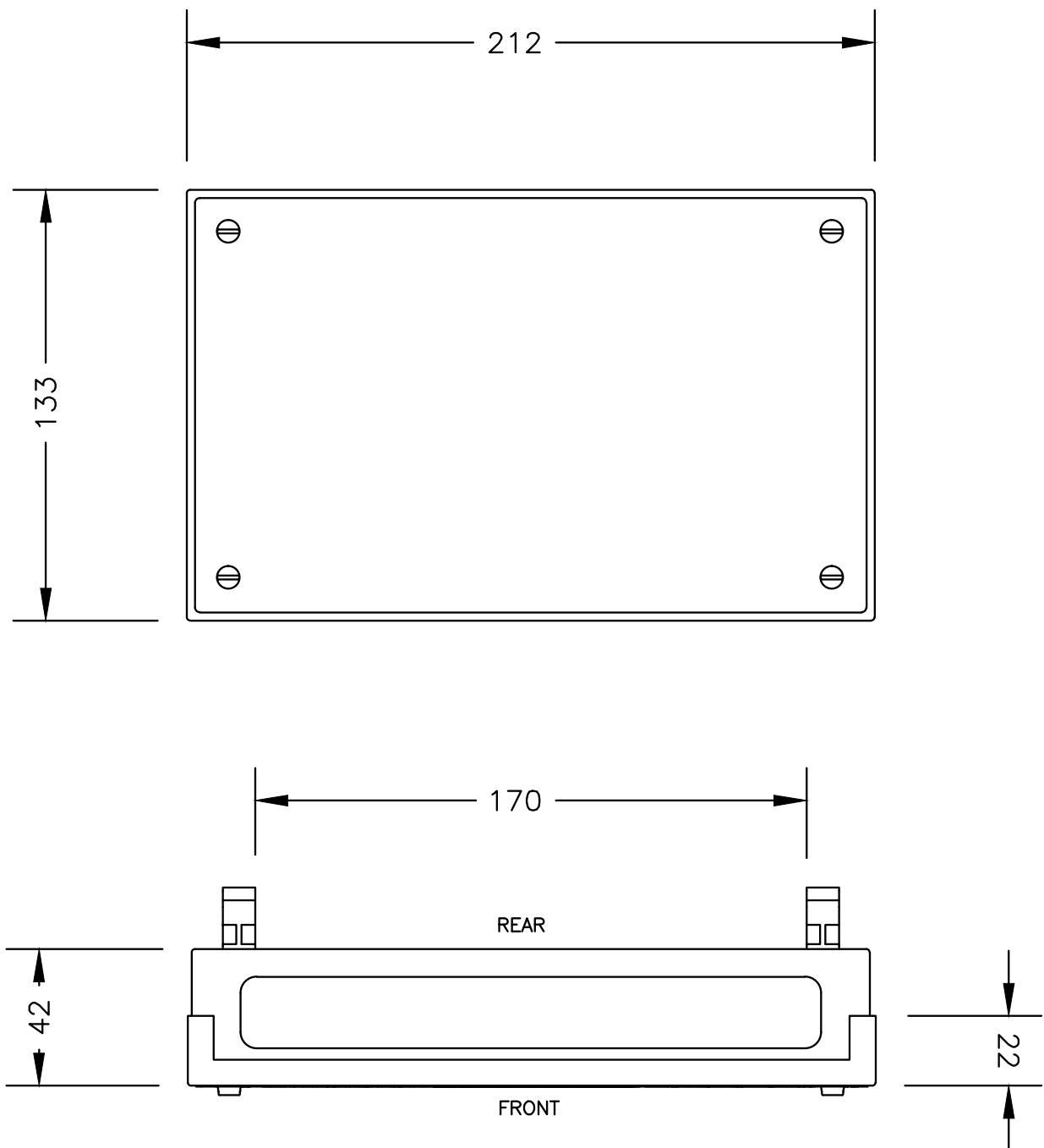


Figure 3.1.2.ii Dimensions

3.1.3 Set-Up I/O Modules on Mk7 D.T.I.

The Mk7 D.T.I. is capable of communications with up to 10 analogue and 10 digital, or 10 Universal input/ output (IO) modules. Once the I/O modules have been configured through the I/O Board Configurator for the Mk7 Universal I/O module (please refer to the PC Software Guide).

Once the I/O modules have been added in section 2.2.2. press the I/O module box on the Home

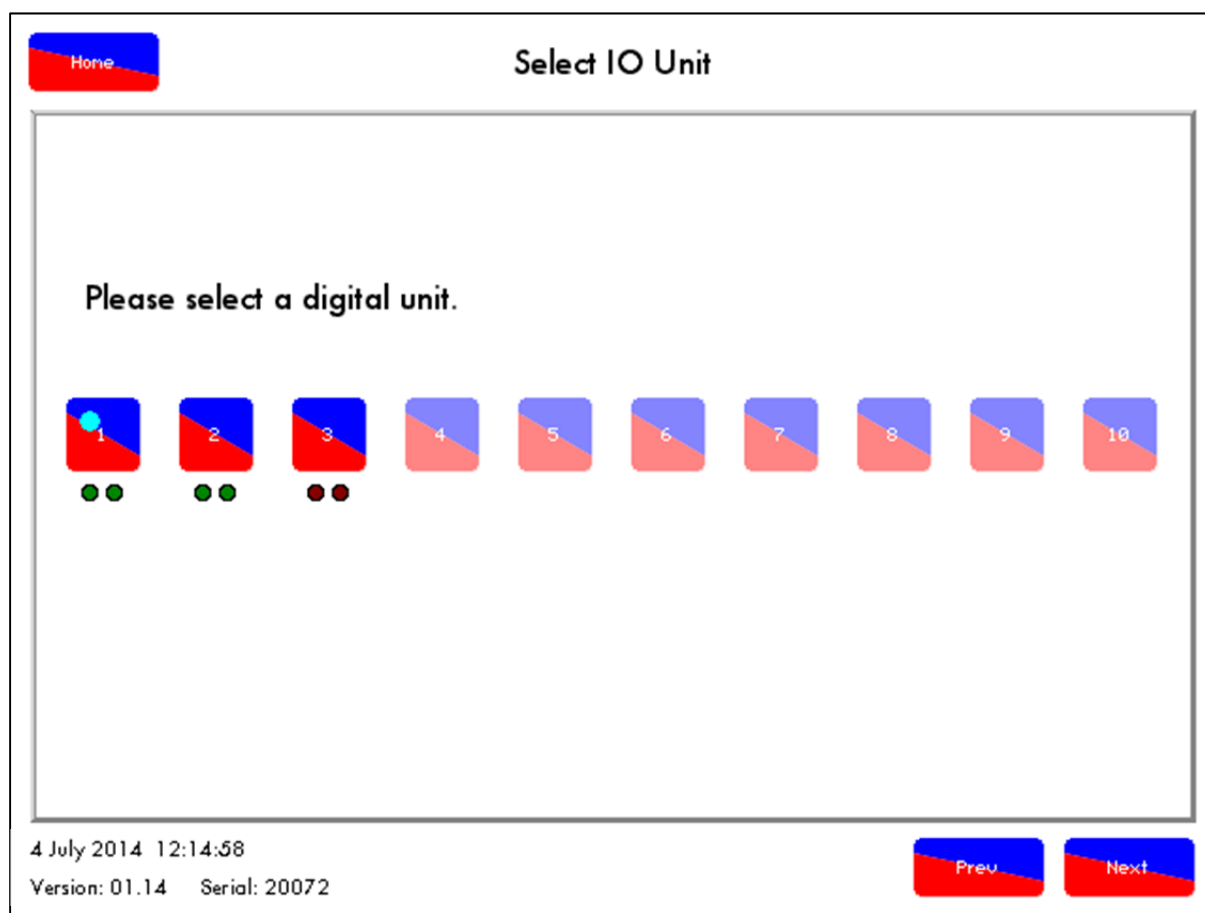
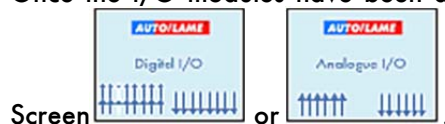


Figure 3.1.3.i Select I/O Module

Select the I/O module to be set-up and then press . The green circles indicate good communications for that I/O module, and red indicates loss in communications.

Note: If the I/O is greyed out, it may be setup via a boiler, go to the relevant boiler via the Home screen (see section 5.1) to view it.

Note: A universal I/O module with ID 1 will assign that ID number to both the digital and analogue sides of the board. Any Mk6 I/O's used in conjunction with a Universal I/O will need an ID number different to the Universal I/O.

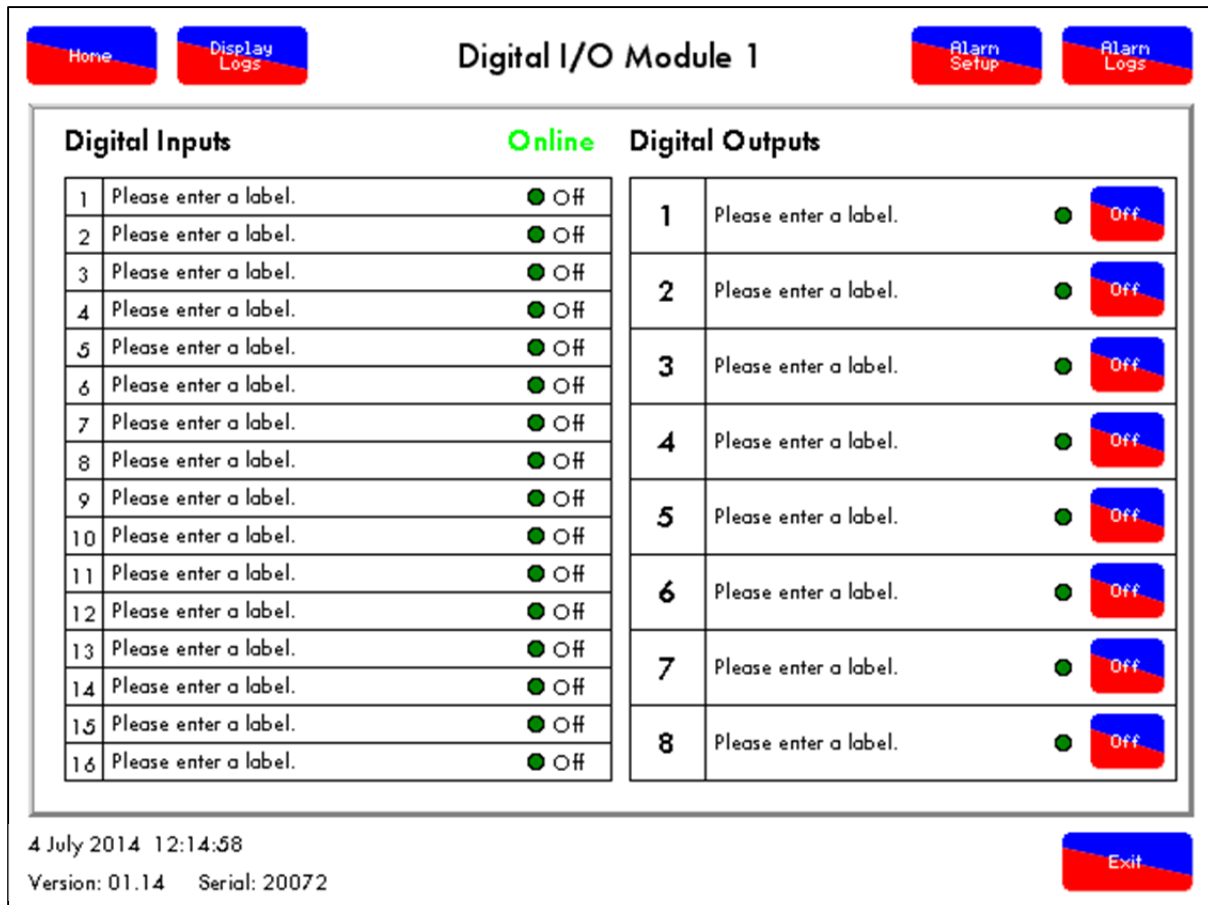


Figure 3.1.3.ii Digital I/O Screen

The digital I/O screens display both inputs and outputs as instantaneous values. The Mk7 D.T.I. can have up to 16 digital inputs.

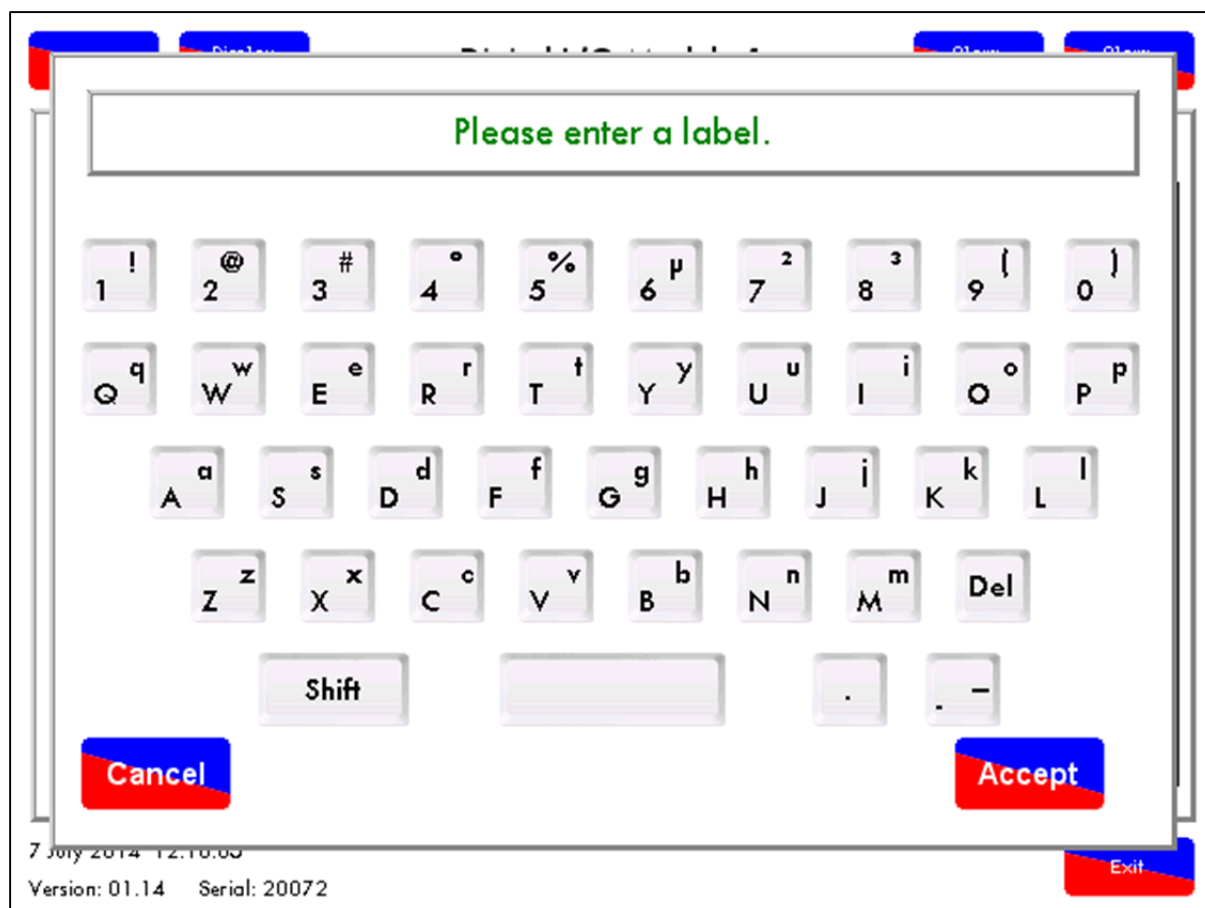


Figure 3.1.3.iii Digital I/O Label

To rename a digital input or output, press 'Please enter a label,' or the label text if it is already setup.

Digital I/O Module 1 Alarms

Digital Inputs			Alarm Configuration													
1	Please enter a label.	● On	Digital Input 1 <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Mode</td> <td style="width: 35%; text-align: center;"> Monitor </td> <td style="width: 35%; text-align: center;"> Alarm </td> </tr> <tr> <td>Triggers on</td> <td style="text-align: center;"> Low </td> <td style="text-align: center;"> High </td> </tr> <tr> <td>Trigger Time</td> <td style="text-align: center;"> - </td> <td style="text-align: center;"> + </td> </tr> <tr> <td colspan="3" style="text-align: center; height: 40px;">0</td> </tr> </table>		Mode	Monitor	Alarm	Triggers on	Low	High	Trigger Time	-	+	0		
Mode	Monitor	Alarm														
Triggers on	Low	High														
Trigger Time	-	+														
0																
2	Please enter a label.	● On														
3	Please enter a label.	● On														
4	Please enter a label.	● Off														
5	Please enter a label.	● On														
6	Please enter a label.	● Off														
7	Please enter a label.	● Off														
8	Please enter a label.	● Off														
9	Please enter a label.	● Off														
10	Please enter a label.	● Off														
11	Please enter a label.	● Off														
12	Please enter a label.	● Off														
13	Please enter a label.	● Off														
14	Please enter a label.	● Off														
15	Please enter a label.	● Off														
16	Please enter a label.	● Off														

4 July 2014 12:18:06
Version: 01.14 Serial: 20072
Exit

Figure 3.1.3.iv Digital I/O Screen – Alarms

Each I/O input can be set to monitor/ alarm. To enable the I/O module alarms, press  in the digital I/O screen.

From this screen, you can set the I/O module to either Alarm, or display a fault when a digital input is gained or lost.

Pressing  in the digital I/O screen in Figure 3.1.3.ii will show the alarms logged for that digital I/O module.

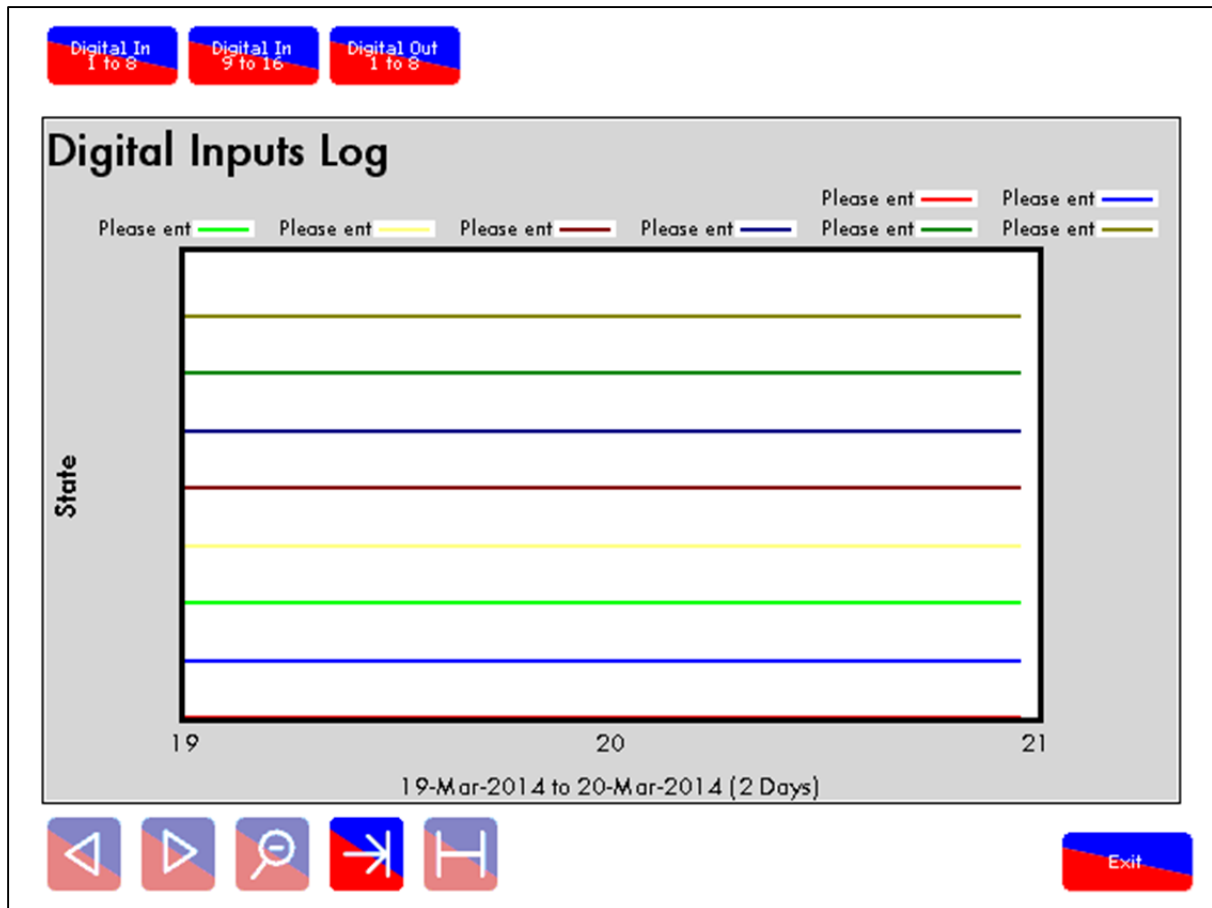


Figure 3.1.3.v Digital I/O Log Screen

The data for digital input and output is stored on the D.T.I. To view this information, press on the



press on each of the inputs at the top of the D.T.I. screen.

To zoom into data, press on two dates/ time on the x-axis to zoom between the two.

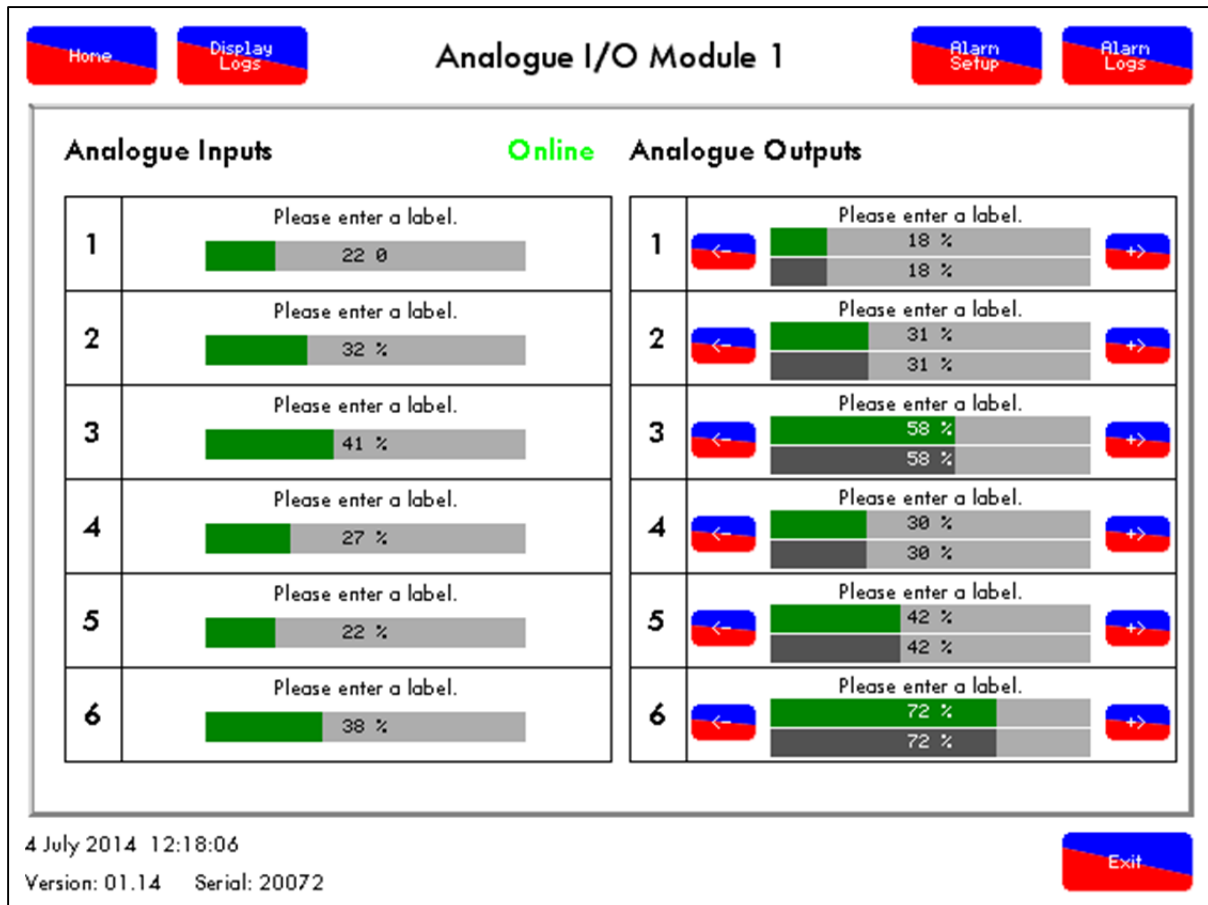


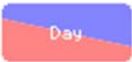
Figure 3.1.3.vi Analogue I/O Screen

If an analogue I/O module has been selected, the screen in Figure 3.1.3.vi will appear.

The analogue I/O screen displays both inputs and outputs as instantaneous values. The Mk7 D.T.I. can have up to 6 4-20mA signals.

Analogue I/O Module 1

Input 1

Label	Please enter a label.				
Units	%				
Minimum Value	0 %				
Maximum Value	100 %				
Is a Rate?					
Totalized					

4 July 2014 12:18:06
Version: 01.14 Serial: 20072



Figure 3.1.3.vii Analogue I/O Label

To edit the label that is seen on the screen, press 'Please enter a label,' or the label text if already setup.

To set the units, minimum value and maximum value, press on the relevant boxes.

If a rate is set on the analogue unit, a totalised value is stored both on the DTI and on the IO module. The rate settings can be changed to per second, minute, hour and day.

Analogue I/O Module 1

Analogue Inputs		Online	Alarm Configuration											
1	Please enter a label. 22 0	Analogue Input 1 <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Mode</td> <td> Monitor Alarm </td> </tr> <tr> <td>Trigger Mode</td> <td> Less than or equal to Greater than or equal to </td> </tr> <tr> <td>Threshold</td> <td style="text-align: center;">0 0</td> </tr> <tr> <td>Trigger Time (seconds)</td> <td> - 0 + </td> </tr> <tr> <td colspan="2" style="height: 40px;"></td> </tr> </table>			Mode	Monitor Alarm	Trigger Mode	Less than or equal to Greater than or equal to	Threshold	0 0	Trigger Time (seconds)	- 0 +		
Mode	Monitor Alarm													
Trigger Mode	Less than or equal to Greater than or equal to													
Threshold	0 0													
Trigger Time (seconds)	- 0 +													
2	Please enter a label. 32 %													
3	Please enter a label. 40 %													
4	Please enter a label. 27 %													
5	Please enter a label. 22 %													
6	Please enter a label. 37 %													

4 July 2014 12:18:06
Version: 01.14 Serial: 20072

Exit

Figure 3.1.3.viii Analogue I/O Screen – Alarms

Each I/O input can be set to monitor/alarm. To enable the I/O module alarms, press on the  button. From this screen, you can set the I/O module to either Alarm, or display a fault when an analogue signal drops below or rises above a set value.

Pressing  in the analogue I/O screen in Figure 3.1.3.vi will show the alarms logged for that analogue I/O module.

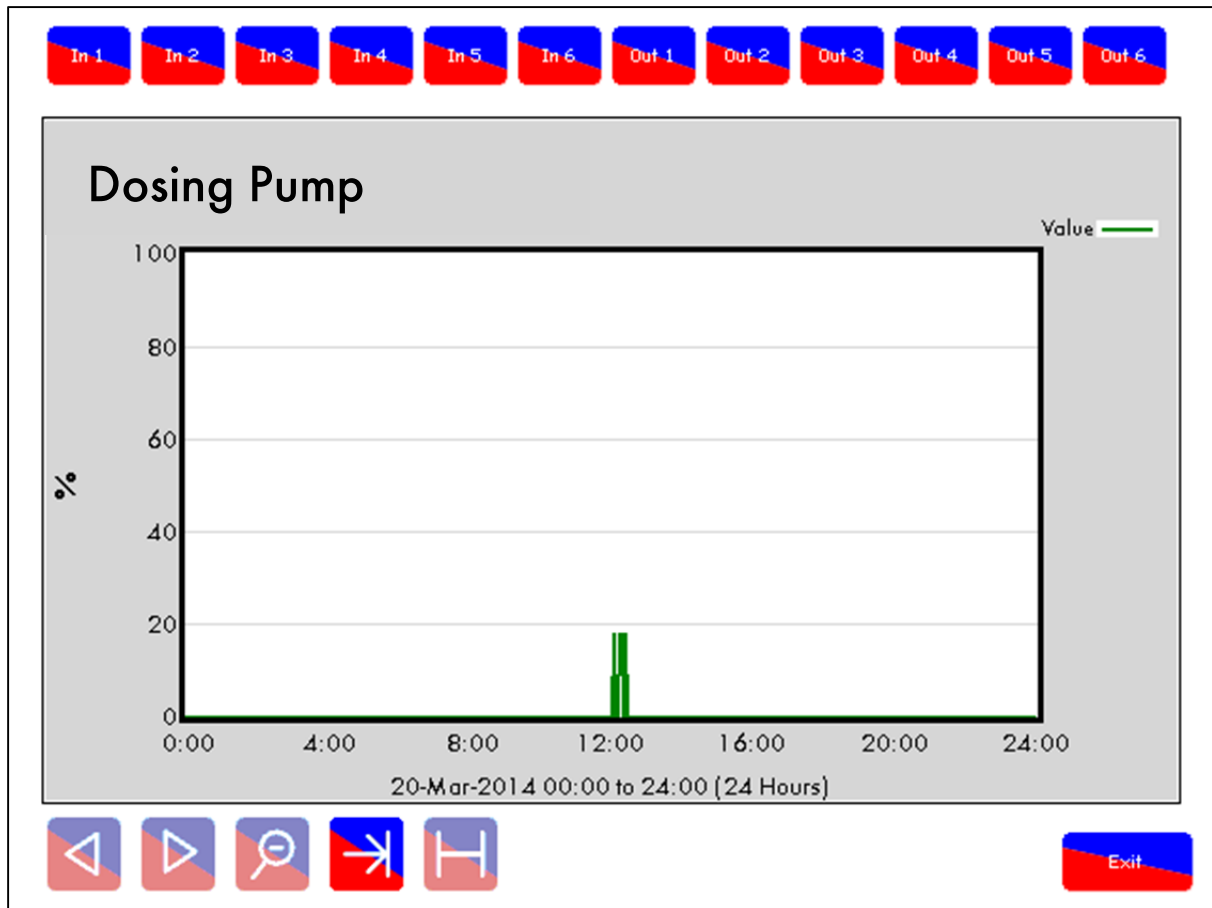


Figure 3.1.3.ix Analogue I/O Log

The data from each input and output is stored on the D.T.I. and logged for 2 years, and can be viewed by pressing the  button, and then pressing on each of the inputs at the top of the D.T.I. screen.

To zoom into data, press on two dates/times on the x-axis to zoom between the two.

4 MODBUS

Through the Modbus protocol, the Mk7 D.T.I. data can be read from the boiler room information. The D.T.I. accepts Read and Read/Write commands. The 0x and 4x addresses are the Read/Write commands, and the 1x and the 3x addresses are the Read commands. The Read/Write commands are those which allow you to control certain aspect of the burners remotely.

4.1 M.M. Read Addresses

The 1x addresses are digital input read only addresses, which will give out either 0 or 1. Refer to section 4.5.1 for relevance of these addresses.

For example, if Modbus address 10457 outputs 1, this means that the M.M. 4 has an E.G.A. optioned.

1x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
CR1 Relay Status	10193	10273	10353	10433	10513	10593	10673	10753	10833	10913
T53 Status	10194	10274	10354	10434	10514	10594	10674	10754	10834	10914
Bottom Blow Down Status	10195	10275	10355	10435	10515	10595	10675	10755	10835	10915
Boiler Temp/Pressure	10201	10281	10361	10441	10521	10601	10681	10761	10841	10921
Flow Metering On	10210	10290	10370	10450	10530	10610	10690	10770	10850	10930
CO Displayed on F2/ F3	10211	10291	10371	10451	10531	10611	10691	10771	10851	10931
Deg C or Deg F	10213	10293	10373	10453	10533	10613	10693	10773	10853	10933
Bar or PSI	10214	10294	10374	10454	10534	10614	10694	10774	10854	10934
External Voltage	10215	10295	10375	10455	10535	10615	10695	10775	10855	10935
EGA Optioned	10217	10297	10377	10457	10537	10617	10697	10777	10857	10937
Actual up to Trim Threshold	10218	10298	10378	10458	10538	10618	10698	10778	10858	10938
Cooler Ready	10219	10299	10379	10459	10539	10619	10699	10779	10859	10939
Ambient Temp OK	10220	10300	10380	10460	10540	10620	10700	10780	10860	10940
NO Optioned	10221	10301	10381	10461	10541	10621	10701	10781	10861	10941
SO2 Optioned	10222	10302	10382	10462	10542	10622	10702	10782	10862	10942
EGA Ambient Temp Hi/Lo	10223	10303	10383	10463	10543	10623	10703	10783	10863	10943
OK to Sample	10224	10304	10384	10464	10544	10624	10704	10784	10864	10944
Sequencing Optioned	10225	10305	10385	10465	10545	10625	10705	10785	10865	10945
Setpoint/ Enable OK	10226	10306	10386	10466	10546	10626	10706	10786	10866	10946
Hand Operation	10233	10313	10393	10473	10553	10633	10713	10793	10873	10953

4 Modbus

1x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Low Flame Hold	10234	10314	10394	10474	10554	10634	10714	10794	10874	10954
MM Comms Bus Driver	10239	10319	10399	10479	10559	10639	10719	10799	10879	10959
Input 88 Status	10240	10320	10400	10480	10560	10640	10720	10800	10880	10960
Lead Boiler Status	10241	10321	10401	10481	10561	10641	10721	10801	10881	10961
Disabled Status	10242	10322	10402	10482	10562	10642	10722	10802	10882	10962
Slave burner left/ right	10249	10329	10409	10489	10569	10649	10729	10809	10889	10969
Online/ Offline Status	11793	11794	11795	11796	11797	11798	11799	11800	11801	11802
Water Level: 0/1	12001	12201	12401	12601	12801	13001	13201	13401	13601	13801
Imperial (0) or Metric (1)	12002	12202	12402	12602	12802	13002	13202	13402	13602	13802
Feedwater Pump: Off/On	12003	12203	12403	12603	12803	13003	13203	13403	13603	13803
TDS: ppm (0), μ Siemens (1)	12004	12204	12404	12604	12804	13004	13204	13404	13604	13804
WL Ready: No (0), Yes (1)	12005	12205	12405	12605	12805	13005	13205	13405	13605	13805
TDS: No (0), Yes (1)	12006	12206	12406	12606	12806	13006	13206	13406	13606	13806
FO1: Normal (0), Fail (1)	12007	12207	12407	12607	12807	13007	13207	13407	13607	13807
FO2: Normal (0), Fail (1)	12008	12208	12408	12608	12808	13008	13208	13408	13608	13808
FO3: Normal (0), Fail (1)	12009	12209	12409	12609	12809	13009	13209	13409	13609	13809
FO4: Normal (0), Fail (1)	12010	12210	12410	12610	12810	13010	13210	13410	13610	13810
FO5: Normal (0), Fail (1)	12011	12211	12411	12611	12811	13011	13211	13411	13611	13811
FO6: Normal (0), Fail (1)	12012	12212	12412	12612	12812	13012	13212	13412	13612	13812
FO7: Normal (0), Fail (1)	12013	12213	12413	12613	12813	13013	13213	13413	13613	13813
FO8: Normal (0), Fail (1)	12014	12214	12414	12614	12814	13014	13214	13414	13614	13814
FO9: Normal (0), Fail (1)	12015	12215	12415	12615	12815	13015	13215	13415	13615	13815
FO10: Normal (0), Fail (1)	12016	12216	12416	12616	12816	13016	13216	13416	13616	13816
FO11: Normal (0), Fail (1)	12017	12217	12417	12617	12817	13017	13217	13417	13617	13817
FO12: Normal (0), Fail (1)	12018	12218	12418	12618	12818	13018	13218	13418	13618	13818
FO13: Normal (0), Fail (1)	12019	12219	12419	12619	12819	13019	13219	13419	13619	13819
FO14: Normal (0), Fail (1)	12020	12220	12420	12620	12820	13020	13220	13420	13620	13820
FO15: Normal (0), Fail (1)	12021	12221	12421	12621	12821	13021	13221	13421	13621	13821

4 Modbus

The 3x addresses are analogue inputs ready only addresses, which will give a number from a range. Refer to section 4.5.2 for relevance of these addresses.

For example, if Modbus address 30160 outputs 42.1, this means that the channel 2 servomotor is at 42.1°.

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Firing Rate %	30101	30151	30201	30251	30301	30351	30401	30451	30501	30551
Startup/ Firing Status	30102	30152	30202	30252	30302	30352	30402	30452	30502	30552
Sequence Status	30103	30153	30203	30253	30303	30353	30403	30453	30503	30553
Burner Rating	30104	30154	30204	30254	30304	30354	30404	30454	30504	30554
Actual Value	30105	30155	30205	30255	30305	30355	30405	30455	30505	30555
Required Value	30106	30156	30206	30256	30306	30356	30406	30456	30506	30556
Fuel Selected	30107	30157	30207	30257	30307	30357	30407	30457	30507	30557
Number of Channels	30108	30158	30208	30258	30308	30358	30408	30458	30508	30558
Channel 1 Position	30109	30159	30209	30259	30309	30359	30409	30459	30509	30559
Channel 2 Position	30110	30160	30210	30260	30310	30360	30410	30460	30510	30560
Channel 3 Position	30111	30161	30211	30261	30311	30361	30411	30461	30511	30561
Channel 4 Position	30112	30162	30212	30262	30312	30362	30412	30462	30512	30562
MM Error Number	30113	30163	30213	30263	30313	30363	30413	30463	30513	30563
Single/ Twin Operation	30114	30164	30214	30264	30314	30364	30414	30464	30514	30564
Run O2	30115	30165	30215	30265	30315	30365	30415	30465	30515	30565
Run CO2	30116	30166	30216	30266	30316	30366	30416	30466	30516	30566
Run CO	30117	30167	30217	30267	30317	30367	30417	30467	30517	30567
Run Exhaust Temperature	30118	30168	30218	30268	30318	30368	30418	30468	30518	30568
Run Efficiency	30119	30169	30219	30269	30319	30369	30419	30469	30519	30569
Run NO	30120	30170	30220	30270	30320	30370	30420	30470	30520	30570
Run SO2	30121	30171	30221	30271	30321	30371	30421	30471	30521	30571
Comm. O2	30122	30172	30222	30272	30322	30372	30422	30472	30522	30572
Comm. CO2	30123	30173	30223	30273	30323	30373	30423	30473	30523	30573
Comm. CO	30124	30174	30224	30274	30324	30374	30424	30474	30524	30574

4 Modbus

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Comm. Exhaust Temp.	30125	30175	30225	30275	30325	30375	30425	30475	30525	30575
Comm. Efficiency	30126	30176	30226	30276	30326	30376	30426	30476	30526	30576
Comm. NO	30127	30177	30227	30277	30327	30377	30427	30477	30527	30577
Comm. SO2	30128	30178	30228	30278	30328	30378	30428	30478	30528	30578
EGA Error Number	30129	30179	30229	30279	30329	30379	30429	30479	30529	30579
Min. Required Value	30130	30180	30230	30280	30330	30380	30430	30480	30530	30580
Max. Required Value	30131	30181	30231	30281	30331	30381	30431	30481	30531	30581
Present Flow Units	30132	30182	30232	30282	30332	30382	30432	30482	30532	30582
Present Flow Thousands	30133	30183	30233	30283	30333	30383	30433	30483	30533	30583
Fuel 1 Flow Total Units	30134	30184	30234	30284	30334	30384	30434	30484	30534	30584
Fuel 1 Flow Total 1000s	30135	30185	30235	30285	30335	30385	30435	30485	30535	30585
Fuel 1 Flow Total Millions	30136	30186	30236	30286	30336	30386	30436	30486	30536	30586
Fuel 2 Flow Total Units	30137	30187	30237	30287	30337	30387	30437	30487	30537	30587
Fuel 2 Flow Total 1000s	30138	30188	30238	30288	30338	30388	30438	30488	30538	30588
Fuel 2 Flow Millions	30139	30189	30239	30289	30339	30389	30439	30489	30539	30589
Fuel 3 Flow Units	30140	30190	30240	30290	30340	30390	30440	30490	30540	30590
Fuel 3 Flow Total 1000s	30141	30191	30241	30291	30341	30391	30441	30491	30541	30591
Fuel 3 Flow Total Millions	30142	30192	30242	30292	30342	30392	30442	30492	30542	30592
Run Ambient Temp.	30143	30193	30243	30293	30343	30393	30443	30493	30543	30593
Run Delta Temp.	30144	30194	30244	30294	30344	30394	30444	30494	30544	30594
Comm. Ambient Temp	30145	30195	30245	30295	30345	30395	30445	30495	30545	30595
Comm. Delta Temp.	30146	30196	30246	30296	30346	30396	30446	30496	30546	30596
Fuel 4 Flow Units	30801	30851	30901	30951	31001	31051	31101	31151	31201	31251
Fuel 4 Flow Total 1000s	30802	30852	30902	30952	31002	31052	31102	31152	31202	31252
Fuel 4 Flow Total Millions	30803	30853	30903	30953	31003	31053	31103	31153	31203	31253
Ch5 Output 0-255	30804	30854	30904	30954	31004	31054	31104	31154	31204	31254
Ch5 Input 0-255	30805	30855	30905	30955	31005	31055	31105	31155	31205	31255
Ch6 Output 0-255	30806	30856	30906	30956	31006	31056	31106	31156	31206	31256

4 Modbus

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Ch6 Input 0-255	30807	30857	30907	30957	31007	31057	31107	31157	31207	31257
Option 1	30808	30858	30908	30958	31008	31058	31108	31158	31208	31258
Option 77	30809	30859	30909	30959	31009	31059	31109	31159	31209	31259
Option 90	30810	30860	30910	30960	31010	31060	31110	31160	31210	31260
Option 91	30811	30861	30911	30961	31011	31061	31111	31161	31211	31261
Option 92	30812	30862	30912	30962	31012	31062	31112	31162	31212	31262
Option 93	30813	30863	30913	30963	31013	31063	31113	31163	31213	31263
Option 94	30814	30864	30914	30964	31014	30164	31114	31164	31214	31264
Option 95	30815	30865	30915	30965	31015	30165	31115	31165	31215	31265
Option 96	30816	30866	30916	30966	31016	30166	31116	31166	31216	31266
Option 97	30817	30867	30917	30967	31017	30167	31117	31167	31217	31267
Option 98	30818	30868	30918	30968	31018	30168	31118	31168	31218	31268
Option 99	30819	30869	30919	30969	31019	30169	31119	31169	31219	31269
Option 100	30820	30870	30920	30970	31020	30170	31120	31170	31220	31270
Option 101	30821	30871	30921	30971	31021	30171	31121	31171	31221	31271
Option 102	30822	30872	30922	30972	31022	30172	31122	31172	31222	31272
Option 103	30823	30873	30923	30973	31023	30173	31123	31173	31223	31273
Option 104	30824	30874	30924	30974	31024	30174	31124	31174	31224	31274
Option 105	30825	30875	30925	30975	31025	30175	31125	31175	31225	31275
Option 107	30827	30877	30927	30977	31027	30177	31127	31177	31227	31277
Option 108	30828	30878	30928	30978	31028	30178	31128	31178	31228	31278
Option 109	30829	30879	30929	30979	31029	30179	31129	31179	31229	31279
Lockout Code	30830	30880	30930	30980	31030	30180	31130	31180	31230	31280
Option 71 fuel 1 type	30831	30881	30931	30981	31031	30181	31131	31181	31231	31281
Option 72 fuel 2 type	30832	30882	30932	30982	31032	30182	31132	31182	31232	31282
Option 73 fuel 3 type	30833	30883	30933	30983	31033	30183	31133	31183	31233	31283
Option 74 fuel 4 type	30834	30884	30934	30984	31034	30184	31134	31184	31234	31284
Option 61 fuel 1 flow units	30835	30885	30935	30985	31035	30185	31135	31185	31235	31285

4 Modbus

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Option 62 fuel 2 flow units	30836	30886	30936	30986	31036	30186	31136	31186	31236	31286
Option 63 fuel 3 flow units	30837	30887	30937	30987	31037	30187	31137	31187	31237	31287
Option 64 fuel 4 flow units	30838	30888	30938	30988	31038	30188	31138	31188	31238	31288
Fuel 1 hours run	30839	30889	30939	30989	31039	30189	31139	31189	31239	31289
Fuel 2 hours run	30840	30890	30940	30990	31040	30190	31140	31190	31240	31290
Fuel 3 hours run	30841	30891	30941	30991	31041	30191	31141	31191	31241	31291
Fuel 4 hours run	30842	30892	30942	30992	31042	30192	31142	31192	31242	31292
Fuel 1 start-ups	30843	30893	30943	30993	31043	30193	31143	31193	31243	31293
Fuel 2 start-ups	30844	30894	30944	30994	31044	30194	31144	31194	31244	31294
Fuel 3 start-ups	30845	30895	30945	30995	31045	30195	31145	31195	31245	31295
Fuel 4 start-ups	30846	30896	30946	30996	31046	30196	31146	31196	31246	31296
Air pressure	30847	30897	30947	30997	31047	30197	31147	31197	31247	31297
Air pressure coding	30848	30898	30948	30998	31048	30198	31148	31198	31248	31298
Gas pressure	30849	30899	30949	30999	31049	30199	31149	31199	31249	31299
Gas pressure coding	30850	30890	30950	31000	31050	30200	31150	31200	31250	31300
MM Error (via D.T.I.)	31301	31302	31303	31304	31305	31306	31307	31308	31309	31310
Lockout (via D.T.I.)	31311	31312	31313	31314	31315	31316	31317	31318	31319	31320
Probe 1 Signal	32001	32101	32201	32301	32401	32501	32601	32701	32801	32901
Probe 1 Reference	32002	32102	32202	32302	32402	32502	32602	32702	32802	32902
Probe 1 Vers/ Iss (ms/ls byte)	32004	32104	32204	32304	32404	32504	32604	32704	32804	32904
Probe 2 Signal	32005	32105	32205	32305	32405	32505	32605	32705	32805	32905
Probe 2 Reference	32006	32106	32206	32306	32406	32506	32606	32706	32806	32906
Probe 2 Vers/ Iss (ms/ls byte)	32008	32108	32208	32308	32408	32508	32608	32708	32808	32908
Alarm Status	32009	32109	32209	32309	32409	32509	32609	32709	32809	32909
Level Status	32010	32110	32210	32310	32410	32510	32610	32710	32810	32910
WL Vers/Issue (ms/ls byte)	32011	32111	32211	32311	32411	32511	32611	32711	32811	32911
Alarm Code	32012	32112	32212	32312	32412	32512	32612	32712	32812	32912
Steam Temp Deg.C	32014	32114	32214	32314	32414	32514	32614	32714	32814	32914

4 Modbus

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Feedwater Temp Deg.C	32015	32115	32215	32315	32415	32515	32615	32715	32815	32915
Steam rate lb/hr	32016	32116	32216	32316	32416	32516	32616	32716	32816	32916
Heat to steam Btus/lb	32017	32117	32217	32317	32417	32517	32617	32717	32817	32917
Control element %	32018	32118	32218	32318	32418	32518	32618	32718	32818	32918
Control point raised	32020	32120	32220	32320	32420	32520	32620	32720	32820	32920
FO CRC	32022	32122	32222	32322	32422	32522	32622	32722	32822	32922
Total steam lbs (ls word)	32023	32123	32223	32323	32423	32523	32623	32723	32823	32923
Total steam lbs (ms word)	32024	32124	32224	32324	32424	32524	32624	32724	32824	32924
Steam Temp Deg.F	32025	32125	32225	32325	32425	32525	32625	32725	32825	32925
Feedwater Temp Deg.F	32026	32126	32226	32326	32426	32526	32626	32726	32826	32926
Steam rate kgs/hr	32027	32127	32227	32327	32427	32527	32627	32727	32827	32927
Heat to steam KJ/kg	32028	32128	32228	32328	32428	32528	32628	32728	32828	32928
Total steam kgs (ls word)	32029	32129	32229	32329	32429	32529	32629	32729	32829	32929
Total steam kgs (ms word)	32030	32130	32230	32330	32430	32530	32630	32730	32830	32930
Probe 1 Temp Deg.C	32031	32131	32231	32331	32431	32531	32631	32731	32831	32931
Probe 2 Temp Deg.C	32032	32132	32232	32332	32432	32532	32632	32732	32832	32932
Probe 1 Temp Deg.F	32033	32133	32233	32333	32433	32533	32633	32733	32833	32933
Probe 2 Temp Deg.F	32034	32134	32234	32334	32434	32534	32634	32734	32834	32934
Max firing rate %	32035	32135	32235	32335	32435	32535	32635	32735	32835	32935
Min firing rate %	32036	32136	32236	32336	32436	32536	32636	32736	32836	32936
Coldstart status: 0/1	32037	32137	32237	32337	32437	32537	32637	32737	32837	32937
Probe 1 working	32038	32138	32238	32338	32438	32538	32638	32738	32838	32938
Probe 2 working	32039	32139	32239	32339	32439	32539	32639	32739	32839	32939
TDS target	32040	32140	32240	32340	32440	32540	32640	32740	32840	32940
TDS measured	32041	32141	32241	32341	32441	32541	32641	32741	32841	32941
WL commdata CRC	32042	32142	32242	32342	32442	32542	32642	32742	32842	32942
WL control type	32043	32143	32243	32343	32443	32543	32643	32743	32843	32943
TDS Valve Angle	32044	32144	32244	32344	32444	32544	32644	32744	32844	32944

4 Modbus

3x Read	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Draft Servo Angle	32045	32145	32245	32345	32445	32545	32645	32745	32945	32945
Draft Actual* Pressure	32046	32146	32246	32346	32446	32546	32646	32746	32946	32946
Draft Com* Pressure	32047	32147	32247	32347	32447	32547	32647	32747	32947	32947
Next BBD Time (HHMM)	32048	32148	32248	32348	32448	32548	32648	32748	32948	32948
Heat Flow	32049	32149	32249	32349	32449	32549	32649	32749	32949	32949
Water Flow	32050	32150	32250	32350	32450	32550	32650	32750	32950	32950

*The draft actual and commissioned pressure values are displayed as the active pressure units.

4.2 E.G.A. Read Addresses

The Modbus addresses in this section are used when a standalone E.G.A. communicates a D.T.I.

The 1x E.G.A. Read addresses give digital inputs. Refer to section 4.5.1 for relevance of these addresses. For example if Modbus address 11002 reads 1, then E.G.A. with ID 1 has an NO cell optioned. The E.G.A ID read addresses are used for a standalone E.G.A. with a D.T.I.

1x Read	E.G.A. ID									
	1	2	3	4	5	6	7	8	9	10
Air Cal. in Progress	10993	11009	11025	11041	11057	11073	11089	11105	11121	11137
Gas Cal. in Progress	10994	11010	11026	11042	11058	11074	11090	11106	11122	11138
Cooler Ready	10995	11011	11027	11043	11059	11075	11091	11107	11123	11139
Ambient Temp OK	10996	11012	11028	11044	11060	11076	11092	11108	11124	11140
Ambient Temp HIGH	10997	11013	11029	11045	11061	11077	11093	11109	11125	11141
Ambient Temp LOW	10998	11014	11030	11046	11062	11078	11094	11110	11126	11142
EGA Ready	11000	11016	11032	11048	11064	11080	11096	11112	11128	11144
CO Optioned	11001	11017	11033	11049	11065	11081	11097	11113	11129	11145
NO Optioned	11002	11018	11034	11050	11066	11082	11098	11114	11130	11146
SO2 Optioned	11003	11019	11035	11051	11067	11083	11099	11115	11131	11147
Deg C (0) or Deg F (1)	11004	11020	11036	11052	11068	11084	11100	11116	11132	11148
Sampling Optioned	11005	11021	11037	11053	11069	11085	11101	11117	11133	11149
2 nd Thermocouple	11006	11022	11038	11054	11070	11086	11102	11118	11134	11150
Voltage Input Optioned	11007	11023	11039	11055	11071	11087	11103	11119	11135	11151
Online/Offline Status	11809	11810	11811	11812	11813	11814	11815	11816	11817	11818

4 Modbus

The 2x Read addresses give analogue inputs. Refer to section 4.5.2 for relevance of these addresses. For example if Modbus address 30602 outputs reads as 2.0 then E.G.A. ID 1 has online O₂ value of 2%.

3x Read	E.G.A. ID									
	1	2	3	4	5	6	7	8	9	10
Fuel Selected	30601	30621	30641	30661	30681	30701	30721	30741	30761	30781
% O ₂	30602	30622	30642	30662	30682	30702	30722	30742	30762	30782
% CO ₂	30603	30623	30643	30663	30683	30703	30723	30743	30763	30783
CO ppm	30604	30624	30644	30664	30684	30704	30724	30744	30764	30784
NO ppm	30605	30625	30645	30665	30685	30705	30725	30745	30765	30785
SO ₂ ppm	30606	30626	30646	30666	30686	30706	30726	30746	30766	30786
Exhaust Temperature	30607	30627	30647	30667	30687	30707	30727	30747	30767	30787
Efficiency	30608	30628	30648	30668	30688	30708	30728	30748	30768	30788
Error number	30609	30629	30649	30669	30689	30709	30729	30749	30769	30789
% Voltage input	30610	30630	30650	30670	30690	30710	30730	30750	30770	30790
Delta Temperature	30611	30631	30651	30671	30691	30711	30731	30751	30771	30791
Ambient Temperature	30612	30632	30652	30672	30692	30712	30732	30752	30772	30792
Auxiliary Temperature	30613	30633	30653	30673	30693	30713	30733	30753	30773	30793
Service LEDs	30614	30634	30654	30674	30694	30714	30734	30754	30774	30794

4.3 Input/ Output Modules Read Addresses

The 1 x Read addresses are digital inputs.

	Digital I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Input 1	10001	10017	10033	10049	10065	10081	10097	10113	10129	10145
Input 2	10002	10018	10034	10050	10066	10082	10098	10114	10130	10146
Input 3	10003	10019	10035	10051	10067	10083	10099	10115	10131	10147
Input 4	10004	10020	10036	10052	10068	10084	10100	10116	10132	10148
Input 5	10005	10021	10037	10053	10069	10085	10101	10117	10133	10149
Input 6	10006	10022	10038	10054	10070	10086	10102	10118	10134	10150
Input 7	10007	10023	10039	10055	10071	10087	10103	10119	10135	10151
Input 8	10008	10024	10040	10056	10072	10088	10104	10120	10136	10152
Input 9	10009	10025	10041	10057	10073	10089	10105	10121	10137	10153
Input 10	10010	10026	10042	10058	10074	10090	10106	10122	10138	10154
Input 11	10011	10027	10043	10059	10075	10091	10107	10123	10139	10155
Input 12	10012	10028	10044	10060	10076	10092	10108	10124	10140	10156
Input 13	10013	10029	10045	10061	10077	10093	10109	10125	10141	10157
Input 14	10014	10030	10046	10062	10078	10094	10110	10126	10142	10158
Input 15	10015	10031	10047	10063	10079	10095	10111	10127	10143	10159
Input 16	10016	10032	10048	10064	10080	10096	10112	10128	10144	10160
Online/ Offline Status	11825	11826	11827	11828	11829	11830	11831	11832	11833	11834

	Analogue I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Online/ Offline Status	11841	11842	11843	11844	11845	11846	11847	11848	11849	11850

	Analogue I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Input 1	30017	30025	30033	30041	30049	30057	30065	30073	30081	30089
Input 2	30018	30026	30034	30042	30050	30058	30066	30074	30082	30090
Input 3	30019	30027	30035	30043	30051	30059	30067	30075	30083	30091
Input 4	30020	30028	30036	30044	30052	30060	30068	30076	30084	30092

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	Analogue I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Input 5	30021	30029	30037	30045	30053	30061	30069	30077	30085	30093
Input 6	30022	30030	30038	30046	30054	30062	30070	30078	30086	30094

Analogue I/O Module ID		Channel ID					
		1	2	3	4	5	6
1	Byte 7/6	31324	31328	31332	31336	31340	31344
	Byte 5/4	31323	31327	31331	31335	31339	31343
	Byte 3/2	31322	31326	31330	31334	31338	31342
	Byte 1/0	31321	31325	31329	31333	31337	31341
2	Byte 7/6	31348	31352	31356	31360	31364	31368
	Byte 5/4	31347	31351	31355	31359	31363	31367
	Byte 3/2	31346	31350	31354	31358	31362	31366
	Byte 1/0	31345	31349	31353	31357	31361	31365
3	Byte 7/6	31372	31376	31380	31384	31388	31392
	Byte 5/4	31371	31375	31379	31383	31387	31391
	Byte 3/2	31370	31374	31378	31382	31386	31390
	Byte 1/0	31369	31373	31377	31381	31385	31389
4	Byte 7/6	31396	31400	31404	31408	31412	31416
	Byte 5/4	31395	31399	31403	31407	31411	31415
	Byte 3/2	31394	31398	31402	31406	31410	31414
	Byte 1/0	31393	31397	31401	31405	31409	31413
5	Byte 7/6	31420	31424	31428	31432	31436	31440
	Byte 5/4	31419	31423	31427	31431	31435	31439
	Byte 3/2	31418	31422	31426	31430	31434	31438
	Byte 1/0	31417	31421	31425	31429	31433	31437
6	Byte 7/6	31444	31448	31452	31456	31460	31464
	Byte 5/4	31443	31447	31451	31455	31459	31463
	Byte 3/2	31442	31446	31450	31454	31458	31462
	Byte 1/0	31441	31445	31449	31453	31457	31461

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Analogue I/O Module ID		Channel ID					
		1	2	3	4	5	6
7	Byte 7/6	31468	31472	31476	31480	31484	31488
	Byte 5/4	31467	31471	31475	31479	31483	31487
	Byte 3/2	31466	31470	31474	31478	31482	31486
	Byte 1/0	31465	31469	31473	31477	31481	31485
8	Byte 7/6	31492	31496	31500	31504	31508	31512
	Byte 5/4	31491	31495	31499	31503	31507	31511
	Byte 3/2	31490	31494	31498	31502	31506	31510
	Byte 1/0	31489	31493	31497	31501	31505	31509
9	Byte 7/6	31516	31520	31524	31528	31532	31536
	Byte 5/4	31515	31519	31523	31527	31531	31535
	Byte 3/2	31514	31518	31522	31526	31530	31534
	Byte 1/0	31513	31517	31521	31525	31529	31533
10	Byte 7/6	31540	31544	31548	31552	31556	31560
	Byte 5/4	31539	31543	31547	31551	31555	31559
	Byte 3/2	31538	31542	31546	31550	31554	31558
	Byte 1/0	31537	31541	31545	31549	31553	31557

4.4 Read/Write Addresses

4.4.1 M.M. Read/Write Addresses

These Modbus addresses can be used to remotely control the M.M.s

	M.M. ID									
	1	2	3	4	5	6	7	8	9	10
Enable/ Disable	00001	00002	00003	00004	00005	00006	00007	00008	00009	00010
Individual Setpoint	40001	40002	40003	40004	40005	40006	40007	40008	40009	40010
Global Setpoint	40011									
Lead Boiler Selection	40012									
Firing Rate On/ Off	40131	40132	40133	40134	40135	40136	40137	40138	40139	40140
Firing Rate Value	40121	40122	40123	40124	40125	40126	40127	40128	40129	40130

4.4.2 Analogue and Digital I/O Read/Write Addresses

	Digital I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Output 1	00017	00025	00033	00041	00049	00057	00065	00073	00081	00089
Output 2	00018	00026	00034	00042	00050	00058	00066	00074	00082	00090
Output 3	00019	00027	00035	00043	00051	00059	00067	00075	00083	00091
Output 4	00020	00028	00036	00044	00052	00060	00068	00076	00084	00092
Output 5	00021	00029	00037	00045	00053	00061	00069	00077	00085	00093
Output 6	00022	00030	00038	00046	00054	00062	00070	00078	00086	00094
Output 7	00023	00031	00039	00047	00055	00063	00071	00079	00087	00095
Output 8	00024	00032	00040	00048	00056	00064	00072	00080	00088	00096

	Analogue I/O Module ID									
	1	2	3	4	5	6	7	8	9	10
Output 1	40017	40025	40033	40041	40049	40057	40065	40073	40081	40089
Output 2	40018	40026	40034	40042	40050	40058	40066	40074	40082	40090
Output 3	40019	40027	40035	40043	40051	40059	40067	40075	40083	40091
Output 4	40020	40028	40036	40044	40052	40060	40068	40076	40084	40092
Output 5	40021	40029	40037	40045	40053	40061	40069	40077	40085	40093
Output 6	40022	40030	40038	40046	40054	40062	40070	40078	40086	40094

4.5 Information, Errors and Lockouts

Each M.M./ E.G.A. can provide the following information and updates the D.T.I. approximately once every 5-10 seconds.

4.5.1 Digital Inputs (1x Reference)

CR1 Relay Status	0	Off
	1	On
Boiler Temperature/ Pressure	0	Temperature
	1	Pressure
Flow Metering On	0	No
	1	Yes
CO off/on fuel 2 (fuel 1 CO always on)	0	Off
	1	On
Deg C or Deg F	0	Deg C
	1	Deg F
Bar or PSI	0	Bar
	1	PSI
External Voltage (modulation)	0	No
	1	Yes
EGA Optioned	0	No
	1	Yes
Actual to up to Trim Threshold	0	No
	1	Yes
Cooler Ready	0	No
	1	Yes
Ambient Temp OK	0	No
	1	Yes
NO Optioned	0	No
	1	Yes
SO2 Optioned	0	No
	1	Yes
EGA Ambient Temp Hi/ Lo	0	Low
	1	High
OK to Sample	0	No
	1	Yes
Sequencing Optioned	0	No
	1	Yes
Setpoint/ Enable commands accepted	0	No
	1	Yes
Hand Operation	0	Modulating
	1	Hand
Low Flame Hold	0	Modulating
	1	Low Flame Hold
MM Comms Bus Driver	0	No
	1	Yes
Input 88 Status	0	No
	1	Yes
Lead Boiler Status	0	Lag boiler
	1	Lead boiler
Disabled Status	0	Enabled
	1	Disabled

4.5.2 Analogue Inputs (3x References)

Firing Rate %	0 – 100	
Burner Rating	0 – 250	
Actual Value	Deg C/ Deg F/ PSI	0 – 999
	Bar	0.0 – 99.9
Required Value	Deg C/ Deg F/ PSI	0 – 999
	Bar	0.0 – 99.9
Fuel Selected	0 – Fuel 1 1 – Fuel 2 2 – Fuel 3	
Number of Channels	1 – 7 (add 1 to this to get total number)	
Channel 1 Position	-6.0 – 96.0 angular degrees	
Channel 2 Position	-6.0 – 96.0 angular degrees	
Channel 3 Position	-6.0 – 96.0 angular degrees	
Channel 4 Position	-6.0 – 96.0 angular degrees	
MM Error Number	0 – System is OK 1 – N System Shutdown	
Single/ Twin Operation	0 – Single burner 1 – Twin burner (both together only) 2 – Twin burner (both together/ one or the other)	
Run O2 %	0.0 – 25.5	
Run CO2 %	0.0 – 25.5	
Run CO ppm	0 – 999	
Run Exhaust Temp	0 – 999	
Run Efficiency %	0.0 – 99.9	
Run NO ppm	0 – 999	
Run SO2 ppm	0 – 999	
Comm. O2 %	0.0 – 25.5	
Comm. CO2 %	0.0 – 25.5	
Comm. CO ppm	0 – 999	
Comm. Exhaust Temp	0 – 999	
Comm. Efficiency	0.0 – 99.9	
Comm. NO ppm	0 – 999	
Comm. SO2 ppm	0 – 999	
EGA Error	0 – Normal N – Any other value indicates an error	
Min Required Value	Deg C/ Deg F/ PSI	0 – 999
	Bar	0.0 – 99.9
Max Required Value	Deg C/ Deg F/ PSI	0 – 999
	Bar	0.0 – 99.9
Present Flow Units	0 – 999	
Present Flow Thousands	0 – 999 (multiple value by 1000, add units value, divide by 100)	
Fuel 1 Flow Total Units	0 – 999	
Fuel 1 Flow Total 1000s	0 – 999	
Fuel 1 Flow Total Millions	0 – 999	
Fuel 2 Flow Total Units	0 – 999	
Fuel 2 Flow Total 1000s	0 – 999	
Fuel 2 Flow Total Millions	0 – 999	
Fuel 3 Flow Total Units	0 – 999	
Fuel 3 Flow Total 1000s	0 – 999	
Fuel 3 Flow Total Millions	0 – 999	
Fuel 4 Flow Total Units	0 – 999	
Fuel 4 Flow Total 1000s	0 – 999	
Fuel 4 Flow Total Millions	0 – 999	

4.5.3 Error and Lockout Codes

Firing Status

The following table lists the start-up/firing status for the below Modbus addresses:

	MM ID									
	1	2	3	4	5	6	7	8	9	10
Start-up/ Firing Status	30102	30152	30202	30252	30302	30352	30402	30452	30502	30552

Code Explanation

19	Waiting for stat circuit to complete
20	Waiting for command to drive air damper to purge position
21	Driving air damper to purge position
22	Purging – Waiting for command to drive valves to ignition
23	Driving valves to ignition position
24	Ignition taking place
25	Burner firing and modulating
26	Post purge taking place

Sequence Status

The following table lists the sequencing status for the below Modbus addresses:

	MM ID									
	1	2	3	4	5	6	7	8	9	10
Sequence Status	30103	30153	30203	30253	30303	30353	30403	30453	30503	30553

Code Explanation

0	On
1	Standby
2	Warming
3	Off

MM Error Codes

The following table lists the error codes for the below Modbus addresses:

Error	MM ID									
	1	2	3	4	5	6	7	8	9	10
Direct	30113	30163	30213	30263	30313	30363	30413	30463	30513	30563
Via D.T.I.	31301	31302	31303	31304	31305	31306	31307	31308	31309	31310

The table below shows the MM error codes, please refer to the Installation and Commissioning or the End User Guides for the Mk7 M.M. or Mini Mk8 M.M.s to see a full description of the error.

Code	Mk7 M.M.	Mini Mk8 M.M.
1	Ch1 positioning error	Ch1 positioning error
2	Ch2 positioning error	Ch2 positioning error
3	Load detector	Ch3 positioning error
4	Software error	
5	PROM memory fault	Ch1 gain error

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Code	Mk7 M.M.	Mini Mk8 M.M.
6	Commission data fault	Ch2 gain error
7	RAM memory fault	Ch4 gain error
8	Ch3 positioning error	
9	Ch4 positioning error	Ch1 movement error
10		Ch2 movement error
11		Ch3 movement error
13		Analogue power supply error
14		Digital power supply error
15		EEProm error
16		ADC Error
17		Watchdog timeout
18		Processor clock error
19		System error
20		Flash data error
21		Processor temperature error
22		Burner control comms error
23		Burner control reset
24		Software error
25		Zero-crossing detection error
26		Mains input detection error
27		Load sensor error
28		VSD error
29		VSD no commission feedback
30		Missing commissioning data
31		FAR execution speed
32		Software error
33		Software error
34		Software error
35		Software error
36		VSD sampling error
37		VSD feedback too low
38		Air pressure commission fault
39		Gas pressure VPS commission fault
40	CR1 test failure	Gas pressure run commission fault
41	Ch1 gain error	Air pressure commission fault
42	Ch2 gain error	
43	Ch3 gain error	
44	5V supply error	
45	Watchdog – CR2 safety test failed	
46	Ch4 gain error	
47	A/D convertor	
80	Ch5 error	
81	Ch6 error	
82	Air pressure outside limits	
83	Ch5 feedback signal error	
84	Ch6 feedback signal error	
100	Twin burner comms failed	
110	Gas pressure sensor – wrong units optioned	
249	Incompatible WL EE-prom	
251	Water level probes detected but not configured	
252	Air Sensor Re-commission	
253	Gas Sensor Re-commission	

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Lockout Codes

The following table lists the lockout codes for the below Modbus addresses:

Lockout	MM ID									
	1	2	3	4	5	6	7	8	9	10
Direct	30830	30880	30930	30980	31030	31080	31130	31180	31230	31280
Via D.T.I.	31311	31312	31313	31314	31315	31316	31317	31318	31319	31320

The table below shows the lockout codes, please refer to the Installation and Commissioning or the End User Guides for the Mk7 M.M. or Mini Mk8 M.M.s to see a full description of the lockout.

Lockout	Mk7 M.M.	Mini Mk8 M.M.
1	CPI input wrong state	CPI input wrong state
2	No air proving	No air proving
3	Ignition output fault	Ignition output fault
4	Motor output fault	Motor output fault
5	Start gas output fault	Start gas output fault
6	Main gas output 1 fault	Main gas 1 output fault
7	Main gas output 2 fault	Main gas 2 output fault
8	Vent valve output fault	Vent valve output fault
9	Fail safe relay fault	Fail safe relay test
10	Simulated flame	Simulated flame
11	VPS air proving fail	VPS air proving fail
12	VPS gas proving fail	VPS gas proving fail
13	No flame signal	No flame signal
14	Shutter fault	Shutter fault
15	No CPI reset	No CPI reset
16	Lockout permanently active	
17	Gas pressure too low	Gas pressure low
18	Gas pressure too high	Gas pressure high
19	RAM test failed	RAM test failed
20	PROM test failed	PROM test failed
21	Watchdog fault 1a	FSR test 1A
22	Watchdog fault 1b	FSR test 2A
23	Watchdog fault 1c	FSR test 1B
24	Watchdog fault 1d	FSR test 3B
25	Watchdog fail 2a	
26	Watchdog fail 2b	Watchdog fail 2B
27	Watchdog fail 2c	
28	Watchdog fail 2d	Watchdog fail 2D
29	Input fault	Input fault
30	Gas sensor error	
31	Air sensor error	
32	Low gas pressure	Gas pressure low limit
33	VPS air zeroing fail	VPS air zeroing fail
34	VPS gas pressure low	
35	UV short circuit	
36	Oil pressure too low	
37	Oil pressure too high	
38	CPU test failed	

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Lockout	Mk7 M.M.	Mini Mk8 M.M.
39	Freeze timeout	Freeze timeout
40	Purge air pressure low	
41	Option 141 incorrect	
42	Terminal 86 inverse	
43	Terminal 85-86 fault	
44	Prove cct fail	
45	No prove cct set	
46	No prove cct reset	
47	Option 118 incorrect	Ion. internal failsafe fault
48		Ion. positive peak failsafe fault
49	High ambient IR	Ion. negative peak failsafe fault
50	IR comms timeout	Ionisation high ambient
51		Ionisation no flame
52		High IR ambient
53		IR comms lost
61	Gas sensor supply voltage	
62	Signal dev. – gas sensor	UV signal too high
63	Counts low – gas sensor	Purge limit switch
64	Counts high – gas sensor	Start limit switch
65	Signal high – gas sensor	FSR A
66		FSR B
67		Gas pressure sensor timeout
68		Wrong gas pressure sensor type
69		Gas pressure sensor fault
70	Air sensor supply voltage	UV SP1 comms failure
71	Signal dev. air sensor	Air pressure sensor timeout
72	Counts low – air sensor	Wrong air pressure sensor type
73	Counts high – air sensor	Air pressure bad value
74	Zero low – air sensor	Air pressure zero commissioned value wrong
75		Air pressure high
76	Signal high – air sensor	Air pressure out of window
77	Zero high – air sensor	Wait for air switch timeout
78		VPS gas input too high
198	BC input short	
199	UV scanner compensation fault	UV error
201	EEPROM checksum failure at power on	CPU PU fail
202	EEPROM has worn out	EEPROM fail

4.5.4 Water Level

The following lists show the various codes for the water level Modbus addresses:

WL control type	0 - Modulating Standard 1 - On/Off 2 - Modulating High High 3 - Modulating Pre 1 st Low/Pre High
Level status	0 - OK 1 - High water 2 - 1 st Low 3 - 2 nd Low 4 - High High Water 5 - Pre 1 st Low 6 - Pre High Water
Alarm code	0 - OK 1 - 2 nd Low 2 - Probe 1 comms 3 - Probe 2 comms 4 - Probe 1 short 5 - Probe 2 short 6 - Probe mismatch 7 - Probe 1 TC 8 - Probe 2 TC 9 - Permanent reset 10 - Permanent test 11 - Keystuck reset 12 - PU EEPROM 13 - PU bogus EE state 14 - Incompatible configuration 15 - Probe 1 bogus comm data 16 - Probe 2 bogus comm data 17 - Config range check fail 18 - 1 st Low 19 - High water 20 - Probe 1 still water 21 - Probe 2 still water 22 - Probes diverse 23 - Pre 1 st Low 24 - Pre high water

5 INTERACTING WITH THE MK7 D.T.I.

5.1 Burner Information

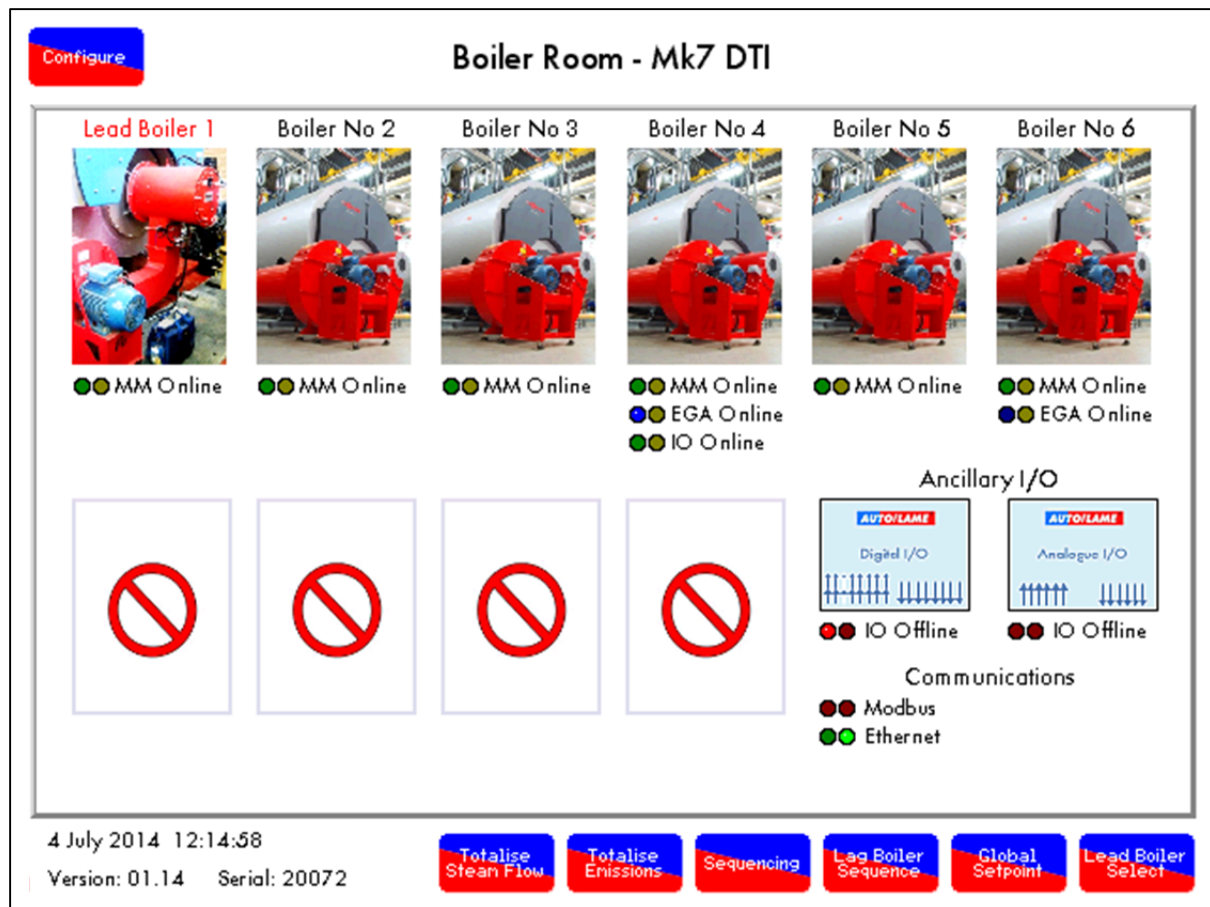


Figure 5.1.i Mk7 D.T.I. Home Screen

Once the D.T.I. has been successfully configured, it is possible to view the information on each of the M.M.s, E.G.A.s, Analogue and Digital Input/ Output Modules connected in the Autoflame system. By pressing on the boiler images, it is possible to display information on the M.M. units and the associated E.G.As. By pressing on the Ancillary I/O images, it is possible to see information on the connected I/O equipment from the boiler plant.

The D.T.I. home screen tells you the following information:

- Number of M.Ms
- E.G.A.s associated with the burners
- Analogue or Digital I/Os
- Status of M.Ms – online or offline
- Lead M.M.
- Status of E.G.A.s – online or offline
- Status of analogue and digital I/Os – online or offline
- Modbus comms status (remote connection)
- Ethernet comms status
- Date and time
- Software version

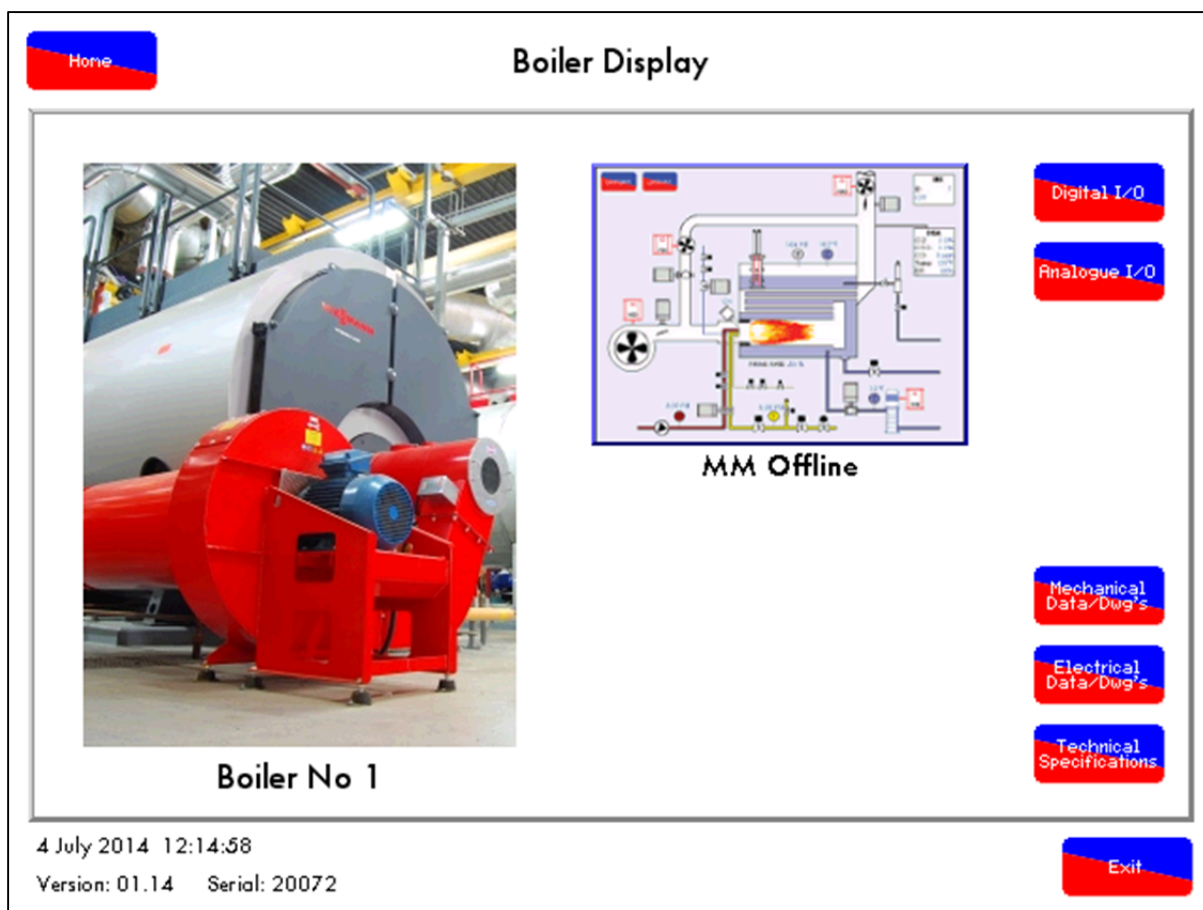


Figure 5.1.ii Select M.M. Screen

Pressing on the Digital I/O or the Analogue I/O will show the input and output information of the I/O associated with that boiler only. Pressing on the Mechanical Data Logs, Electrical Data Logs, or Technical Specifications will go to the screens showing all the additional bitmap files that were uploaded to the D.T.I via the CEMS PC Software (see PC Software Guide).

5.2 M.M. Display Screen

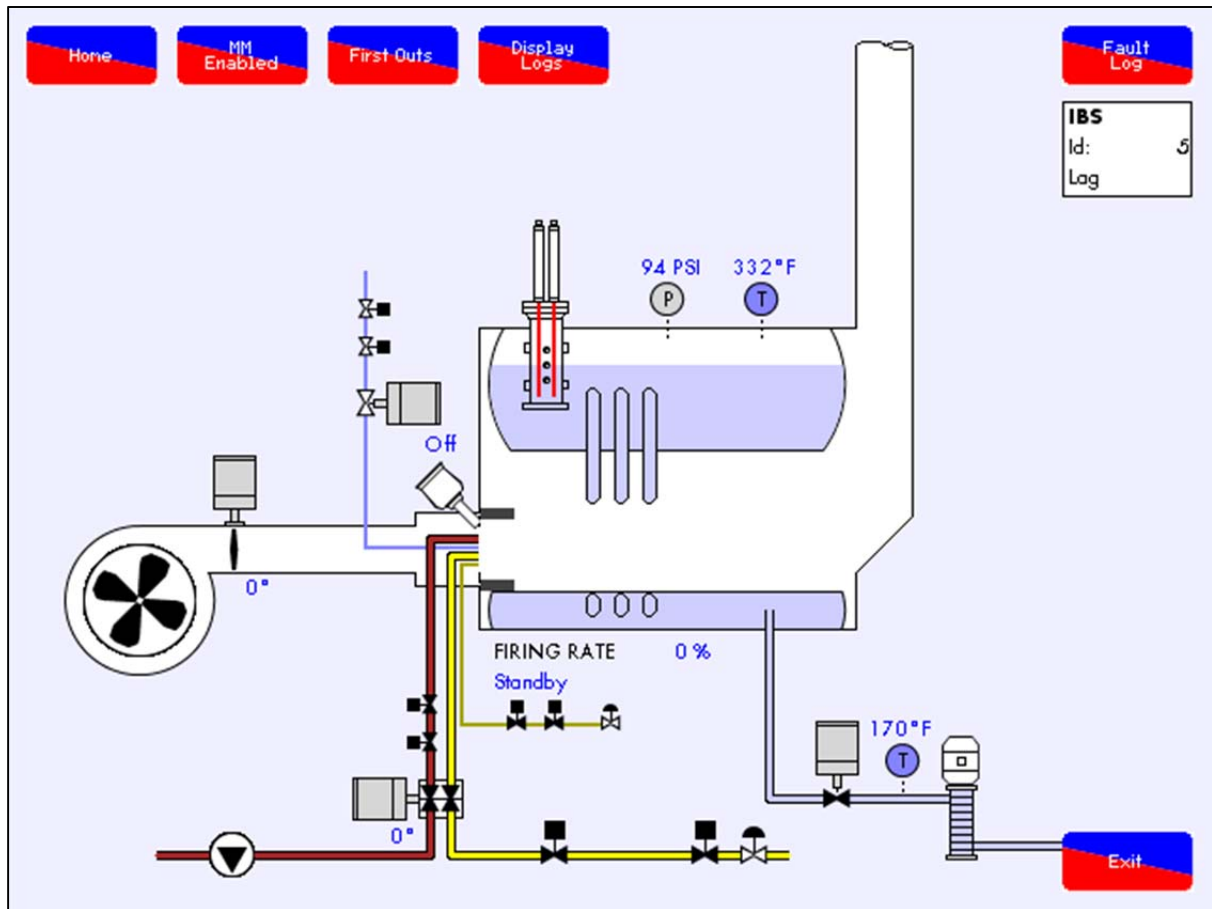


Figure 5.2.i M.M. Home Screen

Pressing on the M.Ms on the D.T.I. will bring up an emulation of the M.M. home screen. This home screen provides access to view information on the information logged just as on the M.M. screen.

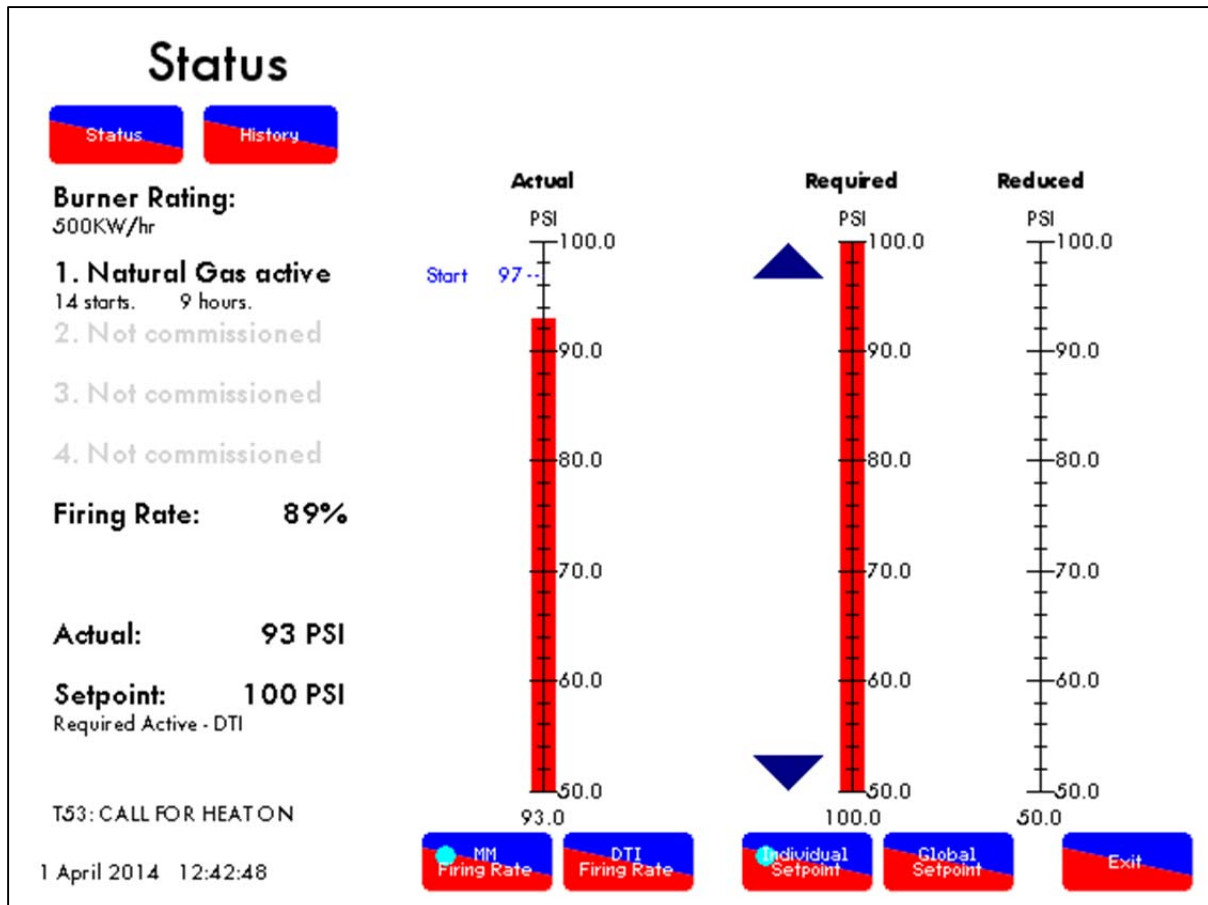


Figure 5.2.ii M.M. Setpoint Screen

Pressing on the flame will display the Setpoint screen, providing the following information:

1. Burner rating
2. Fuel selected
3. Firing rate
4. Actual temperature/ pressure
5. Required setpoint temperature/ pressure
6. Call for heat status
7. Reduced setpoint

On this screen you can change the M.M.'s firing rate, by pressing D.T.I. firing rate. If the M.M. has been set up so that the setpoint can be changed through the D.T.I, then by pressing the 'Individual Setpoint' you can change the setpoint for that M.M.

Note: M.M. Option 16 must be set to 2 or 3 for remote control. Also, the range within which the setpoint can be changed through the D.T.I. (check M.M. options 30 and 31 which set this range).

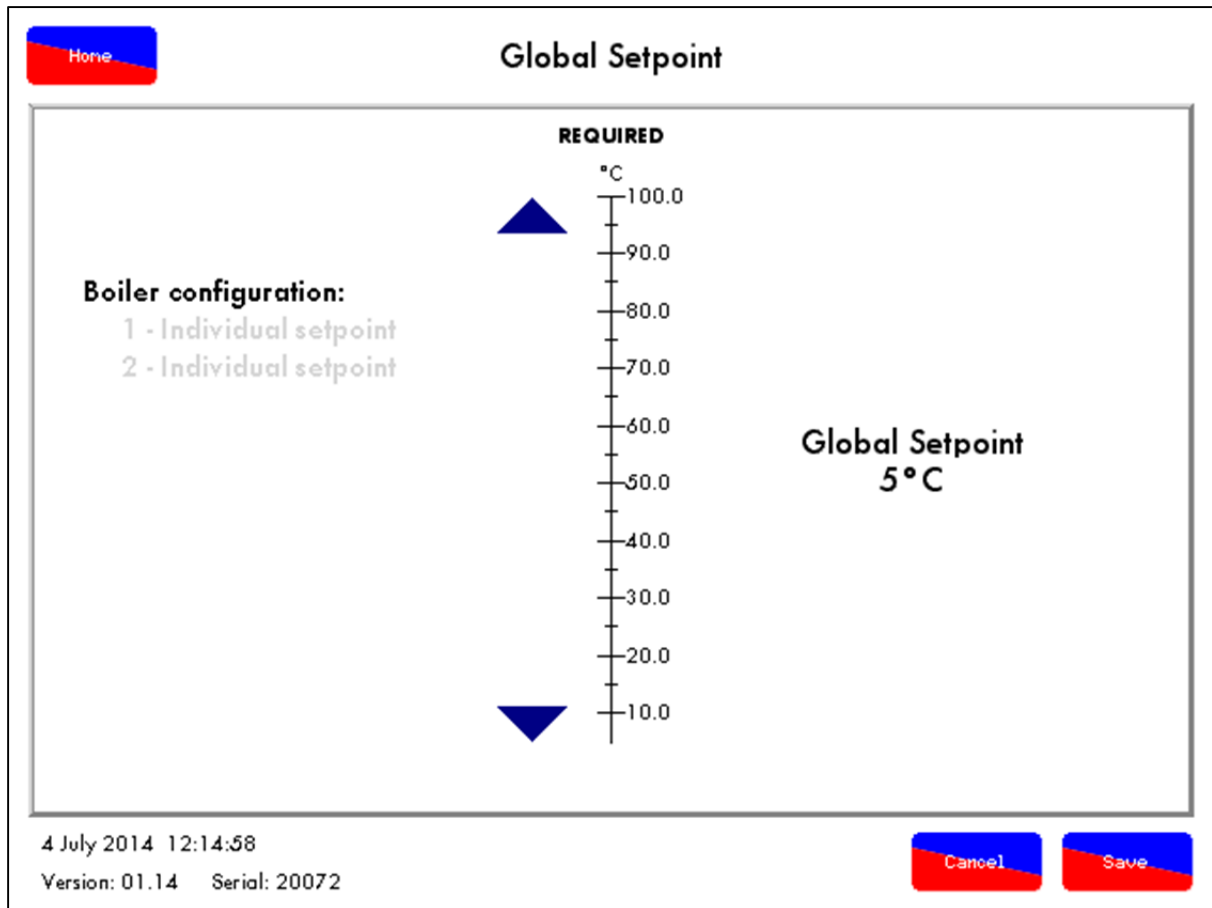
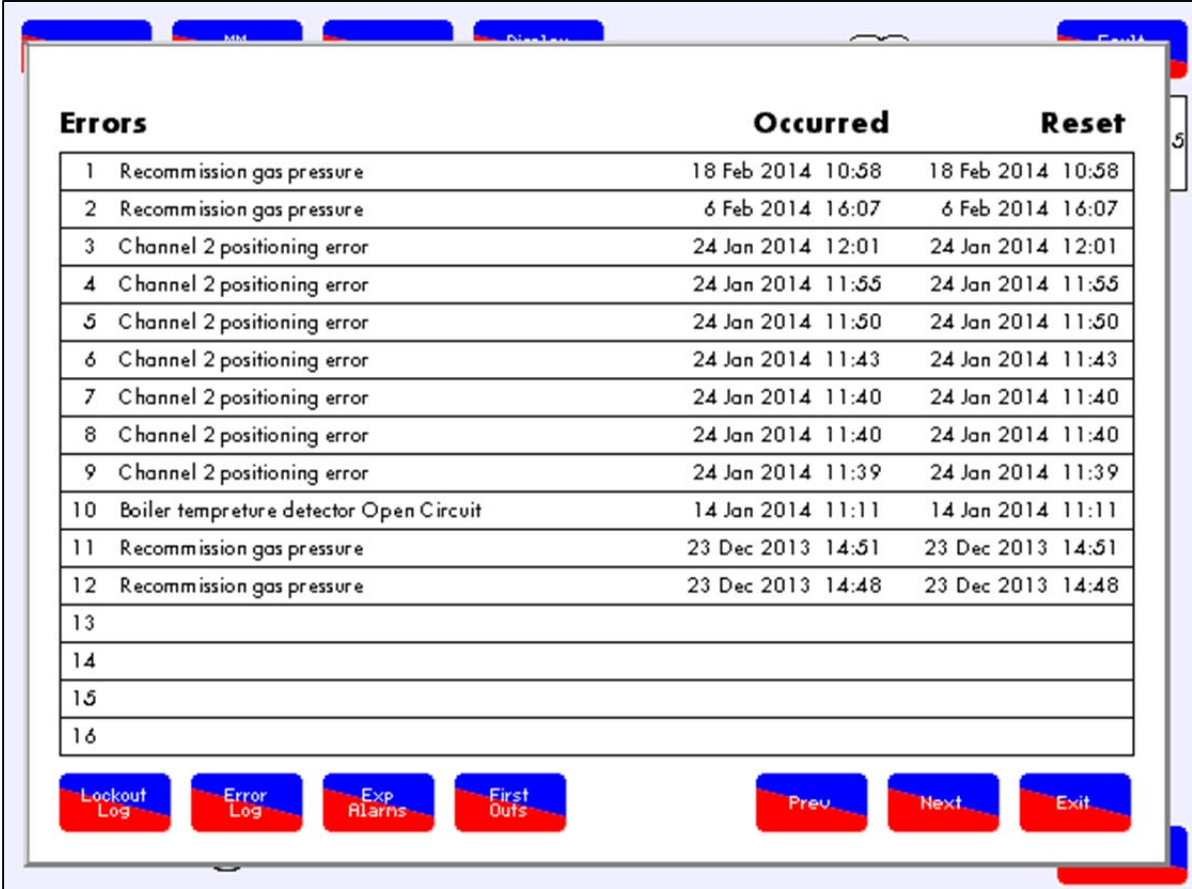


Figure 5.2.iii Global Setpoint Screen

To change the global setpoint i.e. on all the M.M.s in that sequence loop, the 'Global Setpoint' must button must be selected on each of the M.M.s. then go to the home screen and press on Global Setpoint to change it as you require.

Note: All the M.M.s in the sequence loop must have the same maximum and minimum D.T.I. setpoint range set through M.M. options 30 and 31.

5.3 Fault Logs



Errors	Occurred	Reset
1 Recommission gas pressure	18 Feb 2014 10:58	18 Feb 2014 10:58
2 Recommission gas pressure	6 Feb 2014 16:07	6 Feb 2014 16:07
3 Channel 2 positioning error	24 Jan 2014 12:01	24 Jan 2014 12:01
4 Channel 2 positioning error	24 Jan 2014 11:55	24 Jan 2014 11:55
5 Channel 2 positioning error	24 Jan 2014 11:50	24 Jan 2014 11:50
6 Channel 2 positioning error	24 Jan 2014 11:43	24 Jan 2014 11:43
7 Channel 2 positioning error	24 Jan 2014 11:40	24 Jan 2014 11:40
8 Channel 2 positioning error	24 Jan 2014 11:40	24 Jan 2014 11:40
9 Channel 2 positioning error	24 Jan 2014 11:39	24 Jan 2014 11:39
10 Boiler temperature detector Open Circuit	14 Jan 2014 11:11	14 Jan 2014 11:11
11 Recommission gas pressure	23 Dec 2013 14:51	23 Dec 2013 14:51
12 Recommission gas pressure	23 Dec 2013 14:48	23 Dec 2013 14:48
13		
14		
15		
16		

Navigation buttons: Lockout Log, Error Log, Exp Alarms, First Outs, Prev, Next, Exit.

Figure 5.3.i Errors Screen

Pressing on the 'Fault Logs' button will display the lockouts and errors as recorded by the D.T.I. from the M.M. There is a maximum of 100 that will be recorded for each of the burner lockouts, M.M. errors and expansion errors, while connected to the D.T.I. The fault history screen describes the faults with the phase, time and date it occurred, and also when it was reset.

5.4 M.M. I.B.S Screen

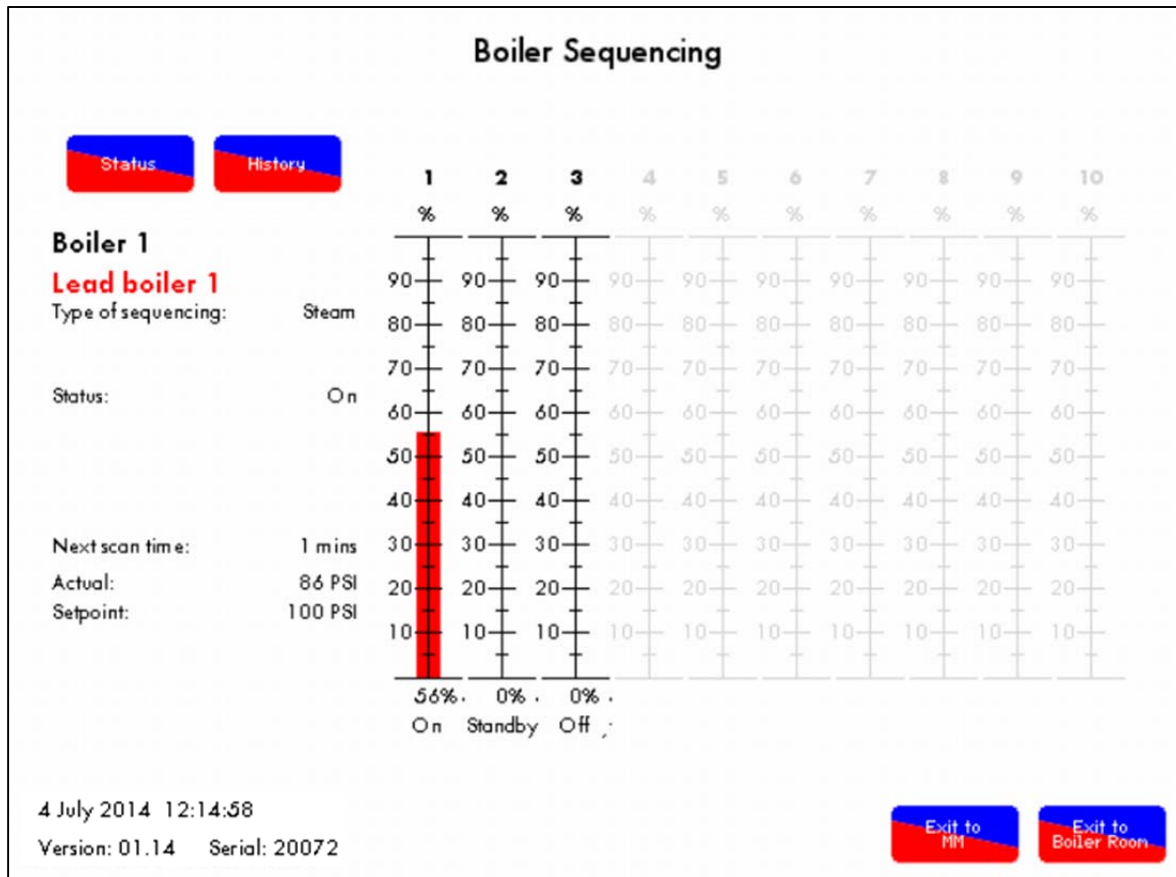


Figure 5.4.i Boiler Sequencing Screen

Pressing on the IBS box will emulate the sequencing screen shown on the M.M., showing which burner is in lead, and which ones are in lag, and their respective firing rates and status.

5.5 Display Logs

By pressing the Display Logs button, this will give access to the logged M.M. data such as the setpoint history and the servomotor position history.

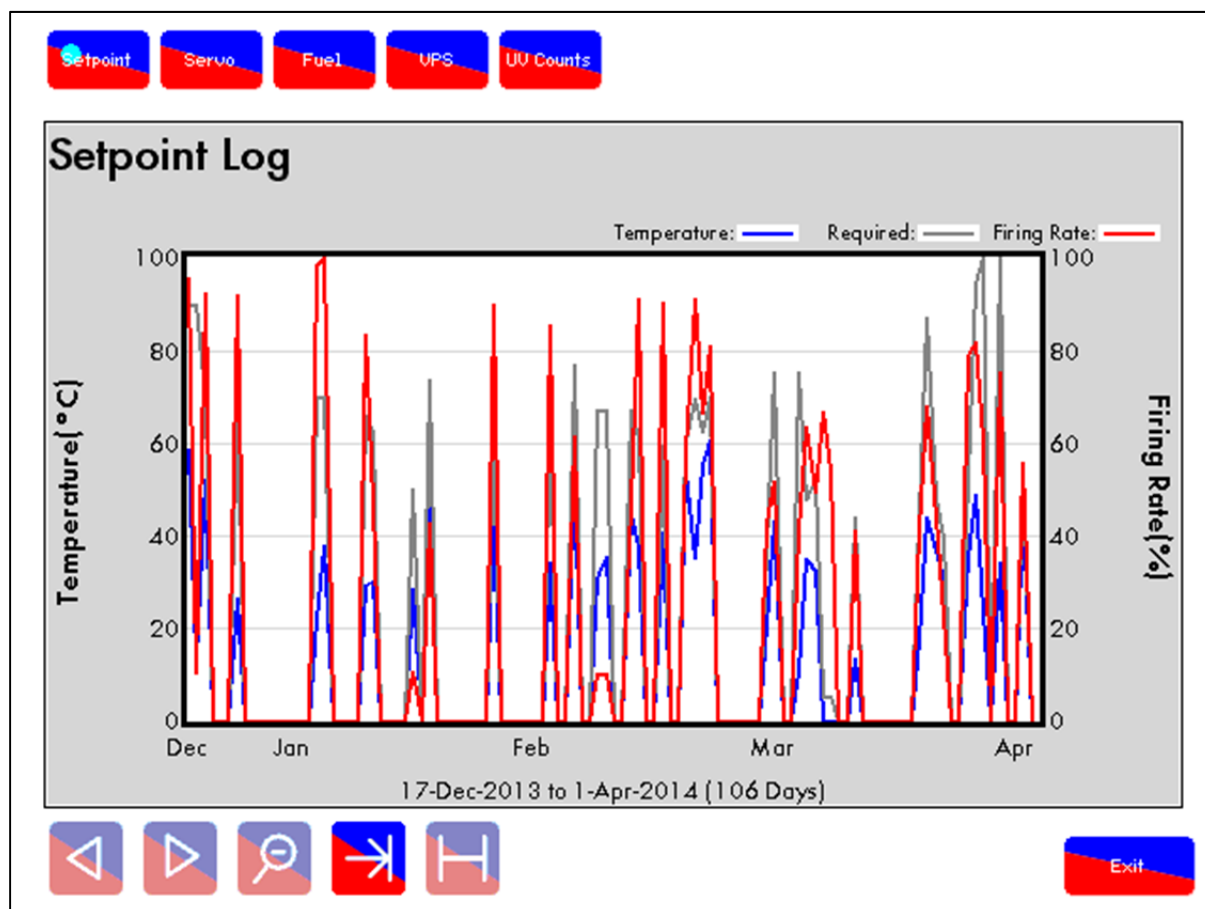


Figure 5.5.i Setpoint Log Screen

Pressing  will display the Setpoint Log screen; the actual setpoint, required setpoint and firing rate are stored for up to 2 years.

Pressing  will display the servomotor positions for up to 2 years.

Pressing  will display the fuel flow for up to 2 years.

Pressing  will display the fuel pressure for up to 2 years.

Pressing  will display the UV signal history for up to 2 years.

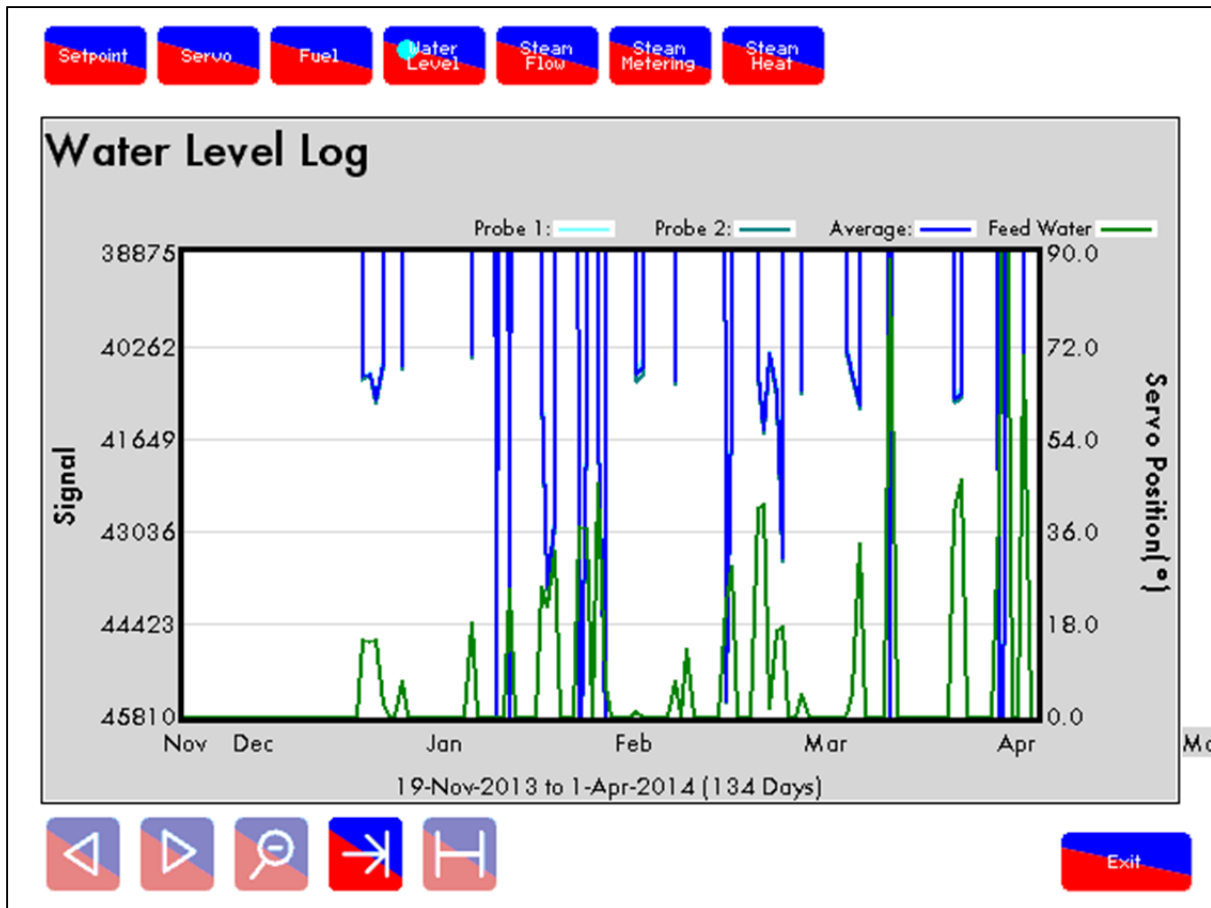


Figure 5.5.ii Water Level Log Screen

If an expansion board is used together with the M.M. for Autoflame water level control, in addition to the display log buttons in Figure 5.5.i, these water level control screens will be shown.

Press  to view the level readings on probes 1 and 2, as well as the average reading and the feedwater valve position for up to 2 years.

Press  to view the steam flow rate for up to 2 years.

Press  to view the steam pressure and calculate steam temperature for up to 2 years.

Press  to view the steam heat history for up to 2 years.

5.6 E.G.A. Display Screen

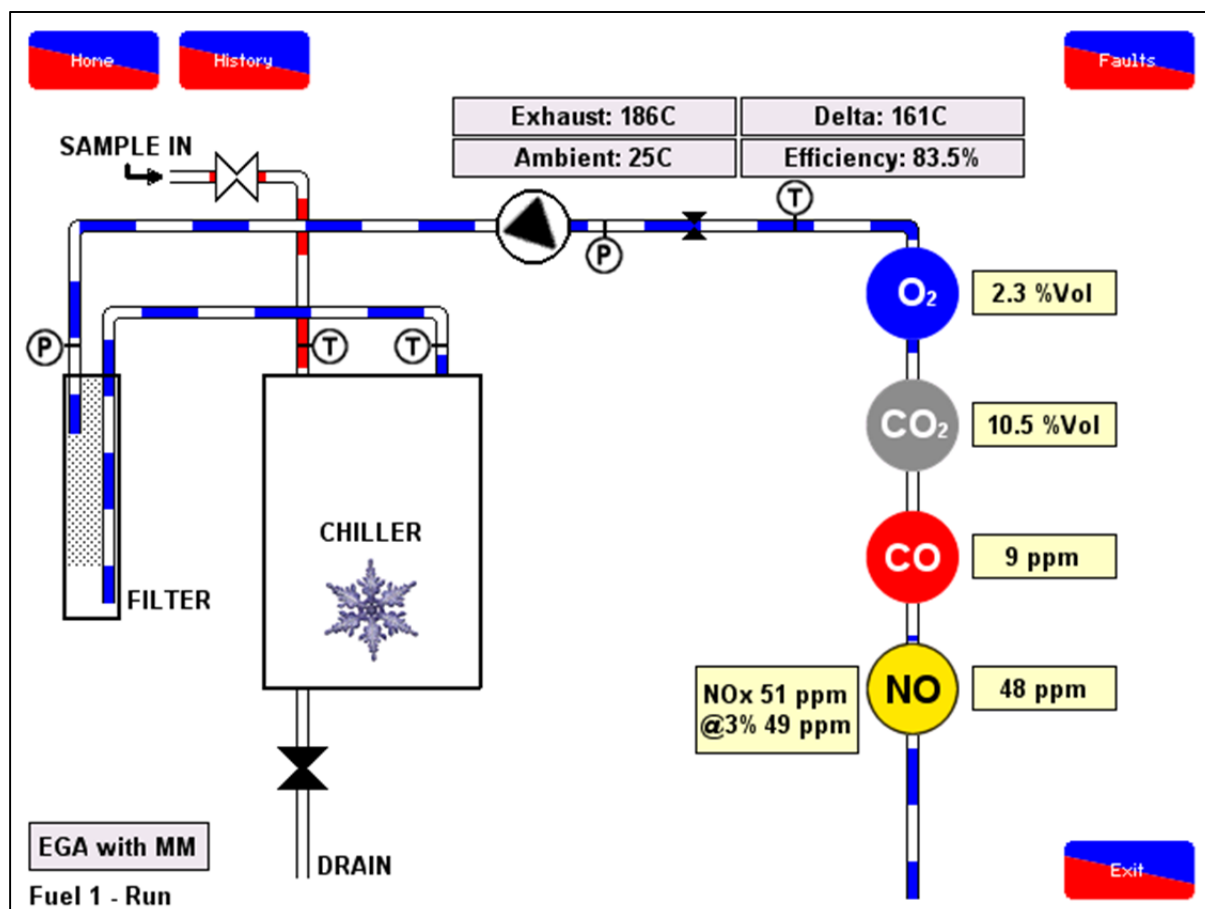


Figure 5.6.i E.G.A. Display Screen

Once you have selected the M.M. on the D.T.I. home screen, if there is an E.G.A. in the system, you can access the E.G.A. screen via 2 ways:

- Press on the boiler in the D.T.I. home screen, and then press on the E.G.A.
- Press on the boiler in the D.T.I. home screen, followed by the M.M., and then the E.G.A. values box

Pressing History on the E.G.A. screen will take you to the exhaust gas emissions and fuel flow rates history.

5.7 I.B.S Information

If the D.T.I. has been setup so that some actions through the M.M. can be remotely controlled by the D.T.I., the sequencing order can be changed.

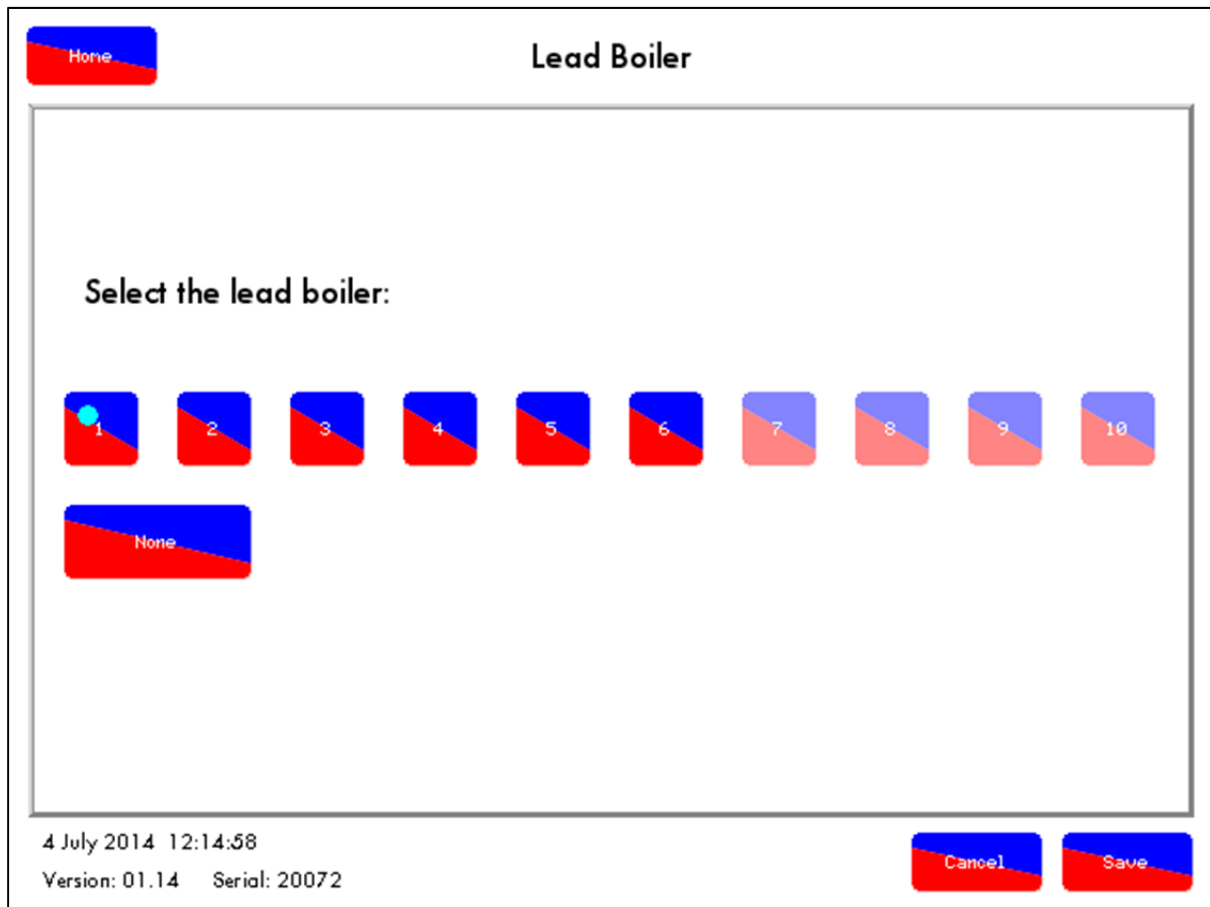


Figure 5.7.i Lead Boiler Select Screen

The lead boiler can be selected by pressing on the Lead Boiler Select button on the D.T.I.

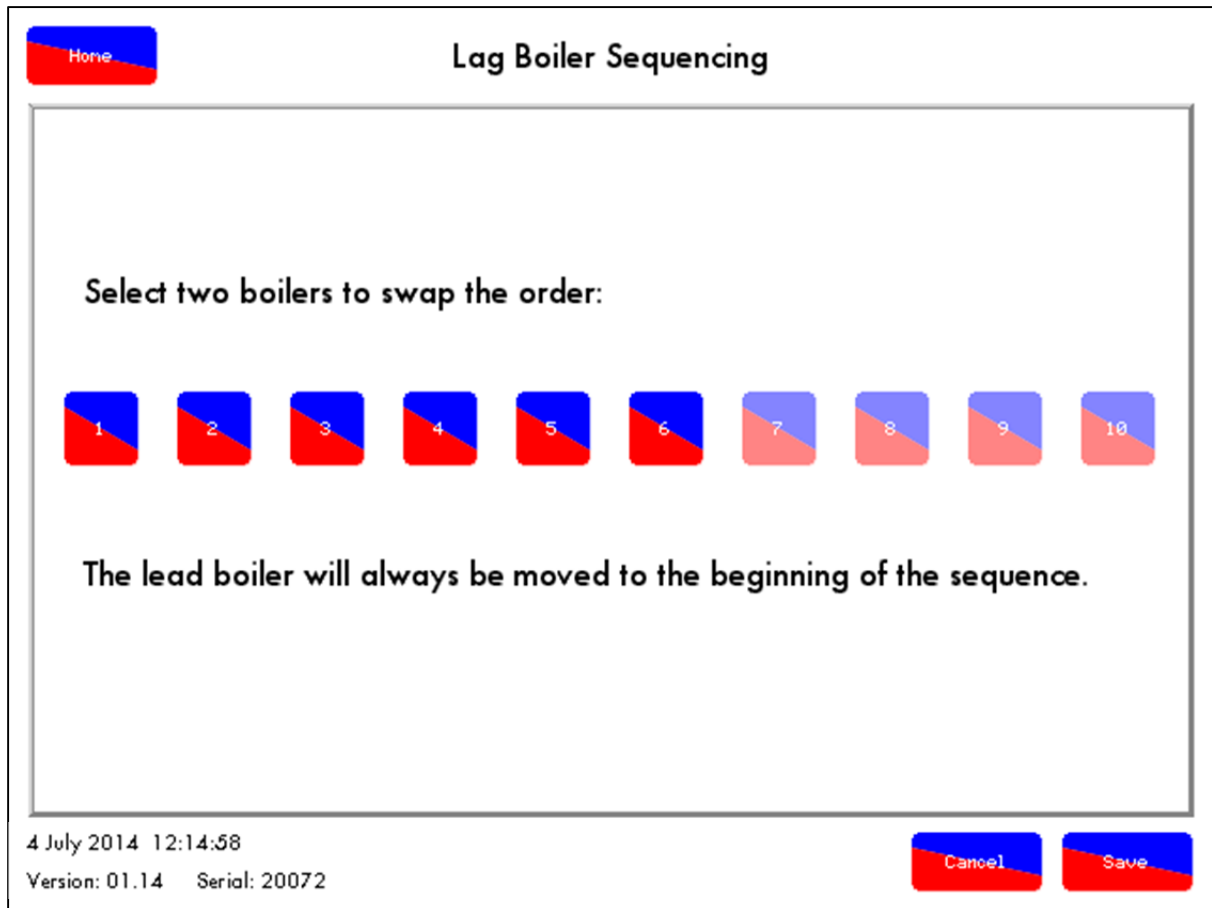
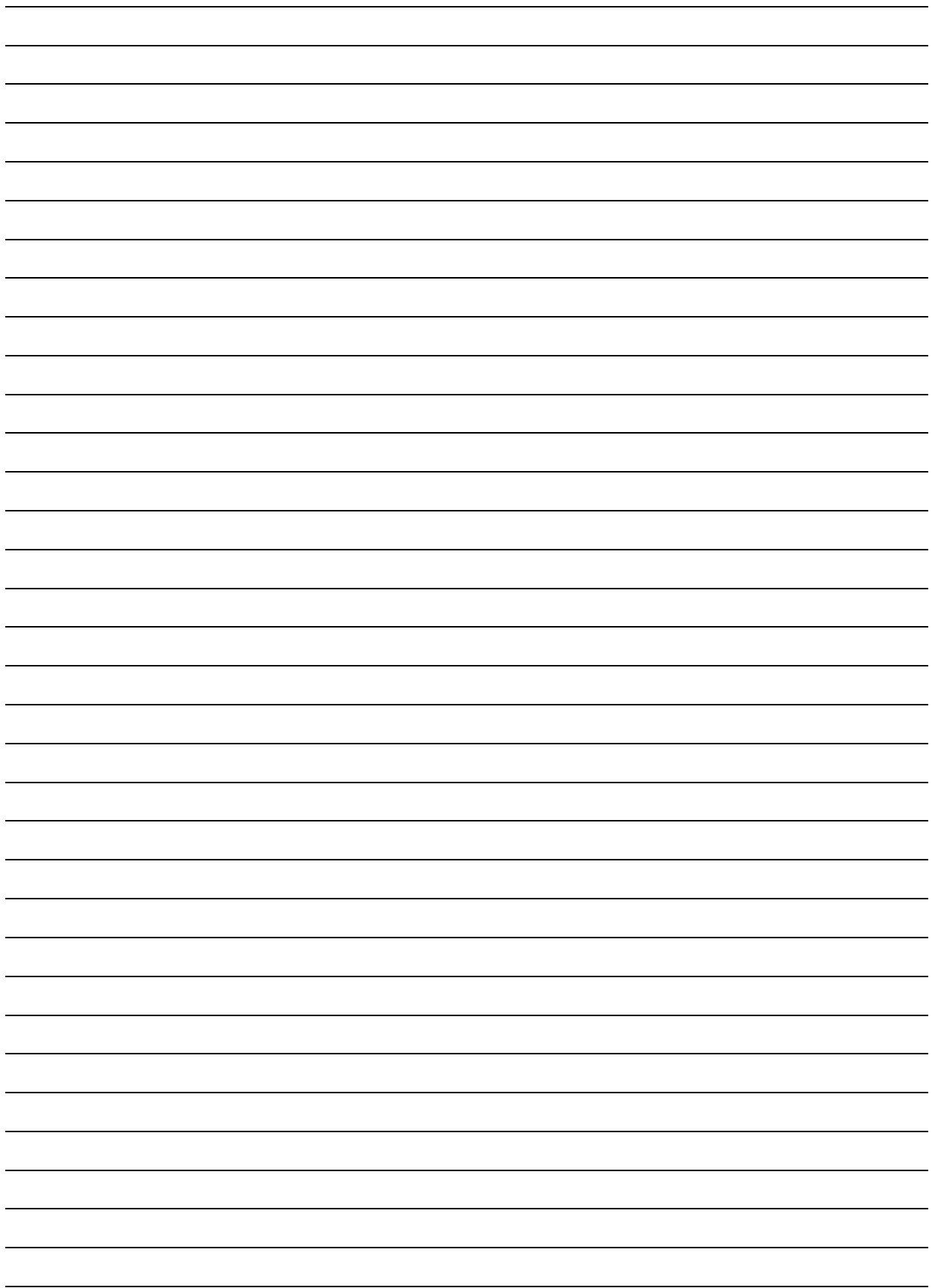


Figure 5.7.ii Lag Boiler Sequence Screen

The lag boiler order can be changed by pressing on the Lag Boiler Sequence button on the D.T.I. home screen. Select two lag boilers to swap them around in the lag sequence order.

Note: D.T.I. shuffle sequencing must be enabled through M.M. parameter 101.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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