NEX-6101
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NX6100

Integrated Burner Controller

Commissioning Manual

NX6100 Burner Controller

DESCRIPTION

The Fireye NEXUS NX6100 Integrated Controller is a microprocessor based, Flame Safeguard and Parallel Positioning Combustion Controller built into one compact, user configurable package. The system consists of the Controller, Display, Temperature / Pressure Sensors, Servomotors, and optional ComFire2 Software.

The Flame Safeguard portion of the control package provides burner sequencing including safe start check, proof of main valve closure, selectable main gas safety proving sequence, supervised pre-purge, low fire-starting position, pilot and main trials for ignition, main flame supervision, and post purge. Safety event timings are provided to meet North American and CE Standards. Time proven Fireye Flame Scanners and amplification circuits using UV, UV-Self Check, and Infrared sensors, provide fast reliable scanning of most commonly burned fuels in addition Fireye Self Checking CANbus sensor may be used for simplified wiring. For exotic fuels and applications, the NX6100 is also compatible with Fireye Phoenix and Insight Integrated Flame Scanners. Seven low voltage and two-line voltage user defined auxiliary inputs provide supervision of safety critical and non-safety critical inputs. A large menu of alarm messages provides enhanced diagnostics.

Control of up to four profiles using an independent Servomotor for each controlled element allows precise positioning, accurate to 0.1º, of the fuel and air metering devices over the burner's firing range. Each profile can be defined to include up to 10 servomotors. Profiles can be configured to share common fuel servomotors or as independent (one profile per fuel) and are not limited by fuel. Up to 24 positions per profile including: Closed, Purge, Ignition (Preferred Start), Low Fire and an additional 20 intermediate points from low to high fire. Each individual servomotor's position and speed are verified, and lockout will occur should either of these parameters be exceeded. All servomotors are controlled via secure CANbus communications link.

Modulation control is provided via the pressure/temperature sensor's input. The Fireye NX1025, NX1030 or NX1040 sensors provide checking circuits for fail safe operation. Two PID setpoints are available for the chosen modulation input, selectable up to two decimal points. Track modulation is available for those applications requiring less precise control.

The NX6220 and NX6330 Twelve-Key Display allows commissioning and current status of the system through the use of its tactile membrane keypad. Multi-function keys allow the commissioning to engineer the ability to access the various Ratio Modes and Option Select menus. The four-line OLED Display clearly illuminates the Control Variable, Firing Mode, Fuel Selected and Hours Run. It further allows the Boiler Operator access to the Auto/Manual selector, Motor Data (servo positions) and other operational parameters such as System Sequence Position, Valve Proving Sequence Status, Gas Pressure, Flame Signal, Modulation Rate and Setpoint, as necessary.

Multiple Boiler Sequencing is accomplished through an RS485 Communications bus using ComFire2 software. Lead/Lag and Standby set points for up to four (4) boilers can be configured.

When replacing control with firmware version 1.307 with firmware version 1.4XX it is required that obsolete displays NX610/NX6110 be removed and replaced with a NX6220/NX6330 this is not necessary if a NXTSDXXX touchscreen is present.

Introduction

Part No	Description
INTERGRATED PARALLEL POSTIONING CONTROL	
NX6100	Standalone parallel positioning controller, with up to ten (10) selectable function CANbus servos for custom applications.
NXDBVSD	VFD daughterboard with two VFD channels, one analog output, two encoder inputs, two programmable relays, isolated RS485 – Modbus RTU.
NXMBDB	MODbus RTU interface cards for NX6100/PPC6000. Networks up to 15 control – one card per control.
NX8WC-HUB	Passive CANbus Hub with Screw terminals - Portrait profile.
DISPLAY MODULES FOR NX6100	
NX6110	Obsolete use NX6220 or NX6330.
NX6220	12 key CANbus Organic LED (OLED) display for NX6300 with upload/download of NX6300 data and three programmable relays. USB port for updates and future functions TBD.
NX6330	12 key CANbus Organic LED (OLED) display for NX6300 with upload/download of NX6300 data and three programmable relays. USB port for updates and future functions TBD. Also mounted with RJ45 Ethernet port for BAS integration. Onboard Modbus TC/PIP and BACnet protocols.
NXTSD007	7" Touchscreen Display with upload/download, full commissioning, data log, internet connection, four programmable relays. Onboard Modbus TC/PIP and BACnet protocols.
NXTSD104	10.4" Touchscreen Display with upload/download, full commissioning, data log, internet connection, four programmable relays. Onboard Modbus TC/PIP and BACnet protocols.
SERVO MOTORS For NX6100	
NXC04	4 wire CANbus Servomotor, 3 ft lbs. torque, 4 Nm, 50/60 Hz, 24 VAC.
NXC12	4 wire CANbus Servomotor, 9 ft lbs. torque, 12 Nm, 50/60 Hz, 24 VAC.
NXC20	4 wire CANbus Servomotor, 14.75 ft lbs. torque, 20 Nm, 50/60 Hz, 24 VAC.
35-321	PG9 male to ½" NPSM female adapter for NXC04, NXC12
35-322	PG11 male to ½" NPSM female adapter for NXC20
35-372	M20 male to ½" NPSM female adapter for NXC40
Type 2 O2 PROBES AND EXPANSION MODULE FOR NX6100	
NXO2TRIM	CANbus O2 interface module with Fireye and generic (4-20mA) probe inputs.
NX-CAB-SET	Interconnecting Cable from O2 probe to controller 33ft (10 m.) ONLY
NXPK224455	O2 probe assembly (for flues 300mm to 1000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NXPK224456	O2 probe assembly (for flues 600mm to 2000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NXPK224457	O2 probe assembly (for flues 1200mm to 4000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NX6083-1	Replacement O2 probe for NXPK224455. Does not include mounting flange, ambient air sensor, or transformer.
NX6083-2	Replacement O2 probe for NXPK224456. Does not include mounting flange, ambient air sensor, or transformer.
NX6083-3	Replacement O2 probe for NXPK224457. Does not include mounting flange, ambient air sensor, or transformer.
NXIATS	NX6300 CANbus Inlet (ambient) Air Temperature Sensor -29°C to 60°C (-20°F to 140°F)

NON-SELF TEST PRESSURE SENSORS FOR NX6100	
PXMS-15K	Steam Pressure Sensor: 0 - 15 PSI, 0 - 1 bar, 4-20mA output, 1/2" NPT, non-self-check.
PXMS-200K	Steam Pressure Sensor: 0 - 200 PSI, 0 - 14 bar, 4-20mA output, 1/2" NPT, non-self-check.
PXMS-300K	Steam Pressure Sensor: 0 - 300 PSI, 0 - 21 bar, 4-20mA output, 1/2" NPT, non-self-check.
BLPS-15	Pressure transducer, 0-15 psi (0-1030 mb), 4-20 mA output linear with pressure. ¼" NPT mounting. Screw terminal connections and conduit adapter cover.
BLPS-30	Pressure transducer, 0-30 psi (0-2070 mb), 4-20 mA output linear with pressure. ¼" NPT mounting. Screw terminal connections and conduit adapter cover.
BLPS-200	Pressure transducer, 0-200 psi (0-13.8 Bar), 4-20 mA output linear with pressure. ¼" NPT mounting. Screw terminal connections and conduit adapter cover.
BLPS-300	Pressure transducer, 0-300 psi (0-20.7 Bar), 4-20 mA output linear with pressure. ¼" NPT mounting. Screw terminal connections and conduit adapter cover.
NON-SELF TEST TEMPERATURE SENSORS	
TS350 (-2), (-4), (-8)	Temperature Sensor, Range 32^{o}F-350^{o}F (0-176^{o}C), 4-20mA linear output, includes 1/2 - 14 NPT well. See bulletin BLZPTS-1 for complete description.
TS752 (-2), (-4), (-8)	Temperature Sensor, Range 32^{o}F-752^{o}F (0-400^{o}C), 4-20mA linear output, includes 1/2 - 14 NPT well. See bulletin BLZPTS-1 for complete description.
SELF-TEST CANbus SENSORS	
NX6043-1	CANbus Gas pressure sensor 600 mbar (8.7psi) span and NPT process connection.
NX6043-2	CANbus Gas pressure sensor 600 mbar (8.7psi) span and G 1/4 P process connection.
NX6044-1	CANbus Pressure sensor 4 bar (58 psi) span and NPT process connection.
NX6044-2	CANbus Pressure sensor 4 bar (58 psi) span and G 1/4 P process connection.
NX6045-1	CANbus Pressure sensor 25 bar (363 psi) span and NPT process connection.
NX6045-2	CANbus Pressure sensor 25 bar (363 psi) span and G 1/4 P process connection.
CANbus Self Checking FLAME SCANNERS	
NX6094	CANbus self-checking Flame Scanner for radial view - includes mounting clamp LA223883.
NX6095	CANbus self-checking Flame Scanner for Axial view.
NX224763	6094 UV Tube Replacement Kit
NX224762	6095 UV Tube Replacement Kit
NX224760-15	5m (15') CANbus quick disconnect connection cable for Pressure sensors. and scanners.

Fireye Flame Scanners	
45UV5-1009	UV self-check scanner, 1" NPT, 102 - 264 VAC shutter.
UV1A3	UV scanner, 1/2" NPT connector, 3 ft. cable rated for Tray Cable - Exposed Run (TC-ER).
UV8A	UV scanner, 1/2" NPT connector, 90-degree angle head, 6 ft. cable.
48PT2-1003	Infrared scanner, 8', straight head
48PT2-9003	Infrared scanner, 8', 90-degree head
85XXX-XWR	Use 59-546-xx cable. FM, UL/c, CE Approved. Uses 60-2692, 60-2919 mounting flange.
95XXXX-X	InSight I Flame Scanner. Use 60-2692 1" NPT Mounting Flange
59-497-020C-WR	Factory wired cable assembly with straight connector and flexible conduit adapter B1266- 20 feet. For use with InSight scanner and direct coupled amplifiers.
59-497-020RC-WR	Factory wired cable assembly with right angle connector and flexible conduit adapter - 20 feet. For use with InSight scanner and direct coupled amplifiers.

Safety Information

SAFETY WARNINGS IN THIS MANUAL

In this manual, we indicate potential safety issues by this symbol: ⚠.
Please read the safety information before you do any task preceded by this symbol.

There are two levels of safety message: **WARNINGS** and **CAUTIONS**:

WARNING

- **Failure to observe a WARNING about the equipment described in this manual can cause property damage, severe injury, or death.**

CAUTION

- **Failure to observe a CAUTION may cause minor injury or damage to equipment.**

Health and Safety when using the NX6100 System

It is the responsibility of the owner or user to make sure that the equipment described herein is installed, operated, and commissioned in compliance with the requirements of all national and local legislation that may prevail.

WARNINGS

1. **When this equipment is mounted to an appliance, due regard must also be given to the requirements of that appliance.**
2. **Before attempting to install, commission or operate this equipment, you MUST read and fully understand all relevant sections of this manual. If in doubt about any requirements, please consult your supplier.**
3. **Repairs to the controller must only be carried out by the manufacturer or their appointed agents.**
4. **Installation, commissioning or adjustment of this product MUST ONLY be carried out by SUITABLY TRAINED ENGINEERS or PERSONNEL QUALIFIED BY TRAINING AND EXPERIENCE.**
5. **After installation or modifications to the installation, all functions of the equipment MUST be checked to make sure safe and reliable operation of the controller.**

- The manufacturer of this equipment accepts no liability for any consequences resulting from inappropriate, negligent, or incorrect installation, commissioning, or adjustment of operating parameters of the equipment.
- This equipment **must only** be mounted to burners as detailed in the contract specification. The supplier must approve in writing any change to the specification.
- **Do not** leave Control panels uncovered while power is ON. If it is essential to do so while rectifying faults, only personnel qualified by training and experience may be involved.
- The time any covers are off must be kept to a minimum, and warning notices **must** be posted.
- Before attempting any work on this equipment or any equipment connected to this equipment, the electrical supplies **must** be isolated.
- Safety interlocks **must not** be removed or overridden. Correct any faults detected before operating the controller.

CAUTION

SOME VERSIONS OF THIS EQUIPMENT CONTAIN A LITHIUM BATTERY IN THE DISPLAY UNIT.

Some sites have a battery disposal policy, which may require used Lithium batteries to be disposed of according to local and/or national regulations.

The lithium battery provides a power backup for the clock/calendar, which is used to timestamp the event and fault history log. Currently, there is no indication of the battery condition, but a low battery condition will manifest itself as the wrong time in the display or event log. At this time, suitable personnel may change the battery.

NOTE: The manufacturer of this equipment has a policy of continual product improvement and reserves the right to change the specification of the equipment and the contents of this manual without notice.

Introduction

Who is this Manual for?

This manual is intended for combustion engineers qualified by training, competence and experience. They might be involved in adding a new set of combustion curves; or replacing system components, controller box, etc.

Scope of this Manual

In this manual, we try to cover all the issues that you are likely to encounter in commissioning the NX6100 Integrated Burner Controller. This includes installation, setup and fault finding. It does not cover Operator instructions.

This manual is split into sections to aid navigation. The section titles are given in the banner line at the top of each page. You will see from the top of this page that you are reading ***Section 1: Introduction***. The section headings and brief contents are as follows:

Section	Content description.
1	Introduction: Introduction and description of the NX6100.
2	Installation: Installation and wiring guide. Servo motor installation and operation.
3	Commissioning: The commissioning process using touchscreen and text displays.
4	VSD, Oxygen and CO Trim options.
5	Faults and Fault Finding: Faults and Fault codes Engineers Keys. Troubleshooting.
6	Technical specifications and Connections.
7	Appendix: Option parameter descriptions Glossary of Terms Licenses.

Maintenance

This manual does not cover maintenance other than basic cleaning of the optional Touch screen interface. In the event of a fault, please contact your supplier.

Disclaimer

The purpose of this manual is to provide instructions for commissioning the NX6100 Integrated Burner Controller.

Nothing contained in this manual constitutes a warranty of any kind in respect of the machine or of the results to be achieved by its use. The only warranties given by Fireye LLC in respect of any device are those expressly given by Fireye LLC or your supplier in the contract under which it sells the device to its purchaser.

The information contained in this manual is believed to be accurate at the date of publication.
However, Fireye LLC gives no guarantees in this respect.

Table of Contents

This manual describes the installation, commissioning, operation and maintenance of the NX6100 integrated burner control.

IMPORTANT: Please read the Health and Safety Issues before working on this equipment.

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1. NX6100 introduction

1.1 System Outline

The NX6100 equipment described in this manual comprises a fully integrated burner control system for industrial burners. It provides:

- a PID (Proportional, Integral and Derivative) function to control the pressure / temperature of the boiler by modulating (varying) the fire rate; and
- full Burner Management Functions, including flame and air pressure monitoring, and a fuel valve shut-off control.

1.2 Controller

This manual covers the basic models.

Model	Description
NX6100	Standard controller.

The NX6100 control are complemented with a range of boiler temperature and pressure sensors, servomotors, and optional interface boards, which facilitate VFD control (for the pump or fan motors), analogue input / output channels and Oxygen Trim functions (with an NX6083-X Oxygen probe).

1.3 NX6100 VFD Interface option

The NX6100 can accommodate an optional **daughter board** within the main enclosure, to allow control of one or two VFD drive units.

This daughter board:

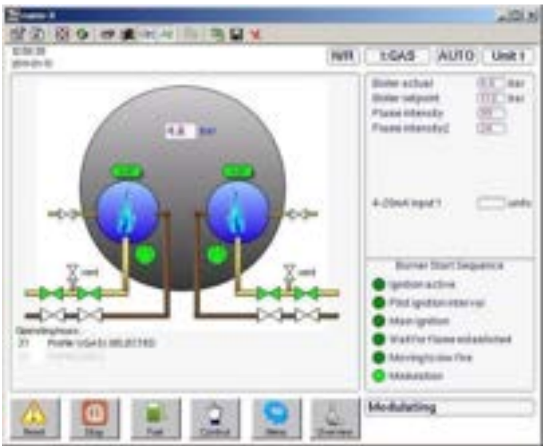
- extends the capability of the main controller board to allow for a speed control option.
- interfaces with VFD feedback as a current signal or pulse signal from an encoder that measures the speed of the relevant motor, fan or pump shaft.
- monitors a rotary cup speed via an encoder input.

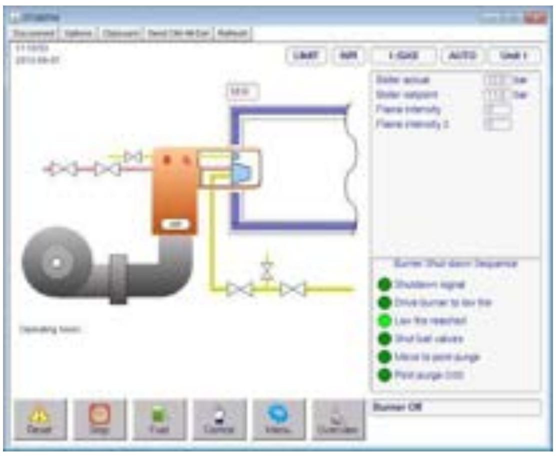
2. Description of Operation

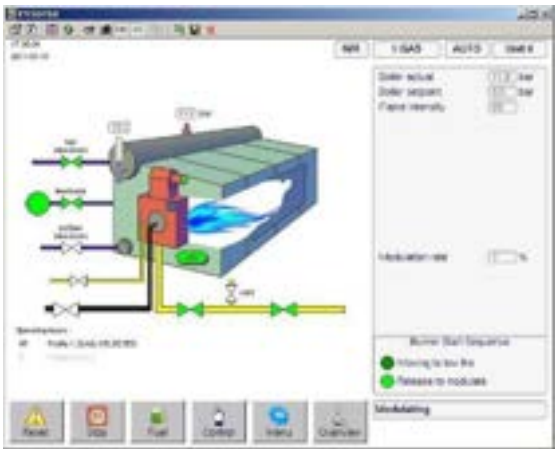
2.1 NXTSD104 10" Touch screen Display option

The Touch screen display provides an advanced, easy-to-use, graphical interface with the boiler control system. You use it by tapping the buttons on the screen, to make selections and settings, or to operate the boiler. This unit includes a lithium battery for the clock / calendar / event log functions.

The boiler type can be represented in various, user-selectable designs:







2.1.1 Touch screen Power ON

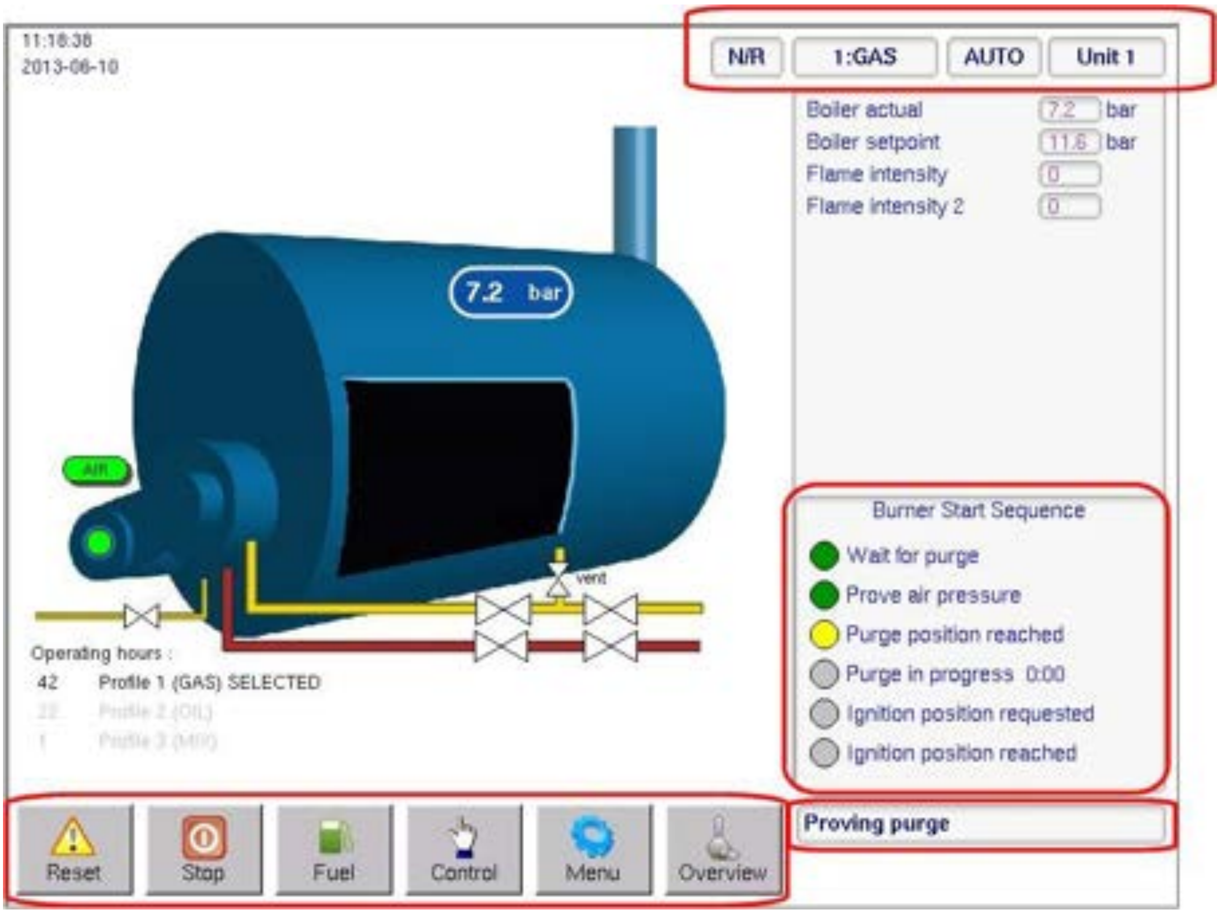
After you switch the system ON, the controller and display will take about 16 seconds to "boot up". During this initialization period, the display backlight will come ON and the relays will be held in their No Alarm state, to avoid the possibility of nuisance alarms that may otherwise occur.

5 seconds after power is applied, the FIREYE splash screen (shown here) will display for 6 seconds, after which a blank white screen will show for 5 seconds.

After the initialization is complete, the Touch screen will show the overview screen (see this section page 7, “The System Overview screen”) and the controller will operate normally, changing the relays to operate according to the control status.

2.1.2 Overview of Touch screen Operation

The optional Touch screen provides all of the functions required to control and monitor the burner, and to commission how the controller works.

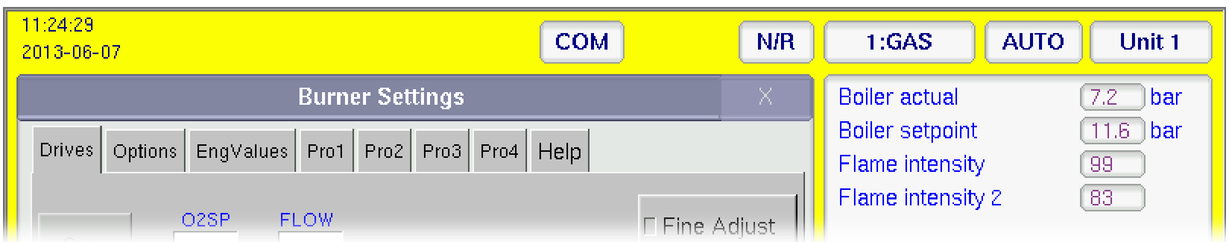


Example screen display, with the significant items marked in red.

To operate the system, give a firm tap (or press) with your finger on the required button controls on the screen. Do not use a sharp object such as a biro, pencil or metal stylus to operate the Touch screen – you may damage the screen or cause undue wear.

2.1.2.1 Screen colour: Adjust Ratio mode (YELLOW)

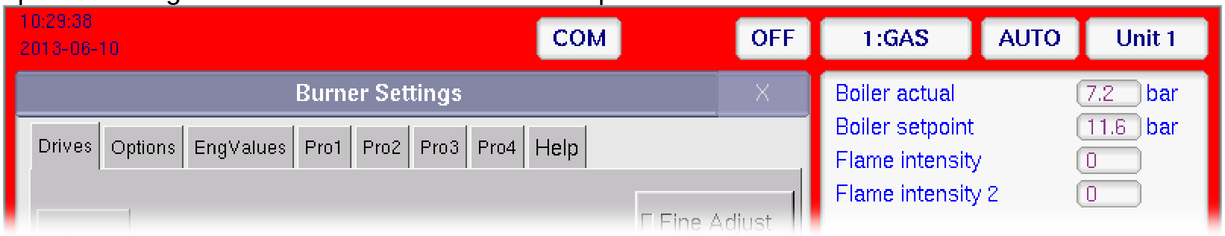
If you were to select Adjust Ratio mode, the display background changes to YELLOW, and you can adjust a limited number of settings:



For more details, see “How to go into Adjust Ration mode (Yellow)” in section 3, Commissioning.

2.1.2.2 Screen colour: Commission mode (RED)

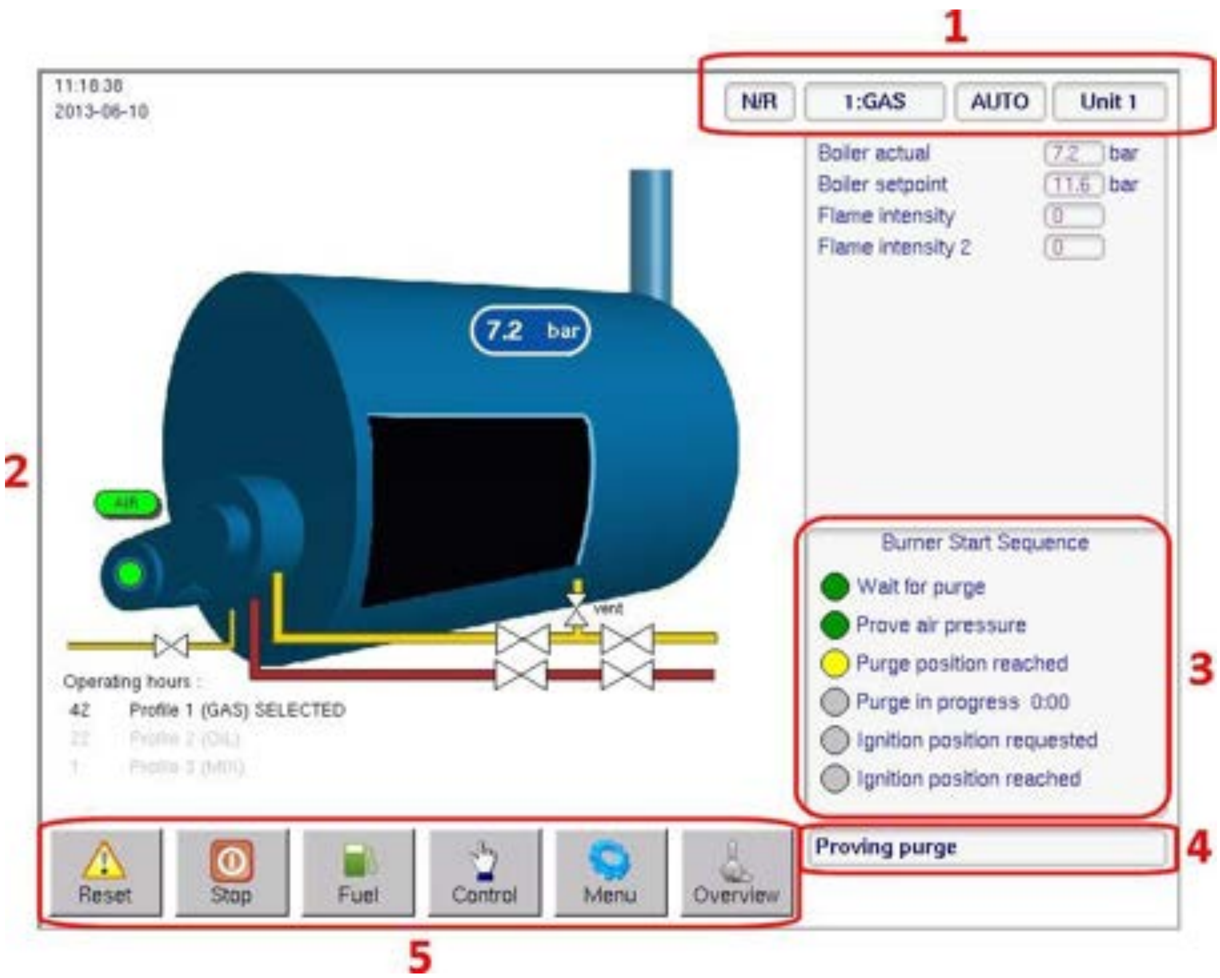
If you select Commission mode, the display background changes to RED, and you can make and adjust special settings that define how the burner will operate:



Because you can only enter Commission mode if the burner is OFF, you cannot monitor certain safety functions such as the Fuel: Air ratio positions.

For more details, see “How to go into Commission mode (Red)” in section 3, Commissioning.

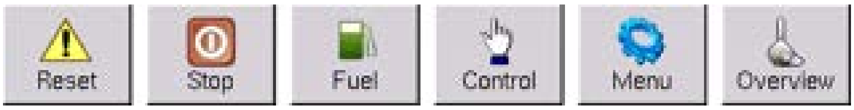
2.1.3 Indications on the Display



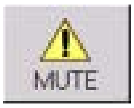
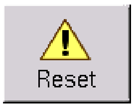
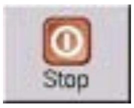
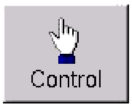
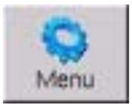
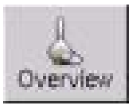
Explanation of the general Touch screen layout

1. The current **Burner Operating mode** (e.g., N/R), the Profile number and fuel type (e.g., 1:GAS), the Modulation mode (e.g., AUTO), and the boiler unit address (e.g., Unit 1).
2. Pictorial representation (user selectable) of your boiler, burner and fuel delivery system.

3. The **Burner Start Sequence** shows graphically the steps during the start-up sequence.
4. **Burner Status** (e.g., Proving Purge) at this particular moment, and **fault information** if applicable. Depending on the actual fault, the audible alarm may be active, and the controller may change to safety shutdown.
5. Dedicated buttons at the bottom of the screen:



These buttons perform the following functions:

 	**Mute / Reset**	Use **Reset** to reset a burner lockout, to mute alarms, or to test audible alarms. If an alarm is present, the button text changes to **MUTE**.
 	**Start/Stop burner**	Starts the burner; greyed out if the burner is already operating. Stops the burner if at a stage where Stop is valid.
	**Fuel**	Allows you to select which fuel/profile to used, from a list of fuels/profiles available.
	**Control**	Used to enable selection of Modulation mode.
	**Menu**	Used to access Configuration and Adjustment modes.
	**Overview**	Returns the screen to Burner Overview mode.

Top-of-screen Indications

The table below shows the Icons and information displayed on the Touch screen above the information panels, and their meaning.

Icon	Description
13:07:16 **2008-05-20**	This indicates the current local Time and Date, used for the fault history and event logging. The date format is yyyy-mm-dd.
	A flashing warning triangle may appear in part of the display to indicate a problem. Look for other indications at the bottom right of the screen.
	You see this when CANbus communication is faulty.
	You see this when Oxygen Interface related fault is present.
	You see this when a passcode has been entered to enable changes to the boiler or burner operation.

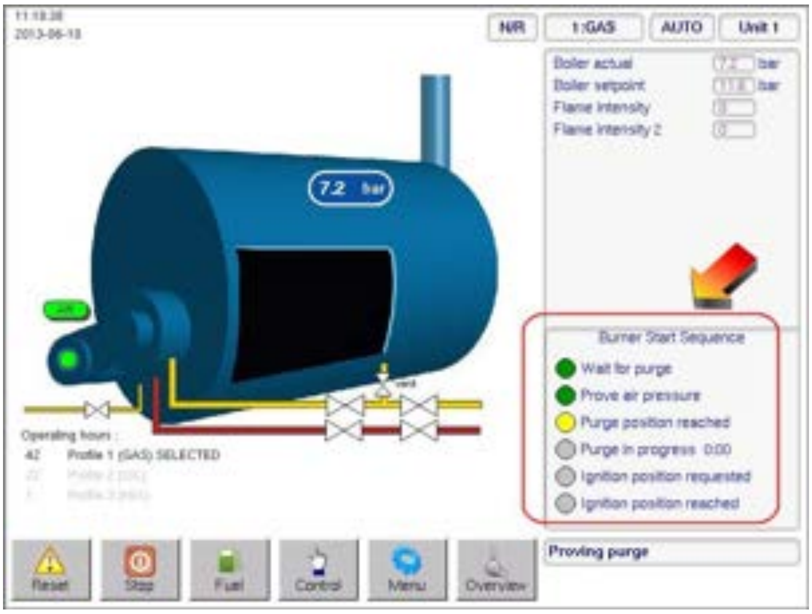
Icon	Description
COM	You see this when the controller is operating in Commission mode.
MAN	You see this when the controller is operating in MANUAL modulation mode.
AUTO	You see this when the controller is operating in AUTO modulation mode.
N/R OFF	**N/R** indicates that the burner is operating in **Normal** or **Remote** mode. This may change to **L(1)** or **L(2)** if a local PID loop set point is forced. This changes to **OFF** when the Burner is OFF
R / L(1) / L(2)	This shows you the Boiler Set Point mode selected: **R**emote, **L**ocal set point **1** or **L**ocal set point **2**.
1 / 2 / 3 / 4 1:GAS 3:MIX	Indicates the profile number for the selected profile, and the fuel type.
Unit 0 Unit 1	Indicates the boiler unit address number that is used in the system.

2.1.4 The System Overview screen

Bottom row > Overview button > …

The Overview screen is the normal start screen for the system and shows you a graphical summary of the current status of the burner and controls.

For example, while the burner is changing status, the lower-right pane of the display shows a graphical indication of changing status, e.g., the Burner Start Sequence.



Example showing the Burner Start Sequence

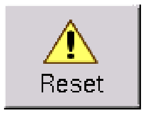
The sequences displayed in this manner include burner start-up, burner shutdown and fuel change-over.

There is a ‘lamp’ for each stage of the sequence, which visually indicates the progress of the changes in burner ‘status’.

This example is for the Burner Startup Sequence display.
After the sequence is completed, the display will return (after a short delay) to the overview screen.

2.1.5 Touch screen Lockout Reset (Alarm Mute) Function

Bottom row > Alarm Mute / Reset button



The **Reset** (Alarm Mute) 'button' on the Touch screen is multi-functional.

In normal operation, you can use this to **test the alarms**, by **pressing the button for more than 10 seconds**, after which the alarm relays will activate.

The **Reset** (Alarm Mute) button is also used to mute alarms and reset the controller following a safety shutdown. If the alarm is sounding, the button will show the text **Mute**. Tap this button to mute the alarm, and then the text in the button will change to **Reset.** Press and hold the button for more than 3 seconds, and this will allow the burner to restart if the faults have cleared. Further details of the functionality of this button are defined below.

There are three types of fault alarm:

1. Alarm Only. This will allow the burner to continue to operate, while the alarm is sounding.

If the **Reset** (Alarm Mute) button is pressed while the controller is in this mode and the alarm is sounding, the alarm will be silenced, and the burner will continue to operate.

2. Controlled Shutdown. This will cause the burner to perform a controlled shutdown, and the alarm will sound. After the fault clears, the burner will restart without the requirement for manual intervention.

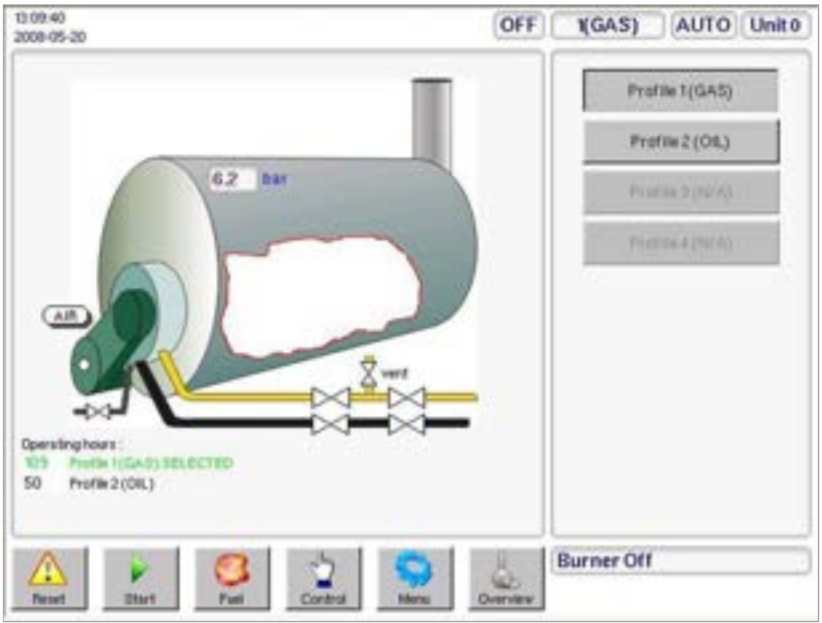
- If you tap the **Mute/ Reset** button while the controller is in this mode, the alarm will be silenced, and the burner will remain in controlled shutdown.
- If you tap the **Mute/Reset** button after the controller has restarted following a controlled shutdown, the alarm will be silenced, and the burner will continue to operate.

3. Safety Shutdown. This will cause the burner to perform a safety shutdown, and the alarm will sound. After the fault has cleared, the burner will remain in safety shutdown until a **Mute/ Reset** is performed.

- If you press **Mute/ Reset** button while the controller is in safety shutdown and the fault is still present, the alarm will be silenced, and the burner will remain in safety shutdown. After the fault clears, the alarm will sound once more.
- If you press **Mute/ Reset** button while the controller is in safety shutdown and the fault has cleared, the alarm will be silenced. If you press the button for more than 3 seconds, the burner will re-start.

2.1.6 View Fuel Profiles

Bottom row > Fuel button > …



Example after selecting **Fuel** button

< After you tap the **Fuel** button (at the bottom), a pop-up panel appears on the right, showing you the available Profiles and Fuels.

The NX6100 allows up to four profiles. Any profiles that are not programmed and therefore not available, will be 'greyed-out'.

The 'Name' for each available profile will be either the default as set by the relevant option parameter, or that entered via the Configuration Screen.

If you change the selected profile while the burner is firing, there are two possibilities, dependent on the options set in the controller. Either:

1. If the unit does **not** have the option to perform an online change-over enabled (i.e., to switch to a different profile without the burner going OFF) then the burner will go through a controlled shutdown on the original profile and then restart on the new profile.

Or:

2. The **online change-over** allows you to configure a digital input that allows a profile swap without turning the burner OFF.

- If this input is ON and you change a fuel profile selection, the controller will go to Low Fire and then back to pilot ignition (P2) on the original profile.
- The controller will interrupt the supply to the main fuel valves, leaving the pilot flame ON. The spark will also be ON if configured in option 14.6.
- It will then move all drives to the P2 position of the new profile and open the appropriate main fuel valves.

To exit from this operation panel and return to the overview screen, tap the **Overview** button.

2.1.7 View ‘Control’ information

Bottom row > Control button

Example after pressing the **Control** button

After you tap the **Control** button, a panel appears on the right, giving you a choice of options.

If an option is unavailable, it will be ‘greyed out’; for example, Manual Modulation may be disabled during commissioning.

If the burner is firing, then the vertical gauge on the right will indicate the modulation rate (0 to 100).

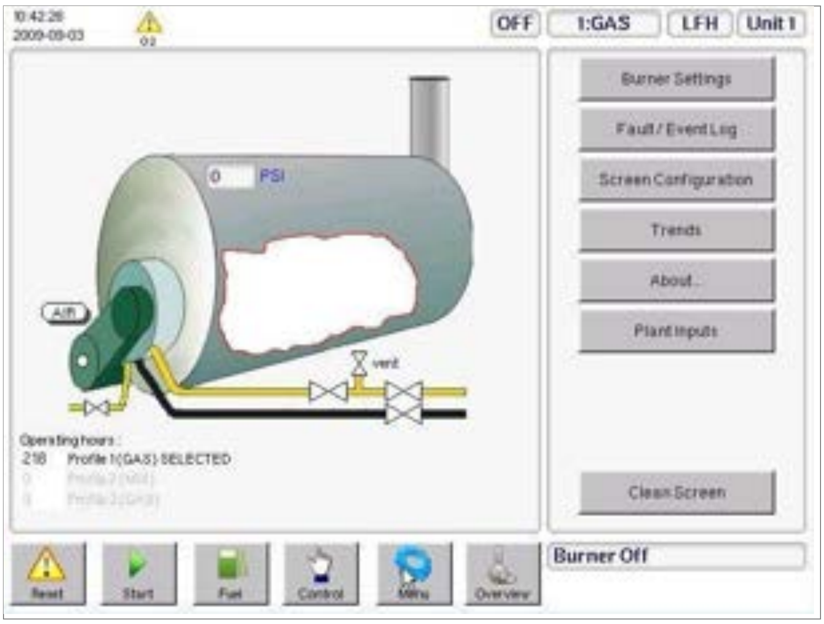
You can select Normal, Local, Manual and LFH (Low Fire Hold) from the buttons in the Control panel.

Subject to passcode priority, you can change the Set point and PID values by tapping the value and adjusting it using the up/down arrow buttons.

To exit this Control Mode panel and return to the overview screen use the **Overview** button.

2.1.8 Touch screen ‘Menu’

Bottom row > Menu button



Example after pressing **Menu** button

After you tap the **Menu** button, a pop-up panel appears on the right, giving you a choice of option buttons.

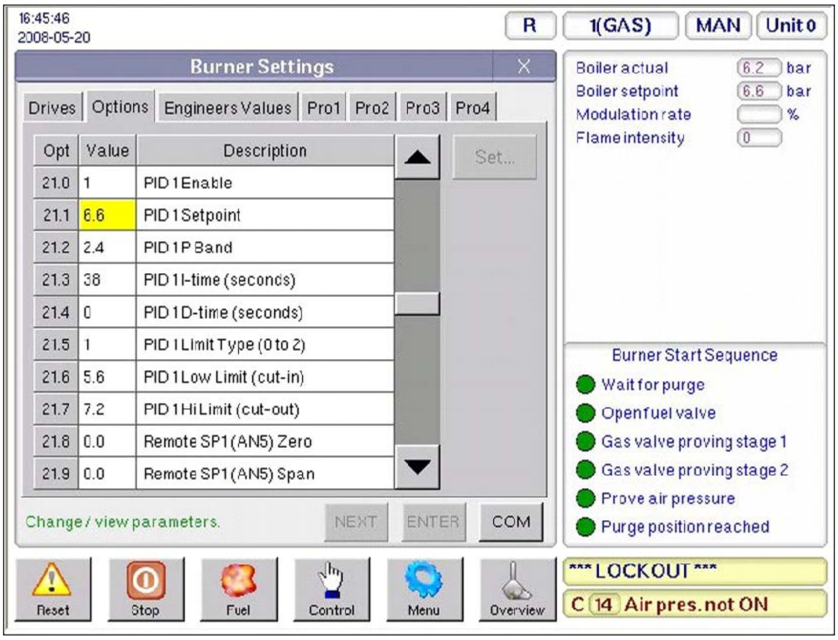
If an option is unavailable, it will be ‘greyed out’.

Using these buttons will generate a new pop-up panel in the left-hand area of the screen.

To exit this operation panel and return to the overview screen, tap the **Overview** button.

2.1.9 View Burner Settings Options

Bottom row > Menu button > right > Burner Settings button > left Options tab



Example after pressing **Menu > Burner Settings > Options**

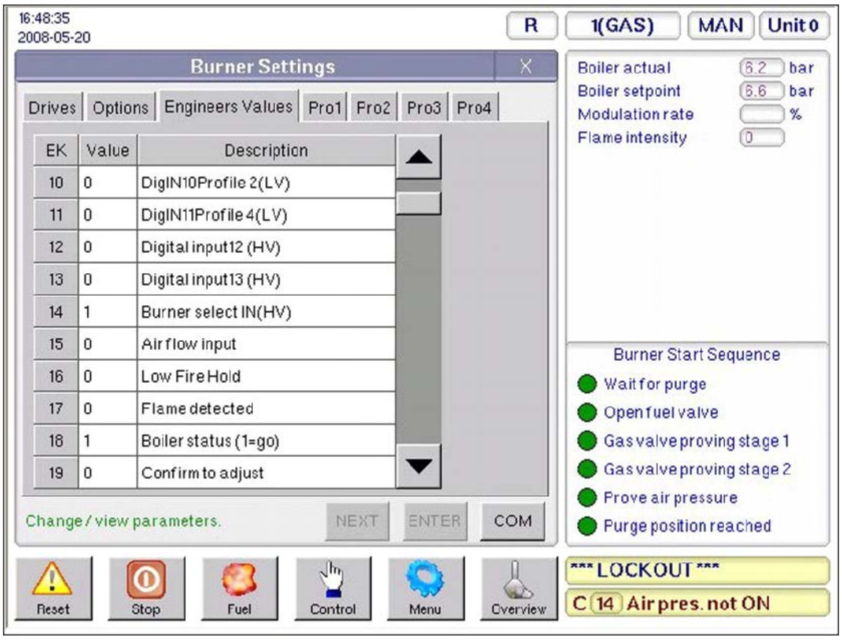
After you tap the **Burner Settings** button, a panel appears giving you a choice of data types by Tab.

Tap to select a Tab, and you can view a variety of data.

In this example here, you can see the **Options** Parameters.

2.1.10 View the Engineer's Key Data Values

Bottom row > Menu button > right > Burner Settings button > left EngValues tab



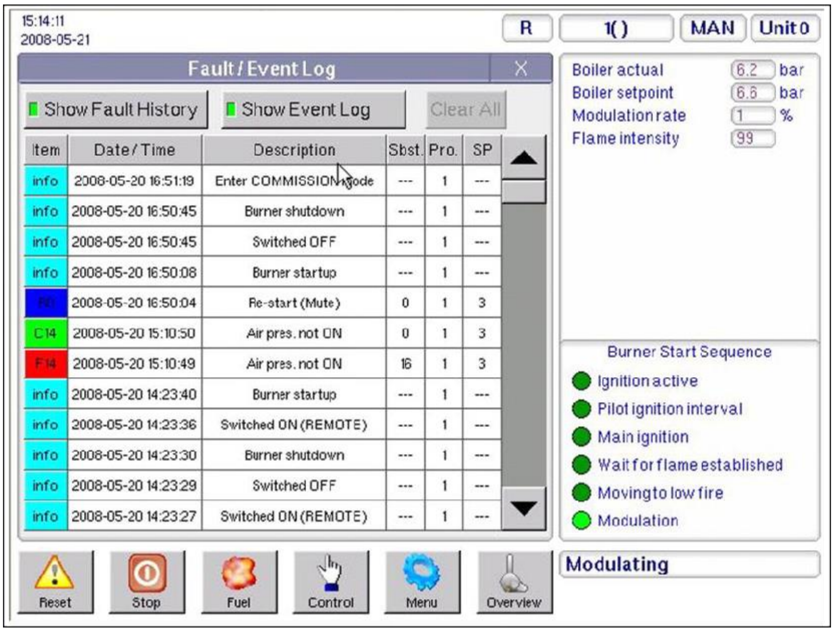
Example after tapping **Menu > Burner Settings > EngValues tab**

In this example, you can see the Engineer's Key Data Values.

The scroll bar at the side of the data tab allows you to move up and down the list.

2.1.11 View Fault History / Event Log

Bottom row > Menu button > right > Fault/Event Log button



Example after tapping **Menu > Fault/Event Log**

After you tap the **Fault/Event Log** button, a panel appears showing the Fault/Event history.

You can select to see Fault data only, Events data only or a combined history as shown in this example.

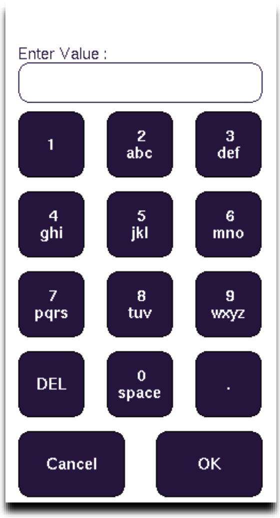
For more information on fault codes and fault finding, refer to the Fault-Finding section of the product manual.

2.1.12 Using the Touch Screen Keypad

For some of the following sections you will need to use the Touch Screen Keypad.

For number fields the keypad will look like this .

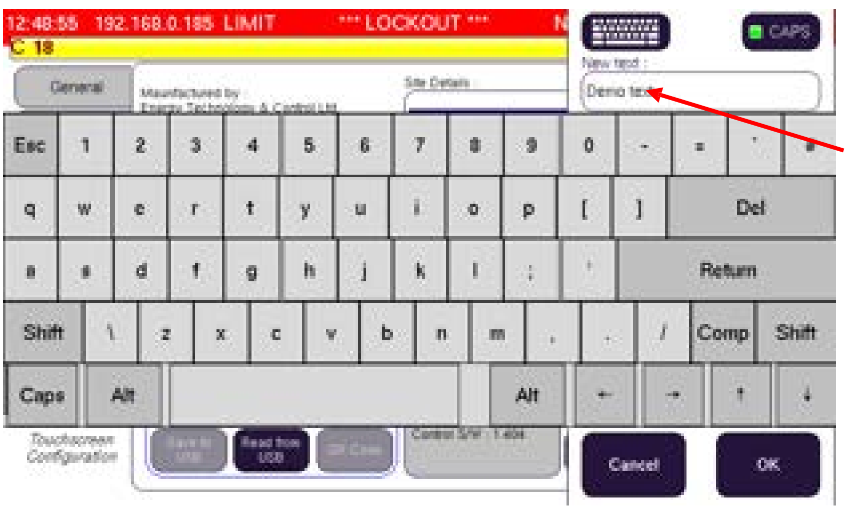
- The buttons are for numbers only, so just tap the numbers.
- To delete a character that you have just entered, tap the **DEL** key, which deletes one character to the left.
- Enter your number as required, then tap **OK** to finish.
- To exit from the keypad without saving changes, tap the **Cancel** key.
-



For mixed text and number fields the keypad looks like this with a **CAPS** button on the keypad. Initially this button is ON, shown by a bright green indicator on the **CAPS** key. When you start typing, the characters will be capital letters.

- The keys work like some mobile phones: if you want the letter '**C**', then you press the '**A**' key three times, A>B>**C**.
- To enter a number, you need to step through the letters first, e.g., press the '**A**' key four times, A>B>C>**2**. Note that for number '**1**' you may need to step through several punctuation characters before number '**1**' appears.
- If you want punctuation marks such as **?**, **%**, **!**, **°**, tap the **1** key and step through the various characters available.
- To delete a character that you have just entered, tap the **DEL** key, which deletes one character to the left.

Alternatively, and much easier, if you tap on the keyboard icon a full keypad will pop-up like this…:



Enter your text and numbers using the keyboard layout, as required, and they will appear in the box *(top-right),* as you can see in this example "Demo text".

Tap **OK** to save the text.

To exit from the keypad without saving your changes, tap the **Cancel** button.

2.1.13 Cleaning the Touch screen

CAUTION

- To prevent possible damage to the Touch screen, make sure you use the correct LCD screen cleaner to clean the screen. Do not use another kind of cleaner - the wrong cleaning fluid may damage the screen.
- DO NOT USE ABRASIVE CLEANERS OR INDUSTRIAL SOLVENTS. These may damage the unit beyond repair. This kind of DAMAGE is NOT covered by warranty or hardware maintenance contracts. Touch screens are expensive to replace.
- Before you try to clean the screen, make sure you select the **Clean Screen** function. This disables the , to prevent unintended operation of the burner controls.
- When you select the **Clean Screen** function, the display keys will be disabled for **20 seconds**. to prevent accidental operation of the burner controls.

Bottom row > Menu button > right > Clean Screen button

Example after tapping **Menu > Clean Screen**

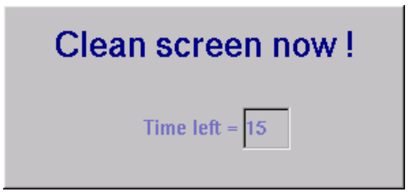
Before you clean the screen, you must select the **Clean Screen** function, to prevent unwanted operation of the screen buttons.

1. Have all your cleaning materials ready.

Clean Screen mode:
2. At the bottom of the screen, tap the **Menu** button.

3. On the right, tap the **Clean Screen** button. A pop-up screen appears, asking you to confirm.

4. To continue, tap **Clean screen**.



There will now be a 20-second count-down to show you how much time you have left to finish cleaning the screen.

2.2 NXTSD007 7” Touch-screen HMI option

The NXTSD007 touch-screen HMI will have a familiar feel to existing users of the 10.4” NXTSD104. However, the boiler and burner mimic feature is not available.

2.2.1 Overview of NXTSD007 Touch screen Operation

This is the format of the Home screen.

There is a status line at the top of the screen.

Key burner operation data is shown here, and the list will expand to show more values depending upon the Option parameter settings.

The Burner Start Sequence list is shown here to indicate the progress through start-up and shut down steps.

The Alarm Mute/Reset button, the Start/Stop button and Menu button are positioned on the right-hand side.

To operate the system, give a firm tap (or press) with your finger on the required button controls on the screen. Do not use a sharp object such as a biro, pencil or metal stylus to operate the Touch screen – you may damage the screen or cause undue wear.

2.2.1.1 Status line colour: Adjust Ratio mode (ORANGE)

If you were to select Adjust Ratio mode, the status line background changes to ORANGE, and you can adjust a limited number of settings:

Adjust mode is identified by an orange status line as shown here.

For more details, see “How to go into Adjust Ration mode (Yellow)” in section 3, Commissioning.

2.2.1.2 Status line colour: Commission mode (RED)

If you select Commission mode, the status line background changes to RED, and you can make and adjust special settings that define how the burner will operate:

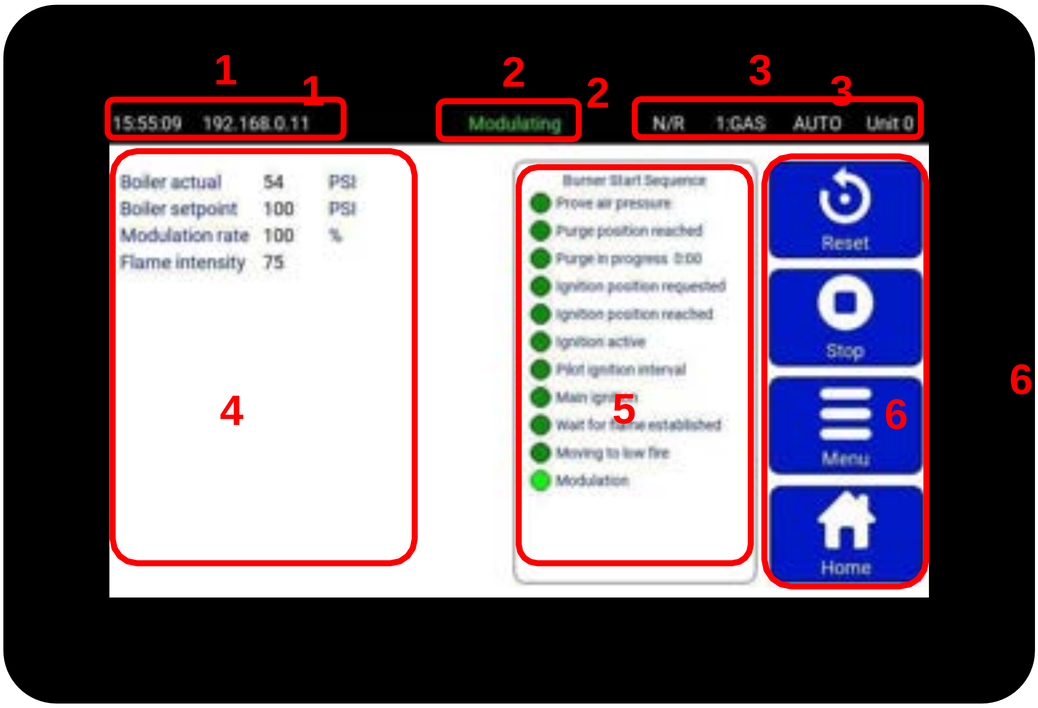
Commission mode is identified by a red status line as shown here.

Because you can only enter Commission mode if the burner is OFF, you cannot monitor certain safety functions such as the Fuel: Air ratio positions.

For more details, see “How to go into Commission mode (Red)” in section 3, Commissioning.

2.2.2 The system Home screen

The Home screen is the normal start screen for the system and shows you a summary of the status of the burner, process inputs and control mode.



The areas numbered in the picture are explained as follows:

1. Time and Ethernet IP address.
2. **Burner Status** at this particular moment in time (Modulation in our example).
3. The current **Burner Operating mode** (e.g., N/R), the Profile number and fuel type (e.g., 1:GAS), the Modulation mode (e.g., AUTO), and the boiler unit address (e.g., Unit 1).
4. Sensor measurement, Set point and modulation data of your boiler, burner and fuel delivery system.
5. The **Burner Start Sequence** shows graphically the steps during the start-up sequence.
6. Dedicated buttons at the right-hand side:
   These buttons perform the following functions:

Mute / Reset	Use **Reset** to reset a burner lockout, to mute alarms, or to test audible alarms. If an alarm is present, the button text changes to **MUTE**.
Start/Stop burner	Starts the burner and Stops the burner at a stage where Stop is valid.
Menu	Used to access Configuration and Adjustment modes.
Home	Returns the screen to Burner Overview mode.

Top-of-screen Indications

The table below shows the Icons and information displayed on the Touch screen above the information panels, and their meaning.

Icon	Description
	A flashing warning triangle may appear in part of the display to indicate a problem. Look for other indications on the screen.
	You see this when CANbus communication is faulty.
	You see this when an Oxygen Interface related fault is present.
	You see this when a passcode has been entered to enable changes to the boiler or burner operation.
COM	You see this when the controller is operating in Commission mode.
MAN	You see this when the controller is operating in MANUAL modulation mode.
AUTO	You see this when the controller is operating in AUTO modulation mode.
N/R **OFF**	**N/R** indicates that the burner is operating in **Normal** or **Remote** mode. This may change to **L(1)** or **L(2)** if a local PID loop set point is forced. This changes to **OFF** when the Burner is OFF
1 Gas	Indicates the current profile number, followed by the fuel type.
Unit 1	Indicates the boiler unit address number that is used by the digital communications system and for data back-up purposes.

2.2.3 Touch screen Lockout mode

If the controller is forced to a Lockout, then the screen will look like this…

The Status bar will show *** Lockout ***

A fault description box will pop up to show the alarm or fault code, subset and date time stamp.

.
Tapping the **Mute** button once will mute the alarm and then the button will change to **Reset** mode.

There are three types of fault alarm:

1. Alarm Only. This will allow the burner to continue to operate, while the alarm is sounding.

If the **Reset** (Alarm Mute) button is pressed while the controller is in this mode and the alarm is sounding, the alarm will be silenced, and the burner will continue to operate.

2. Controlled Shutdown. This will cause the burner to perform a controlled shutdown, and the alarm will sound. After the shutdown condition clears, the burner will restart without the requirement for manual intervention.

- If you tap the **Mute/ Reset** button while the controller is in this mode, the alarm will be silenced, and the burner will remain in controlled shutdown.
- If you tap the **Mute/Reset** button after the controller has restarted following a controlled shutdown, the alarm will be silenced, and the burner will continue to operate.

3. Safety Shutdown. This will cause the burner to perform a safety shutdown, and the alarm will sound. After the fault has cleared, the burner will remain in safety shutdown until a **Mute/ Reset** is performed.

- If you press **Mute/ Reset** button while the controller is in safety shutdown and the fault is still present, the alarm will be silenced, and the burner will remain in safety shutdown. After the fault clears, the alarm will sound once more.
- If you press **Mute/ Reset** button while the controller is in safety shutdown and the fault has cleared, the alarm will be silenced. If you press the button for more than 3 seconds, the burner will re-start.

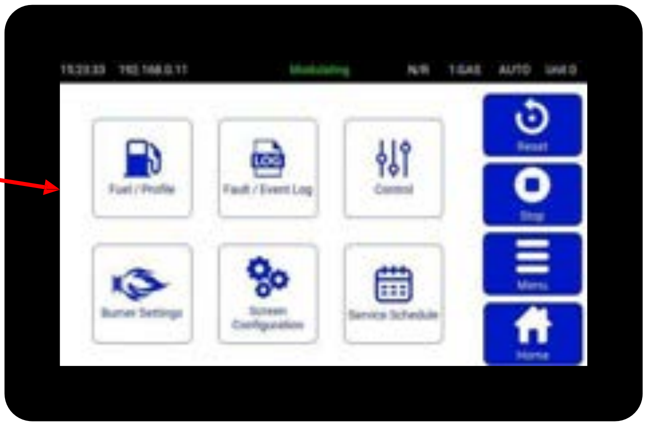
The alarm **Mute** 'button' on the Touch screen is multi-functional.

In normal operation, you can use this to **test the alarms**, by **pressing the button for more than 10 seconds**, after which the alarm relays will activate.

2.2.4 Touch screen ‘Menu’ button

Tapping the **Menu** button will change the screen to reveal a grid of large buttons like this.

From this screen you can select a new display function mode by tapping on one of the buttons.



2.2.5 View Profile (curve) select information

The **Fuel / Profile** button opens this screen which allows the user to change profiles.

To change to a new profile, tap on the profile button that you want to change to.
If you select a new profile, you will be asked to verify the change before the change is made.
Normally the burner will go OFF to change to the new profile that you select.

The “Hours Run” counter for each profile is shown here.

Tap the **Menu** or **Home** button to exit this screen.

2.2.6 View Fault History / Event Log

Side menu > Menu button > Fault/Event Log button

Example after tapping **Menu > Fault/Event Log**

After you tap the **Fault/Event Log** button, a panel appears showing the Fault/Event history.

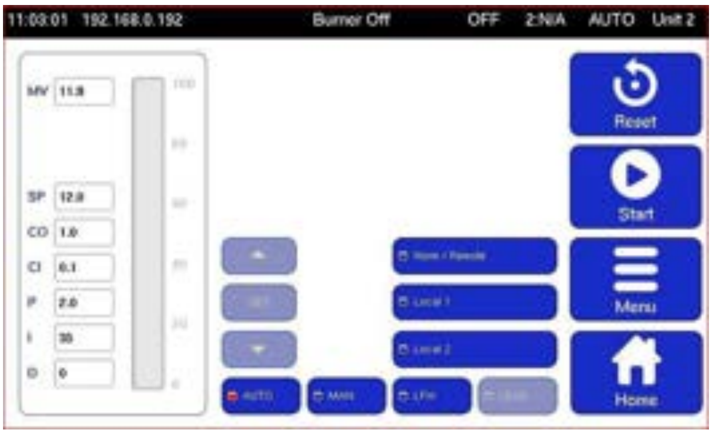
You can select to see Fault data only, Events data only or a combined history as shown in this example.

For more information on fault codes and fault finding, refer to the Fault-Finding section of the product manual.

Tap the **Menu** or **Home** button to exit this screen.

2.2.7 View 'Control' information

Side menu > Menu button > Control button



Example after pressing the **Control** button

After you tap the **Control** button, a panel appears on the right, giving you a choice of options.

If an option is unavailable, it will be 'greyed out'; for example, Manual Modulation may be disabled during commissioning.

If the burner is firing, then the vertical gauge on the left will indicate the modulation rate (0 to 100).

You can.

Subject to passcode priority, you can select Normal, Local, Manual and LFH (Low Fire Hold) from the buttons in the Control panel. You can change the Set-point, PID and Limit values by tapping the value and adjusting it using the up/down arrow buttons.

Tap the **Menu** or **Home** button to exit this screen.

2.2.8 View Burner Settings information

Side menu > Menu button > right > Burner Settings button

Example after pressing **Menu > Burner Settings > Drives**

After you tap the **Burner Settings** button, a panel appears giving you a choice of data types by Tab selection on the left-hand side of the panel.

Tap to select a Tab, and you can view a variety of data.

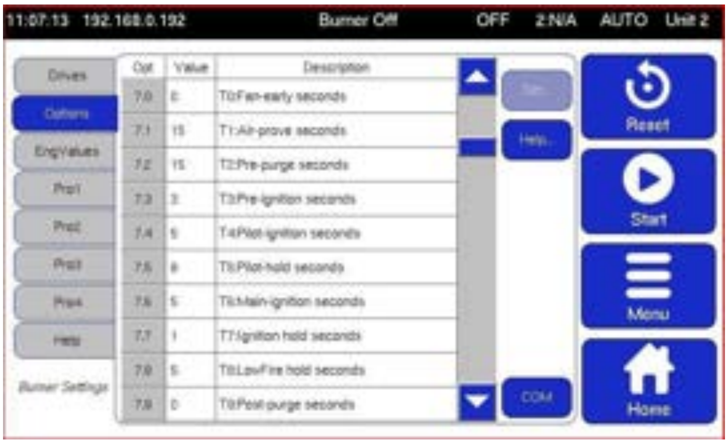
In this example here, you can see the Drive position settings.

Tap the **Menu** or **Home** button to exit this screen.

Tapping the **Options** tab will change the display to show option parameter data indicated by the tab colour changing.

Use the scroll bar to move through the options table to view or set new option values.

Tap the **Menu** or **Home** button to exit this screen.



Example after pressing **Menu > Burner Settings > Options**

Similarly, tapping the **EngValues** tab will change the screen to show the Engineers Key data.

Use the scroll bar to move through the EK table to view the values.

Tap the **Menu** or **Home** button to exit this screen.

Example after pressing **Menu > Burner Settings > EngValues**

2.2.9 Using the Touch Screen Keypad

For some of the following sections you will need to use the Touch Screen Keypad. Refer to 2.1.12 for further instructions.

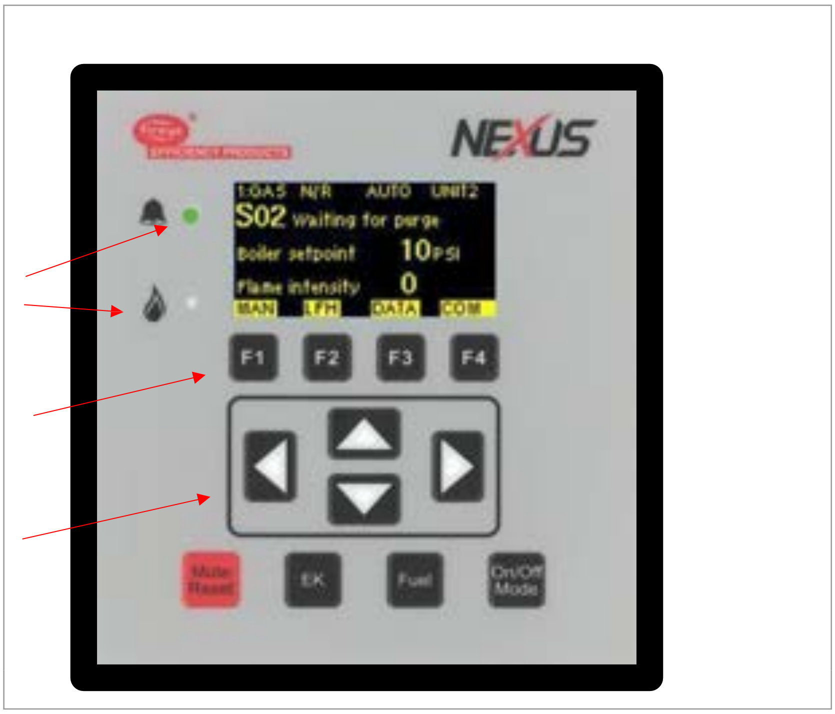
2.3 NX6220 and NX6330 OLED Display & Keypad option

The OLED display supports plain text information in a variety of formats. This display is used for setting up the controller parameters and operating the boiler. The keypad is a membrane construction with tactile keys (you can feel the ‘click’) that gives a positive feedback of the actuation. This unit includes a lithium battery for the clock / calendar / event log functions.

Indication LEDs

Function Keys 1-4
These keys will activate the function as displayed above them on the OLED display

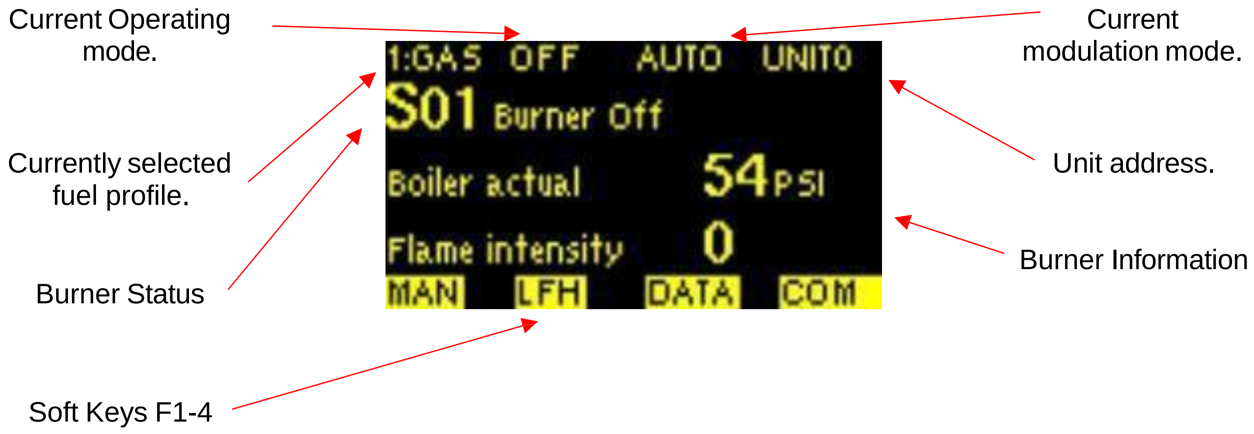
Up/Down, **Left/Right**
These keys are used to navigate the menus and information displayed.



Key	Function
EK	Press this key to select the Status and Engineer's Key Data (EK) modes.
Fuel	Press this key to change the Fuel/Profile. If you change fuel when the burner is firing, the burner will go OFF and then restart, firing the new fuel selection.
On/Off Mode	Press this key to switch the burner ON or OFF, and to enable changes between Normal and Local operation. (For explanation, see section 12. and 2.8.2) Note: Terminal PE9 must be ON for this switch to start the burner.
Mute Reset	Press this key to mute (open) the alarm relays, and then press and hold the key down for approximately three seconds to reset the cleared faults.

2.3.1 System Overview

The system overview is the default information displayed during normal operation of the burner.



Key	Function
F1	Selects the modulation modes (AUTO, MAN and LFH).
F2	Selects the modulation modes (AUTO, MAN and LFH).
F3	Opens the Data screen, which shows further operational data of the controls.
F4	Enters commissioning mode.

2.3.2 Engineers Keys

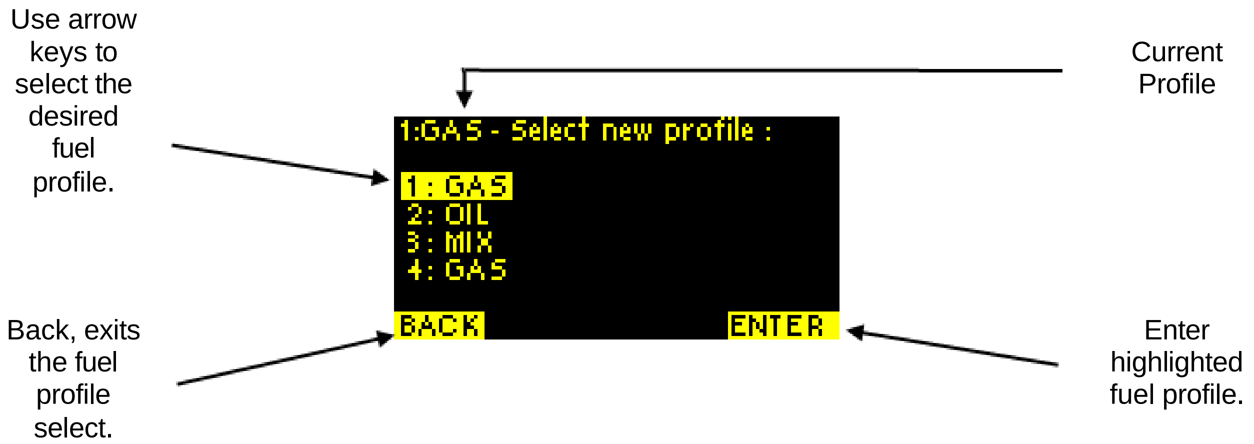
This is the Engineers Key screen, it is used to view the value or status of various control parameters. It is accessed using the Engineers Key on the keypad.

Engineers Keys Screen

Key	Function
F1	Exit Engineers Key screen and return to the system overview.
F2	Set the display time and date, for fault logging.
F3	Displays Ethernet connection information.
F4	Displays the fault log for the display.

2.3.3 Fuel (Profile) Selection

This is the Fuel (profile) selection screen, it is used to switch between fuel profiles. It is accessed using the Fuel key on the keypad.

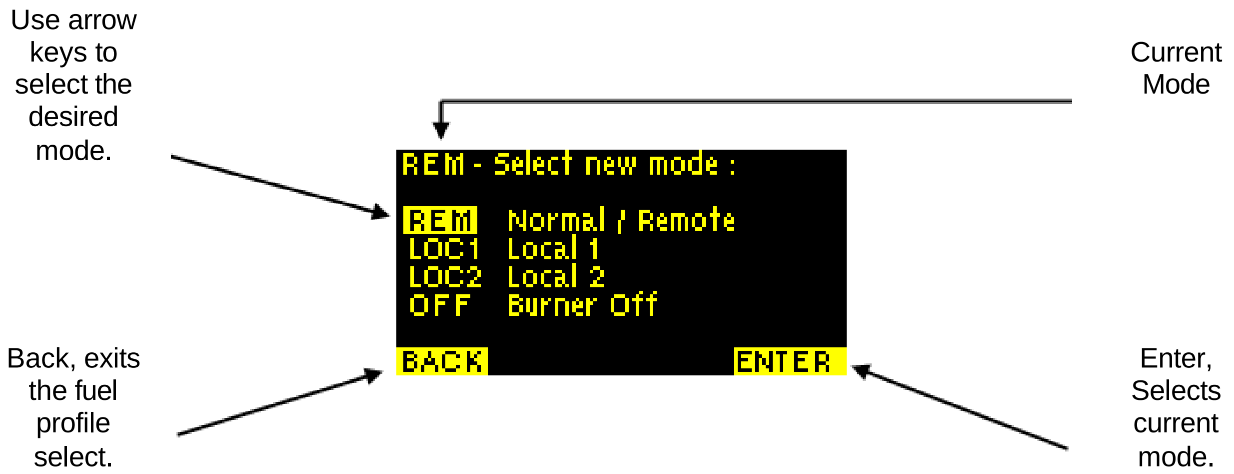


Fuel (Profile) Selection Screen

Key	Function
F1	Go Back to the system overview display.
F4	Selects the current highlighted fuel profile.

2.3.4 On/Off Mode Selection

This is the On/Off Mode screen, it is used to switch between burner operation modes and to also to shut the burner off. It's accessed using the On/Off Mode key on the keypad.

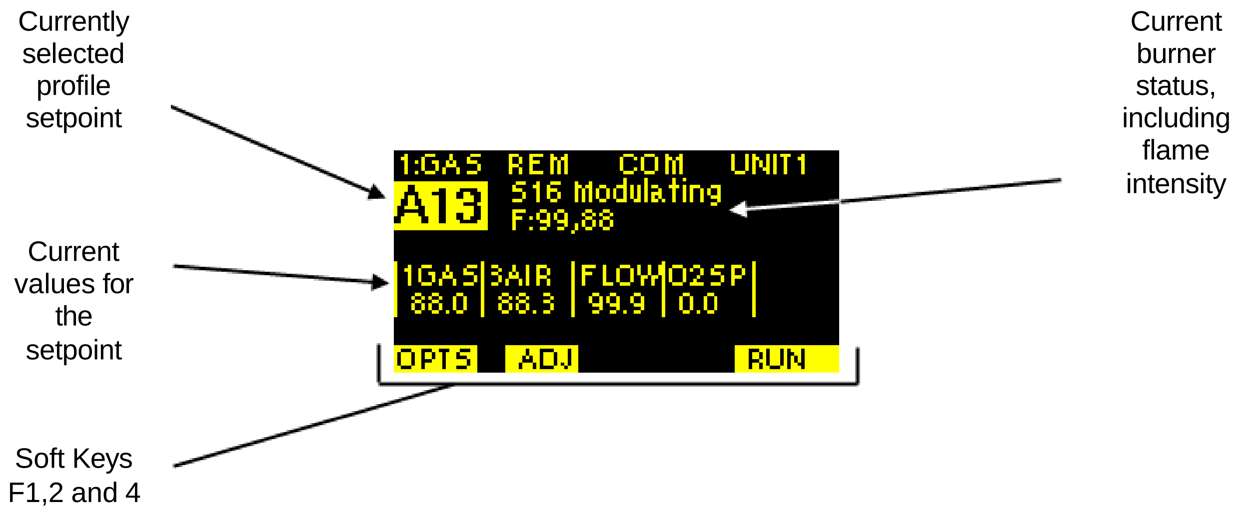


On/Off Mode Screen

Key	Function
F1	Go Back to the system overview display.
F4	Selects the current highlighted burner mode.

2.3.5 Commissioning/Profile Adjust

This is the commissioning and profile adjust screens; they're used to adjust the option parameters and the profile setpoints. These are accessed using the commissioning soft key (F4) from the system overview.



Profile Adjust Screen

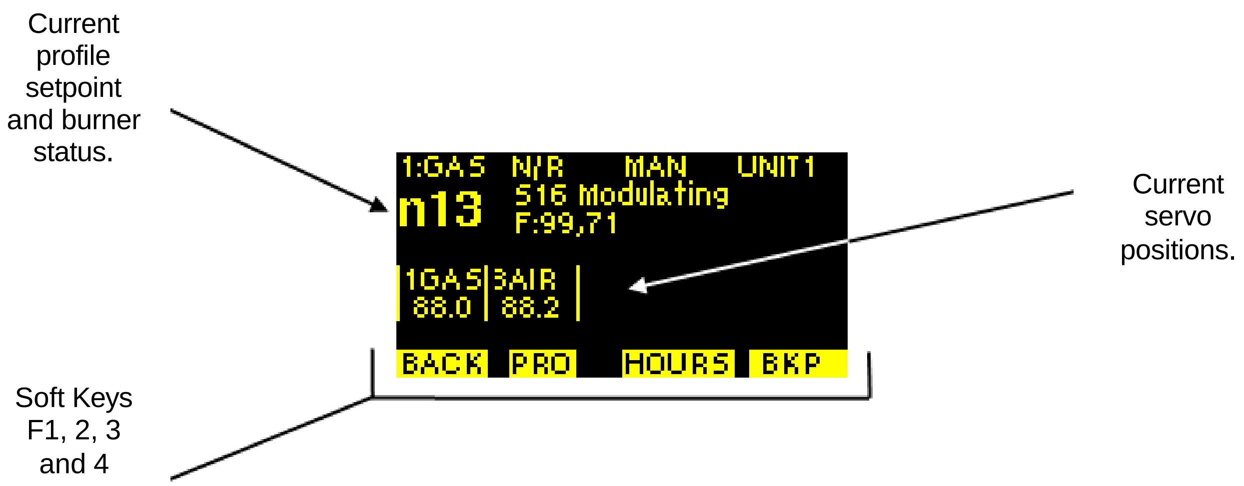
Key	Function
F1	Access option parameters.
F2	Adjust values for the currently selected setpoint.
F4	Exit Commission/Profile Adjust mode.

Commission Screen

Key	Function
F1	Return to Profile Adjust.
F2	Display all option parameters.
F3	Select option parameter group.
F4	Adjust currently displayed option parameter.

2.3.6 Data Screen

This is the Data screen, it is used to view operating data, profiles and backup.

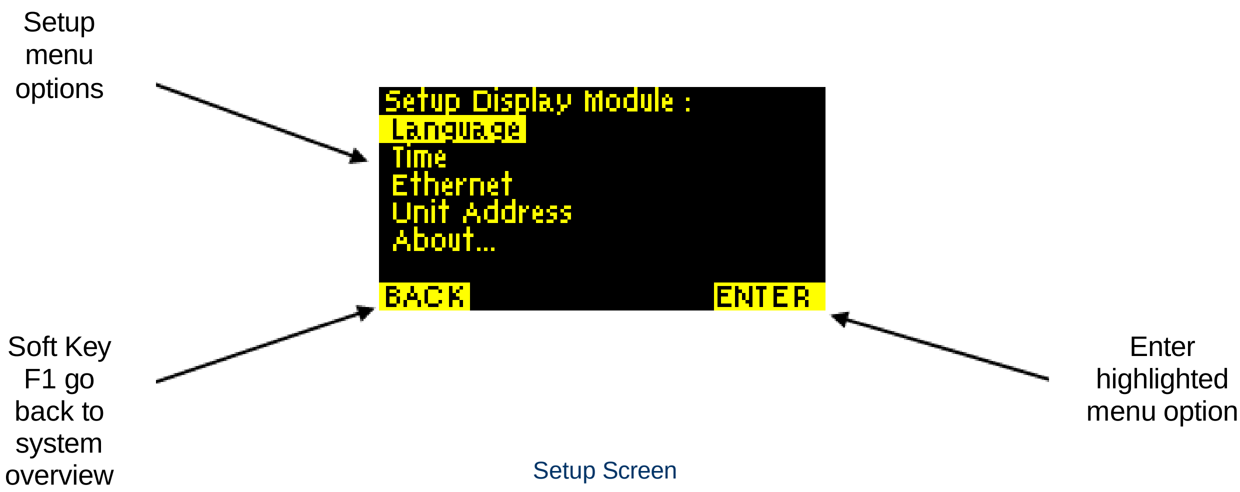


Data Screen

Key	Function
F1	Return to system overview.
F2	View profile setpoints.
F3	View hours run data.
F4	View backup status.

2.3.7 Setup Screen

This is the Setup screen; it is used to adjust various options and view communications data. It is accessed by using commissioning soft key (F4) from the system overview then pressing soft key 2 when prompted to enter the commissioning passcode.



Setup Screen

Key	Function
F1	Return to system overview.
F4	Enter highlighted menu selection.

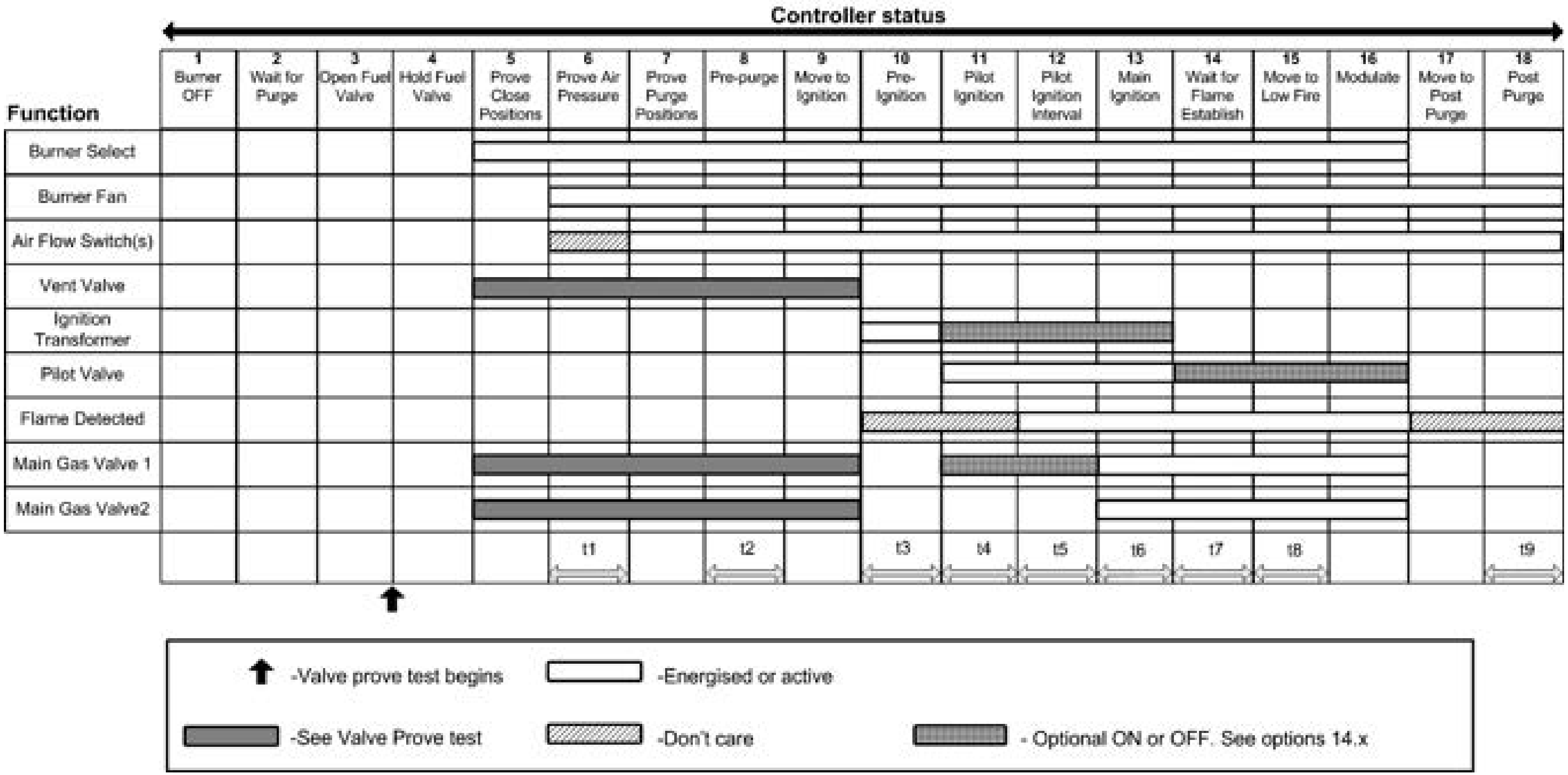
2.4 The Start-up Sequence

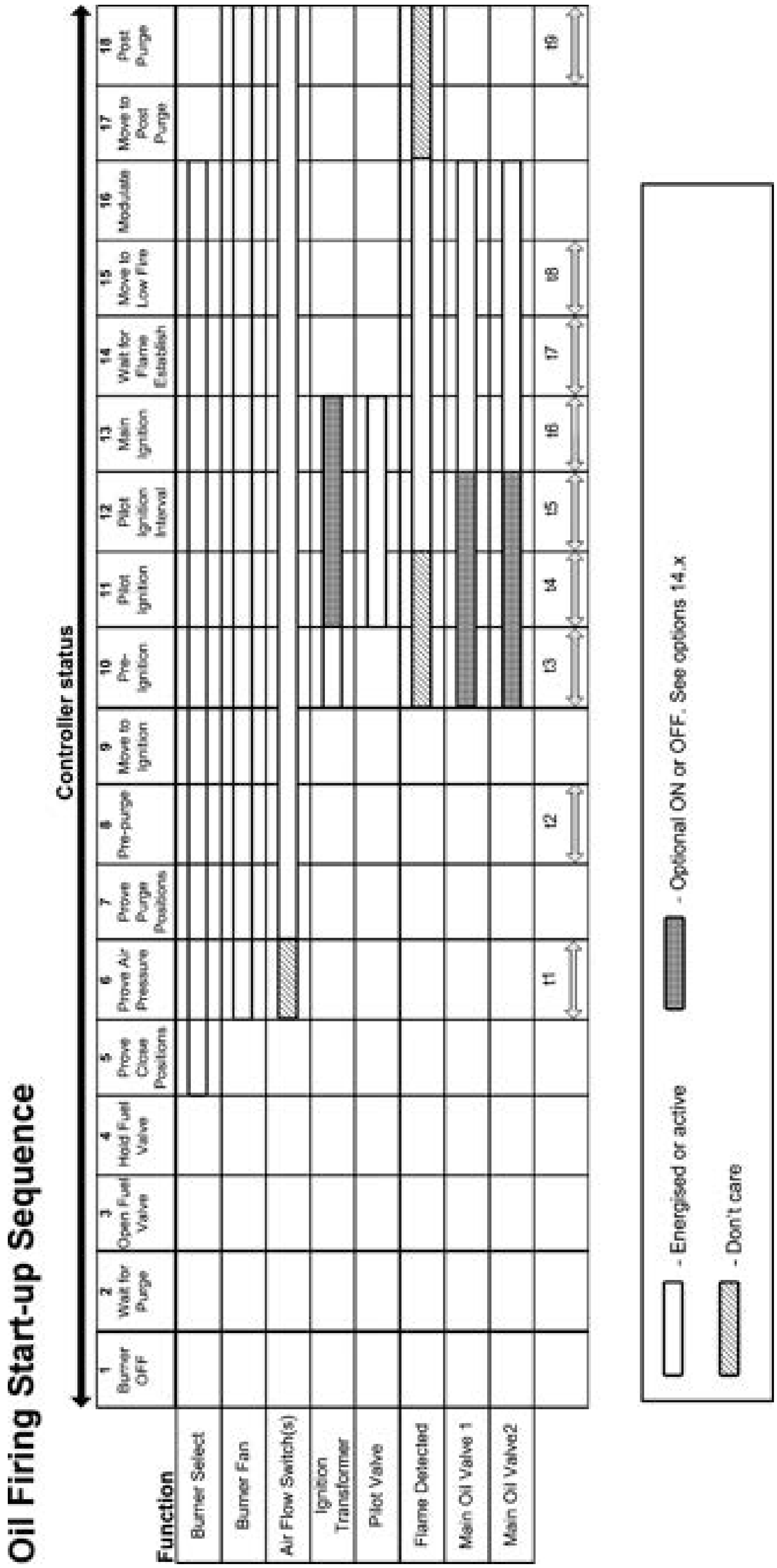
When a fuel selection is made and the 'burner select' signal is given to start the burner, the controller performs the sequence described below.
If a gas profile is selected and the safety valve leak test ("proving") function is selected, then the controller will perform a safety valve pressure leak test concurrently with the start-up sequence.

State no.	State name	Description
0.	Non-volatile lockout	The controller sets all fuel valve outputs OFF and the Alarm output is ON until silenced. The burner remains locked out until all faults are removed.
1.	Burner OFF	The controller checks the burner to make sure that it has switched OFF completely. Testing includes main fuel safety valves closed, no flame signal, and no air pressure signal. The controller will remain in this state until there is a call for heat from the PID system.
2.	Wait for purge	The controller waits for both a burner select (PE9 ON) and a fuel/air profile to be selected. External influences may prevent progression to stage 3 or 5, e.g., Digital Communications control, or digital input controlled by an external circuit.
3.	Open fuel valve	If gas firing and safety valve proving (leak testing) are selected, the gas valve servomotor opens for five seconds to allow any gas in the test section to be vented easily during the leak test sequence.
4.	Hold fuel valve	The fuel servomotor is held in its position until step 1 of the safety valve prove (leak) test sequence (open main valve 2, or vent valve) is completed.
5.	Prove closed positions	If gas is selected, the gas valve prove (leak) test sequence begins (see section 2.5) The fuel and air valve actuating motors are moved to closed position until they stop. The final positions are compared with the closed positions stored in memory when the profile was commissioned.
6.	Prove air pressure	The burner motor output is set ON and the air pressure prove (leak test) time **t1** is initiated. The selected valve actuating motors are moved 'open' towards the purge position. If the 'fan start early' option parameter has been set, then the valve actuating motors will not move until the option time has expired.
7.	Prove purge positions	When the air pressure prove time has elapsed, the air pressure switch must give a 'pressure' signal, or the controller will **lock out** the burner and move to stage 0. If primary air is selected, then both primary and secondary air pressure signals must be ON to prove air pressure. The selected valve actuating motors are driven 'open' until they reach their commissioned purge position.
8.	Pre-purge	After the servomotors are at their purge positions, the controller starts the pre-purge **t2** timer.
9.	Move to ignition positions	When pre-purge time **t2** has elapsed, the fuel and the air valve actuating motors are moved to the ignition position for the selected profile. The controller will wait at the ignition positions while the gas valve prove (leak test) sequence finishes, before progressing to stage 10.
10.	Pre-ignition	After the fuel and air valve actuating motors reach their ignition positions, the ignition transformer output is energized, and pre-ignition time **t3** starts.

State no.	State name	Description
11.	Pilot ignition	After pre-ignition time **t3** has elapsed, the ignition transformer remains ON, the first main valve (if required for pilot flame gas) and the pilot valve outputs are energized, and the first safety time **t4** is started. If firing on oil, and you select ignition to be with both pilot and the main valve, use the timing in the startup sequence table for main valve 1. If firing on oil and you have not selected ignition with the main valve, then pilot ignition will occur with only the pilot valve; use the timing in the startup sequence table for main valve 2. For Gas and Oil profiles, only Gas is available at the moment.
12.	Pilot ignition interval	When **t4** is complete, a flame must be detected, or the controller will lock out the burner and move to stage 0. The ignition transformer may optionally be ON or OFF (See option parameter 14.6). For Gas and Oil profiles, only Gas is available at the moment.
13.	Main ignition	After the pilot interval time **t5** has elapsed, the second (and first if not already open) main valve output(s) for gas, or main oil valve output for oil is energized and the second safety time **t6** is started. If you selected firing on oil and ignition with main valve, then the main oil valve will have already opened for pilot ignition. The ignition transformer may optionally be ON or OFF (see option parameter 14.6). A flame and air pressure signal must be detected, or the controller will lock out the burner and move to stage 0. For Gas + Oil profiles, Gas and Oil are available now.
14.	Wait for Main flame established	When **t6** has expired, the pilot valve output is turned OFF. If permanent pilot is selected and the burner is firing on gas, then the pilot will remain open with the main valves. Main flame interval time **t7** starts. A flame and air pressure signal must be detected, or the controller will lock out the burner and move to stage 0.
15.	Moving to Low Fire or at Low Fire **t8**	When main flame interval time **t7** has elapsed, the flame is considered established, and the fuel and air valve actuating motors are moved from their ignition positions to their Low Fire positions and held at Low Fire for the duration of the Low Fire Hold Time **t8**. A flame and air pressure signal must be detected, or the controller will lock out the burner and move to stage 0.
16.	Modulation	When **t8** has elapsed, the fuel and air valve actuating motors are modulated according to the demand placed on the burner. If the fuel selection is changed or the ‘burner ON’ signal (PE9) is removed, the main valve output(s) are turned OFF. A flame and air pressure signal must be detected, or the controller will lock out the burner and move to stage 0.
17.	Move to post-purge	If Post Purge is **not** programmed, then the controller returns to state 1 to wait for another startup command. If Post Purge has been selected, then the fuel servomotor is moved to its closed position, and the selected air motor(s) are moved to their post purge position(s).
18.	Post-purge	When the air drive(s) have reached their post purge positions then the Post Purge Time **t9** is started. When **t9** has elapsed, the burner motor is turned OFF and the controller returns to state 1 to wait for another startup command.

Gas Firing Start-up Sequence





Oil Firing Start-up Sequence
Controller status
Function
1 Burner OFF
2 Wait for Purge
3 Open Fuel Valve
4 Hold Fuel Valve
5 Prove Close Positions
6 Prove Air Pressure
7 Prove Purge Positions
8 Pre-purge
9 Move to Ignition
10 Pre-Ignition
11 Pilot Ignition
12 Pilot Ignition Interval
13 Main Ignition
14 Wait for Flame Establish
15 Move to Low Fire
16 Modulate
17 Move to Post Purge
18 Post Purge
Burner Select
Burner Fan
Air Flow Switch(s)
Ignition Transformer
Pilot Valve
Flame Detected
Main Oil Valve 1
Main Oil Valve2
t1
t2
t3
t4
t5
t6
t7
t8
t9
- Energised or active
- Optional ON or OFF. See options 14.x
- Don't care

2.5 Flame detection

The NX6100 control can validate the presence of a flame from a variety of devices. The choice of detection device will depend upon the burner application and the fuel type(s) used in the combustion process.

The control have 250Vac terminals suitable for Flame Ionisation or UV detection tubes, and 5Vdc terminals for dry-contact connection or light dependent resistor devices.

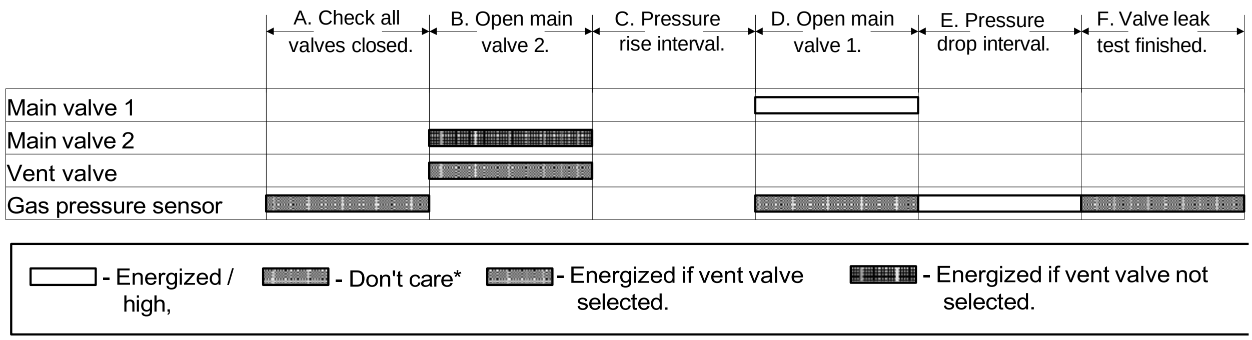
The NX609x Flame detectors are shuttered UV detectors, suitable for continuous operation of burner plant.

2.6 Gas Safety Valve Leak Test (VPS) using FIREYE fail-safe sensors.

If the gas valve leak (prove) test has been programmed and a gas profile is selected, then the controller will start the gas safety valve leak test sequence on stage 5 of the start-up sequence. If any step of the gas valve leak test sequence fails, the controller will perform a non-volatile lockout, and lock out the burner.

Step	Function	What happens
1.	Open main valve 2	Main valve 2 (or the vent valve) is opened for the first safety time **t4**, or 3 seconds (whichever is the smaller). If main valve 2 (or the vent valve) does not open, the controller will indicate a fault. The system checks that the test section pressure is below 15% of nominal gas pressure.
2.	Pressure rise interval	All valves are closed, and the gas pressure is monitored for t_{test} seconds. During this time, the test section pressure must not rise by more than P_{test}. If this occurs, the controller will indicate a fault.
3.	Open main valve 1	Main valve 1 is opened for the first safety time **t4**, or 3 seconds (whichever is the smaller). If main valve 1 does not open, the controller will indicate a fault.
4.	Pressure drop interval	All valves are closed, and, after a pre-set delay of 10 seconds, the gas pressure is monitored for t_{test} seconds. During this time, the test section pressure may not drop by more than P_{test}. If this occurs, the controller will indicate a fault. The system also checks that the test section pressure is between the low gas pressure limit and high-pressure range of the sensor.
5.	Valve test (prove) finished	The gas safety valves have been proved satisfactorily, and the controller may proceed with ignition. The sequence remains in state 5 until the burner is switched OFF. The gas pressure high and low limits will be checked for burner status between 11 and 16.

Valve leak test sequence



For the leak test sequence, t_{test} is given by the following formula:

$$t_{test} = \frac{3600.V.P_{test}}{(P_{atm} + P_G + P_{test}).Q}$$

Where: V = Volume of test section (l)

P_G = Measured gas pressure above atm. (mbar)

P_{test} = Max. test pressure drop/rise (mbar)

P_{atm} = Atmospheric pressure (1013 mbar)

Q = Maximum permitted leakage rate (l/hr)

The controller automatically calculates P_{test} and t_{test} based on the entered gas pressure, test volume and leakage rate. During the calculation, the controller chooses P_{test} to keep t_{test} low and avoid lengthy pre-purges. You can see the calculated values of P_{test} and t_{test} in the Engineer's Key EK data.

Note: The actual units used for the calculation may vary from the above. See option parameter 10.0.

2.7 Gas Safety Valve Leak Test (VPS) using a pressure switch

If the Gas Valve prove leak (prove) test is enabled and a gas profile is selected, the controller will begin the gas safety valve leak test sequence on stage 5 of the start-up sequence. If any step of the gas valve leak test sequence fails, the controller will perform a non-volatile lockout of the burner.

The pressure between the gas valves is tested using a single pressure switch. The following sequence expects the switch contacts will be **closed** if the pressure is **>50%** of nominal, and **open** if **<50%** nominal.

Step	Function	What happens
1.	Open main valve 2	Main valve 2 (or the vent valve) is opened for the first safety time **t4**, or 3 seconds (whichever is the smaller). If main valve 2 (or the vent valve) does not open, the controller will indicate a fault.
2.	Pressure rise interval	All valves are closed, and the gas pressure is monitored for t_{test} seconds. During this time, the test section pressure may not rise by more than P_{test}. If this occurs, the pressure switch will close, and the controller will indicate a fault.

3.	Open main valve 1	Main valve 1 is opened for the first safety time **t4**, or 3 seconds (whichever is the smaller). If main valve 1 does not open, the controller will indicate a fault.
4.	Pressure drop interval	All valves are closed, and after a pre-set delay of 10 seconds the gas pressure is monitored for t_{test} seconds. During this time, the test section pressure may not drop by more than P_{test}. If this occurs, the pressure switch will open, and the controller will indicate a fault.
5.	Valve prove finished	The gas safety valves have been proved (tested) satisfactorily and the controller can proceed with ignition. The sequence remains in state 5 until the burner switches OFF. The High gas pressure and Low gas pressure switches are monitored between burner status 11 and 16.

The valve leak test sequence diagram is the same as shown in 2.4 The Start-up Sequence above.
For the leak test sequence using a single pressure switch, t_{test} is given by the following formula:

$$t_{test} = \frac{3600.V.P_{test}}{(P_{atm} + P_G + P_{test}).Q}$$

Where: V = Volume of test section (l)

P_G = Nominal gas pressure above atm. (mbar)

P_{test} = Max. test pressure drop/rise (mbar)

P_{atm} = Atmospheric pressure (1013 mbar)

Q = Maximum permitted leakage rate (l/hr)

The controller automatically calculates t_{test} based on the entered nominal gas pressure, test volume and leakage rate. During the calculation, the controller will use P_{test} as 50% of nominal gas supply pressure P_G. The values being used for t_{test} and P_{test} can be seen on EKs 52 and 53.

The test switch **must** be connected to input 7, PB14 – PB17, and set to operate at P_{test}, which is 50% of nominal gas pressure. Option parameter 10.0 must be set to zero, options 10.2, 10.5 and 10.6 must have accurate values, and option 10.8 must be set to a value of 1 or more for the system to operate correctly.

Note: The units used for option parameters and calculations, when using a single pressure switch, will be mbar.

2.8 Modulation of the Burner

"Modulation" means varying the burn fire-rate.

During stage 16 (modulation), the controller will position the fuel and air valve actuating motors within the programmed profile appropriate to the requirement for heat. The controller has two modes of operation using the standard FIREYE modulation functions, Normal and Local. The mode of operation is set via the keypad by pushing the “Burner ON/OFF” key and selecting the mode.

2.8.1 Normal mode

In Normal mode, the modulation rate is determined by the internal PID control settings, or by Manual modulation from the keypad, or by one of the following remote influences:

- Auxiliary modulation input
- Digital set point selection
- Serial communications – ComFire2 or Lead/Lag.

2.8.2 Local mode

In Local mode, the internal PID settings or Manual modulation via the UP/DOWN keys determine the modulation rate. It ignores external modulation inputs and set point selection inputs.

When “Local1” is displayed, the burner is running using the Set point 1 PID settings.

When “Local2” is displayed, the burner is running using the Set point 2 PID settings.

2.9 Non-volatile lockout

Non-volatile is a state that cannot be changed by removing power to the device. The state can only be changed by a pre-determined sequence of actions, such as key presses.

Non-Volatile lockouts cannot be cleared without operator intervention and are stored in memory if power is removed from the controller.

A non-volatile lockout will occur under the following conditions:

- If any step of the gas leak test sequence fails
- In stages 1-9 (inclusive) if a flame is detected
- In stages 11-16 (inclusive) if a flame is not detected
- In stage 4 if the air pressure switch goes high (air pressure present)
- In stages 7-18 (inclusive) if the air pressure switch goes low (air pressure not present)
- In stages 5, 7 and 8, stages 10-16 (inclusive) and stage 18 if a motor is not in the correct position
- In any stage, if an internal or external fault not previously mentioned occurs which may affect the safe operation of the burner, refer to “Fault Finding” in section 5.

2.10 NXDBVSD VFD Interface - extra information

An VFD drive unit provides variable-frequency electrical power for varying the speed of a pump or fan motor.

The NX6100 may have an optional daughter board within the main enclosure to allow control of 1 or 2 VFD drive units (daughter board dependent).

Feedback may be in the form of 4-20 mA signals or from encoders measuring the speed of the relevant motor, fan or pump shaft. There is also an option to allow the speed of an additional rotary device to be measured from an encoder input, e.g., atomizing cup.

When not configured to control an VFD, the 4-20 mA outputs may be configured to transmit system variables as current outputs.

There are special wiring requirements for VFD feedback – see “Wiring Requirements” in section 2, Installation and Wiring.

2.11 Post Purge Operation

If a post combustion purge is selected (with option parameter 7.9), a normal shutdown post purge will be performed. The drives will move to the option defined purge position (if not already there) and the post-purge time will then start. If the burner has turned OFF because the fuel profile selection has been changed, then no post-purge will be performed.

If the burner locks out, at or after ignition, and post-purge is configured, then the controller will also attempt a post purge. For a flame failure fault, the controller will attempt to post purge at High Fire. For all other faults, the drives will stay at the positions they were in when the lockout occurred. In both cases, the post-purge time starts at the instant that the lockout occurs – the controller does not wait for drives to position before starting the post-purge time.

——— End of Section 1 ——

3. Section 1 Update History

New version	Date		Changes in brief
V1pt4D	May 2022	GFS	Updates to sections 2.1.12, 2.2.9, 2.6, 2.8.
V1pt4D	June 2024	RAL	Created Fireye Document.

Section 2: Installation

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1. How to Install and Wire the System

This section contains basic installation information concerning the choice of controller and servomotor environment, wiring specification and connection details.

WARNING

EXPLOSION OR FIRE HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY OR DEATH

- **To prevent possible hazardous burner operation, you must verify the safety requirements each time a control is installed on a burner, or if the installation is modified in any way.**
- **This manual may cover more than one model in the NX6100 series. Check for additional information at the end of this chapter.**
- **This control MUST NOT be directly connected to any part of a 'Safety Extra Low Voltage' (SELV) circuit.**

WHEN INSTALLING THIS PRODUCT:-

- Read these instructions carefully. Make sure you fully understand the product requirements. Failure to follow them could damage the product or cause a hazardous condition.
- Check the ratings given in these instructions to make sure the product suits your application.
- After installation is complete, check that the product operates as described in these instructions.

CAUTION

- Disconnect the power supply before beginning installation, to prevent electrical shock, equipment and/or control damage. More than one power supply disconnect may be involved.
- Wiring must comply with all applicable codes, ordinances, and regulations.
- Loads connected to the NX6100 series must not exceed those listed in the specifications as given in this manual.
- All external components connected to the control must be approved for the specific purpose for which they are used.
- Choose the servomotors carefully to make sure they operate within their specification.
- Make sure all sections of the control are earthed, to maintain electrical safety.

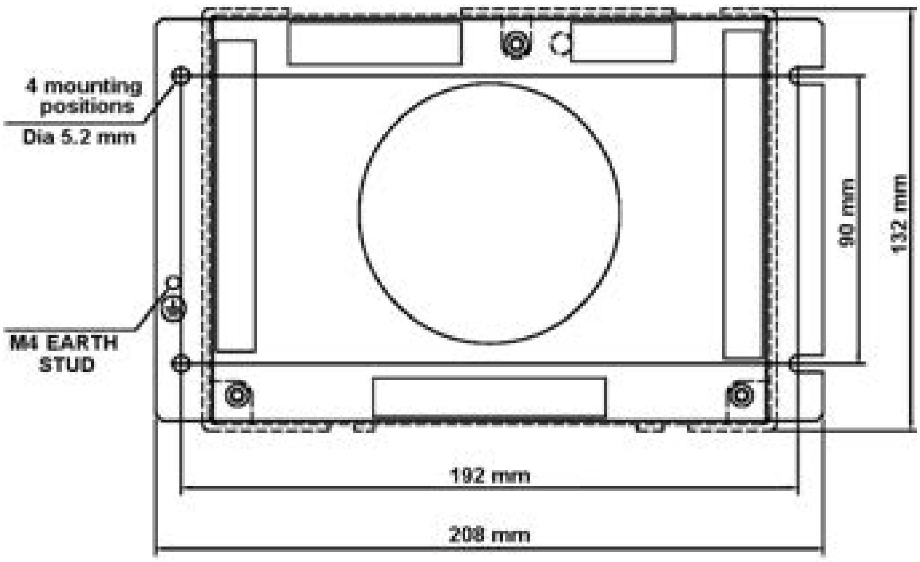
1.1 Mounting details for the NX6100 series Controller Module

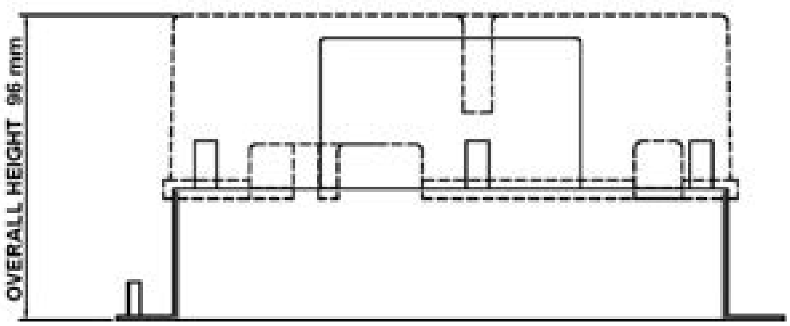
The control unit has been designed for fitting inside a burner control cabinet. The cabinet should have a minimum protection level of IP40 for indoor use, or IP54 for outdoor use.

The control unit can be mounted in any orientation.

Leave a clearance of a least 60 mm (2.5 in.) around the unit to allow sufficient space for wiring, and to ensure reliable operation.

Mounting details:



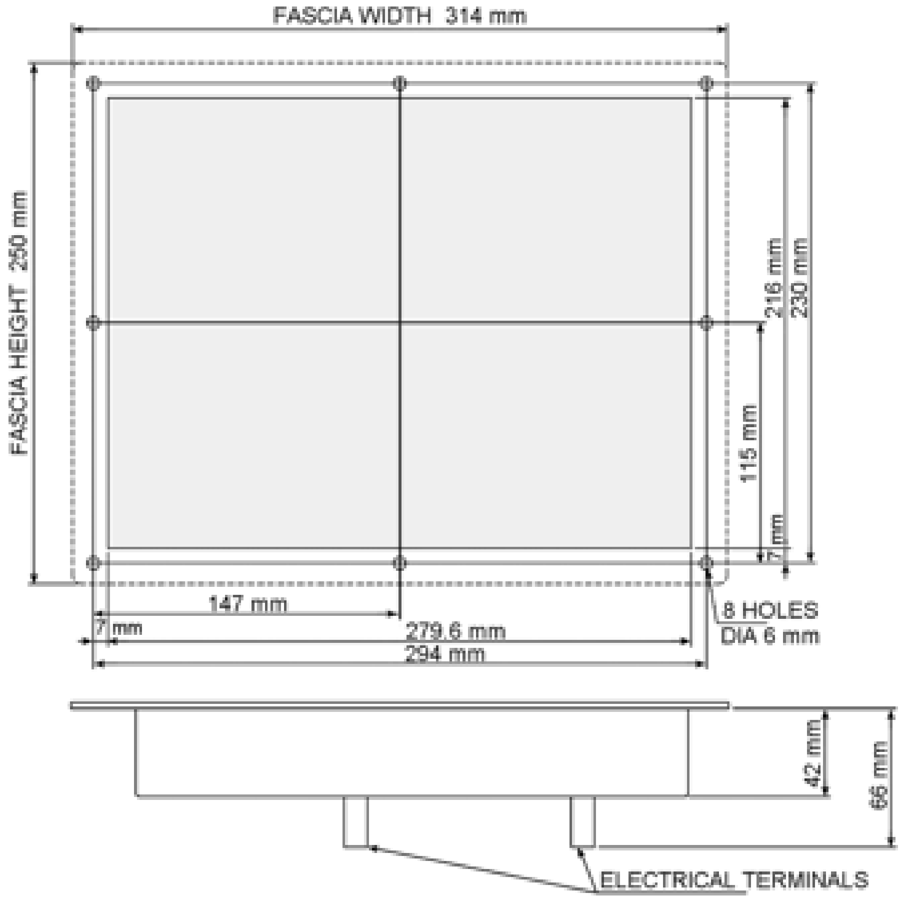


The controller must be installed in a clean environment that meets EN6730-1, and where the ambient temperature is within the range 0 to 60 °C (32 to 140 °F). Refer to section 6, “Specifications” for more details.

Allow 100 mm (4 in.) for the depth of the controller including the lid and LED window. Provide additional clearance as required.

The controller MUST be earthed to maintain electrical safety and ensure reliable operation.

1.2 Mounting details for the Touch Screen display option



Mount the Touch screen on the front of the burner cabinet, or similar location. If possible, avoid reflections from windows or boiler house lighting when planning the location of the screen.

The maximum allowable cabinet wall thickness is 7 mm (0.276 in.).

Install the Touch screen so that the part within the panel is in a PD1 or PD2 environment according to EN6730-1, and the ambient operating temperature range of the equipment is 0 to 60 °C (32 to 140 °F).

With the sealing gasket installed between the panel and the Touch screen, the protection from ‘outside’ the panel will be IP65.

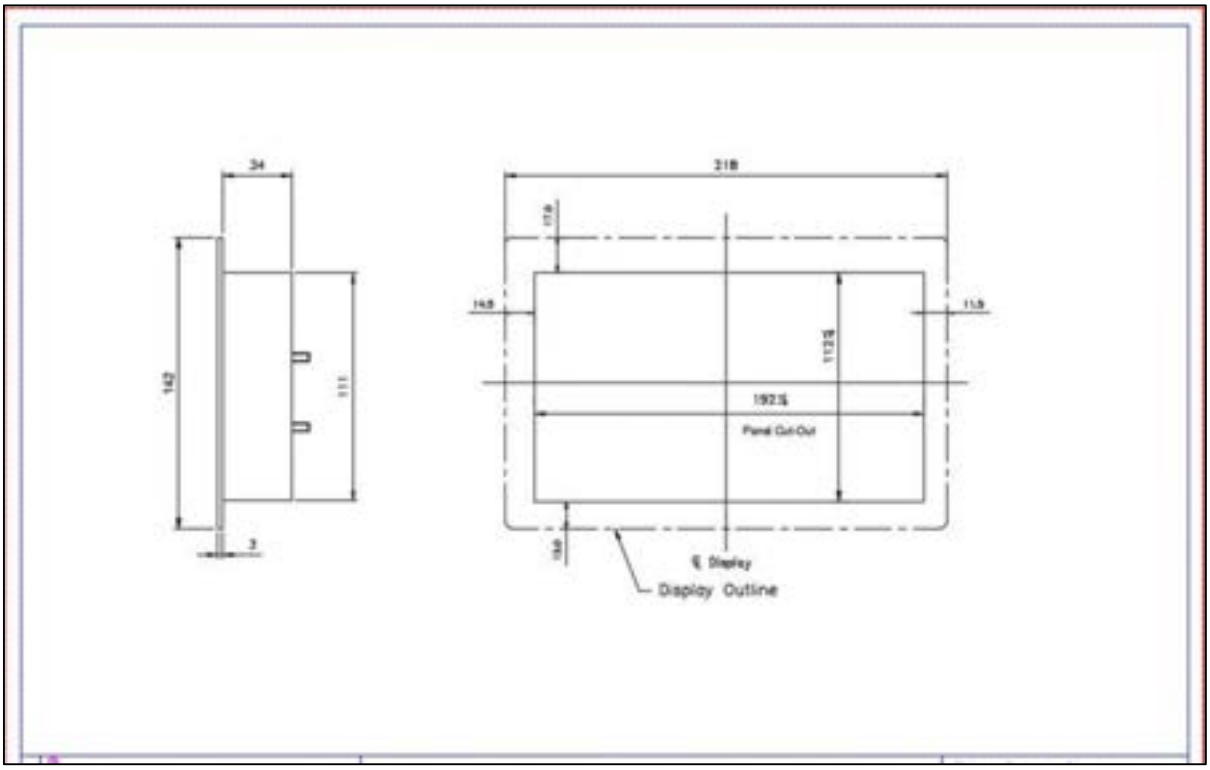
WARNING

- **The Touch screen chassis earth point MUST be earthed to maintain electrical safety and ensure reliable operation.**
- **The screen of the CANbus cable is NOT designed to provide the earth connection for the Touch screen display. Therefore, you must make a separate earth connection using the largest cross-section area cable possible.**

1.3 Mounting details for the 7” Touch-screen display option

The NXTSD007 HMI is designed to be mounted in the front door of an electrical panel. This requires an aperture to be cut in the panel door and then the HMI is offered up to the door, to thread the rear cover through the aperture.

Aperture dimension drawing.



Screw-jack clamps are supplied with the NXTSDXXX HMI to fix it in-place. The clamps provide tension to compress a molded gasket between the panel front and the HMI fascia plate which makes a waterproof seal. The colored material applied to the screw threads prevents any vibration in the panel from loosening the screws when the HMI is fixed in place.

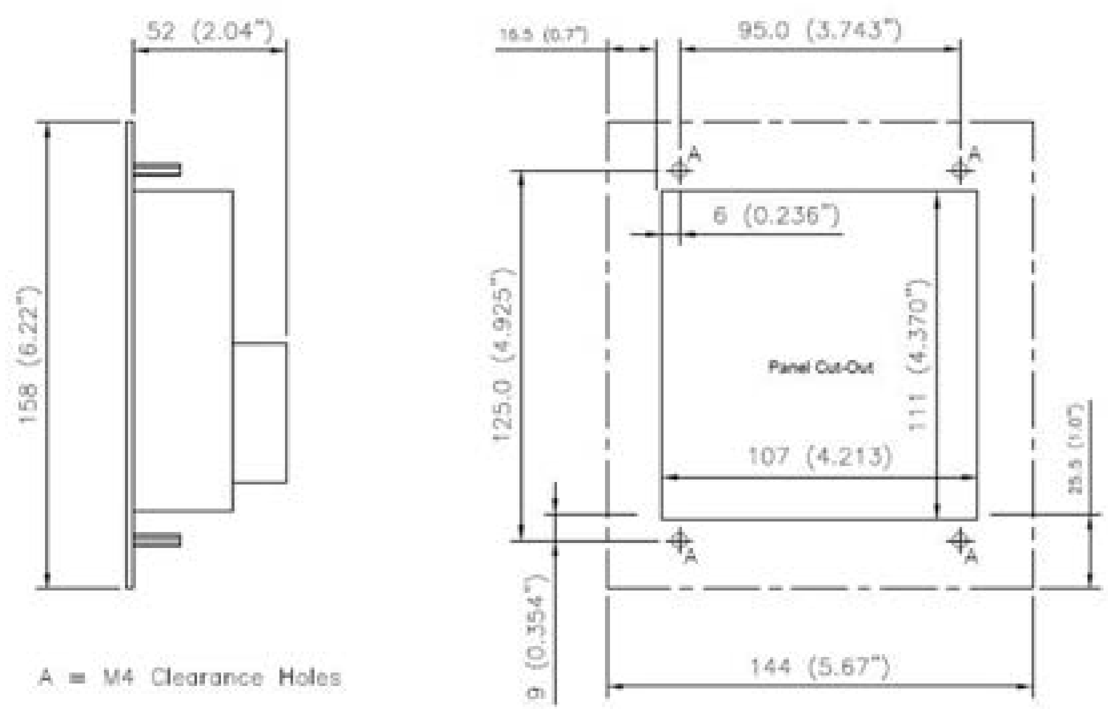
The clamps are put into place like this, then the hexagon cap head clamp screws (3mm AF) are tightened evenly.

3.

until the fascia plate of the HMI is tight to the panel door forming a IP65 seal to the door front surface.

There are two clamp mounting apertures in the HMI cover, this is to cater for different panel thicknesses. In most applications the apertures closest to the fascia plate should be used.

1.4 Mounting details for the 12 Key Display option



Mount the display on the front of the burner cabinet, or in a similar accessible location.

The maximum allowable panel thickness is 3 mm (0.118 in).

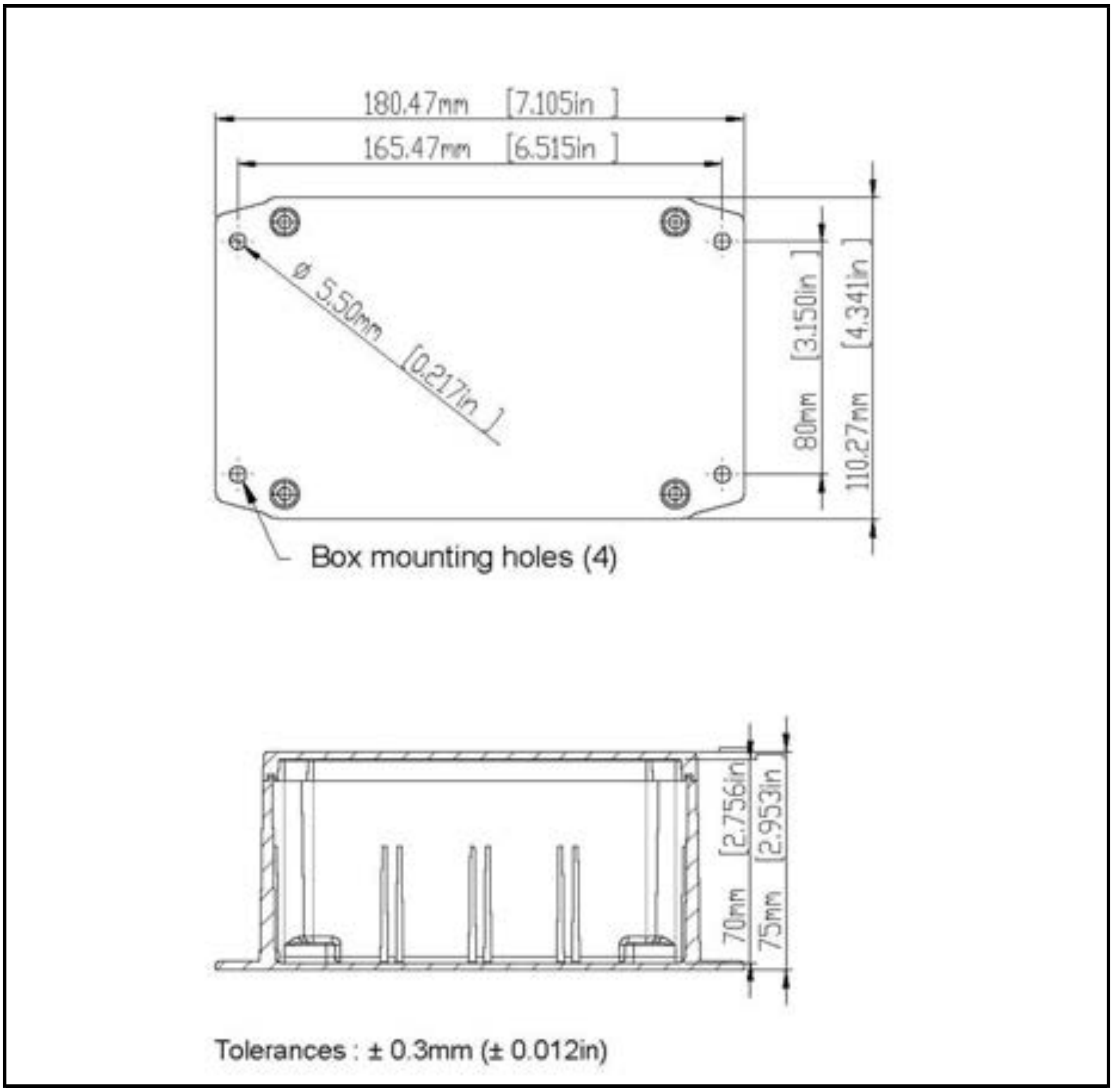
Install the display such that the section within the panel is in a clean environment, according to EN6730-1. The ambient operating temperature range of the equipment is 0 to 60 °C (32 to 140 °F).

With the sealing gasket installed between the panel and the display, the display unit 'outside' of the panel will provide protection to IP65.

The display unit MUST be earthed to maintain electrical safety and ensure reliable operation. An earth terminal is provided on the back cover of the display unit. Connect the screen of the CANbus cable to this earth connection point.

1.5 Mounting details for the Oxygen Probe Interface option

The NXO2TRIM oxygen trim interface enclosure has different dimensions and mounting points, compared to the original design. The following drawing gives the dimensional information, and the details required to fix the interface to a wall or panel surface.



If you use suitable conduit glands, the NXO2TRIM Oxygen Probe Interface unit has a protection level of IP65. You can mount it in any orientation, either inside or outside a control cabinet.

Maintain a clearance around the conduit entries to the unit to allow sufficient space for wiring Fireye. The ambient operating temperature range is specified as 0 to 60 °C (32 to 140 °F).

The Oxygen probe interface MUST be connected to earth to maintain electrical safety and ensure reliable operation. The Earth connection point is symbolized on the mounting 'ears' of the enclosure.

1.6 Mounting arrangements for FIREYE Boiler and Burner Sensors

For full technical specifications of sensors, see “Specifications” in section 6.

1.6.1 Boiler Temperature sensors

The temperature sensor has a protection level of IP65 if suitable conduit glands are used, and it can be mounted in any attitude. It has been designed for mounting into a well, or pocket, that has been inserted into the boiler shell. When choosing the position of the well, make sure that the sensor will operate within its environmental specifications, and that the position will allow measurements and subsequent control actions to be correlated to other devices e.g., auxiliary safety stats.

The ambient operating temperature range is 0 to 60 °C (32 to 140 °F).

The sensor must be electrically earthed to maintain electrical safety, and to ensure reliable operation.

The electrical connection may be one of two methods:

- conduit connection M16.
- a 12mm plug and socket arrangement.
- ½ Conduit Adaptor P/N 35-336

1.6.2 Gas Pressure sensors

The preferred mounting for the gas pressure sensors is **vertically**, to make sure water vapor does not collect inside the sensor.

Maintenance procedures must include inspecting the inspected for evidence of condensates from the gas at the sensing point.

If evidence of condensate is found, then you must take preventative action to eliminate the cause.

The ambient operating temperature range is 0 to 70 °C (32 to 185 °F).

The sensor must be electrically earthed to maintain electrical safety, and to ensure reliable operation.

The electrical connection may be one of two methods:

- conduit connection PG7.
- a 12mm plug and socket arrangement.
- Fireye ½" Conduit Adapter P/N 35-371

Example pressure sensor

1.6.3 Steam Pressure Sensors

When fitting the sensor, make sure that the sensor operates within its environmental specifications. An important issue is the heating effect of the steam. Also, connect the sensor to the process in such a way that readings, and subsequent control actions, can be correlated to other devices, such as the boiler pressure dial gauge and any auxiliary safety stats.

Steam Pressure sensors **must be mounted vertically** to make sure that water vapor does not collect inside the sensor. Additional devices, e.g., a "pig tail" feed pipe, may be required to reduce the possibility of moisture reaching the sensor during normal operation.

Maintenance procedures must include inspecting the sensor for evidence of condensation collecting at the sensing point. If evidence of condensate is found, then preventative action must be taken to eliminate the cause.

Example pressure sensor

The ambient operating temperature range is 0 to 70 °C (32 to 185 °F).

The sensor must be electrically earthed to maintain electrical safety, and to ensure reliable operation.

The electrical connection may be one of two methods:

- conduit connection PG7.
- a 12mm plug and socket arrangement.
- Fireye ½" Conduit Adapter P/N 35-371

1.6.4 Combustion Air Pressure sensor

The NX6087-X combustion air pressure sensor connects to the burner air duct to measure the pressure of the air being delivered to the combustion process. There is provision for this measurement to be a gauge or differential pressure measurement.

The preferred mounting for the NX6087-X combustion air pressure sensors is **vertically**, to make sure water vapor does not collect inside the sensor.

The ambient operating temperature range is 0 to 70 °C (32 to 185 °F).

The sensor <u>must</u> be electrically earthed to maintain electrical safety, and to ensure reliable operation.

The electrical connection is a 12mm plug and socket arrangement.

The conduit connection for gas pressure sensors is PG9, an adaptor for $^1/_2$" NPSL is available.
Fireye $^1/_2$" Conduit Adaptor PN35-371.

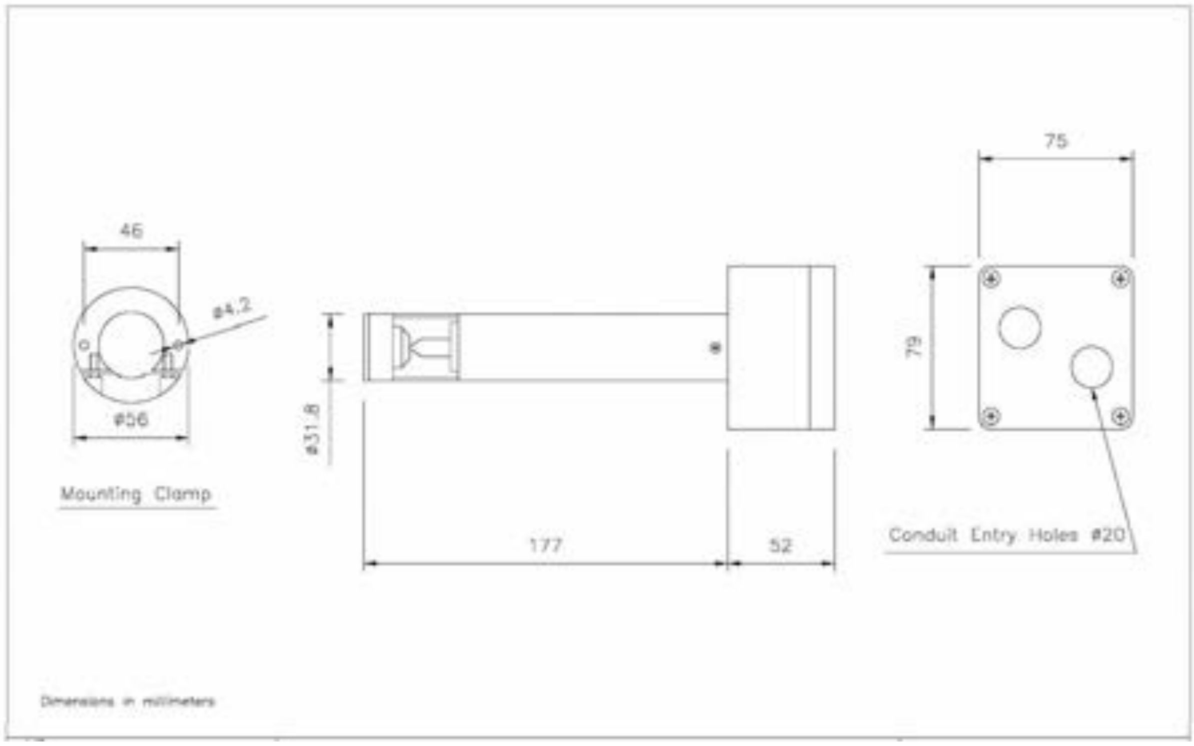
Example pressure sensor

1.6.5 NX6094 Shuttered UV flame detector

Mounting the flame detector to the burner is by way of a clamp ring around the sight tube. The maximum torque that may be applied to the clamp screws is 0.3 Nm. Over-tightening of the clamp screws may damage internal components and degrade the performance of the device.

If there is any doubt that the burner casing is not a good electrical Earth, then the clamp ring <u>must</u> be connected to electrical 'Earth' using suitable cable.

FIREYE recommended that the detector is mounted in a horizontal attitude.



There are two 20mm conduit connections apertures on the rear of the terminal box.

The ambient operating range for this device is 0 to 60 °C (32 to 140 °F).

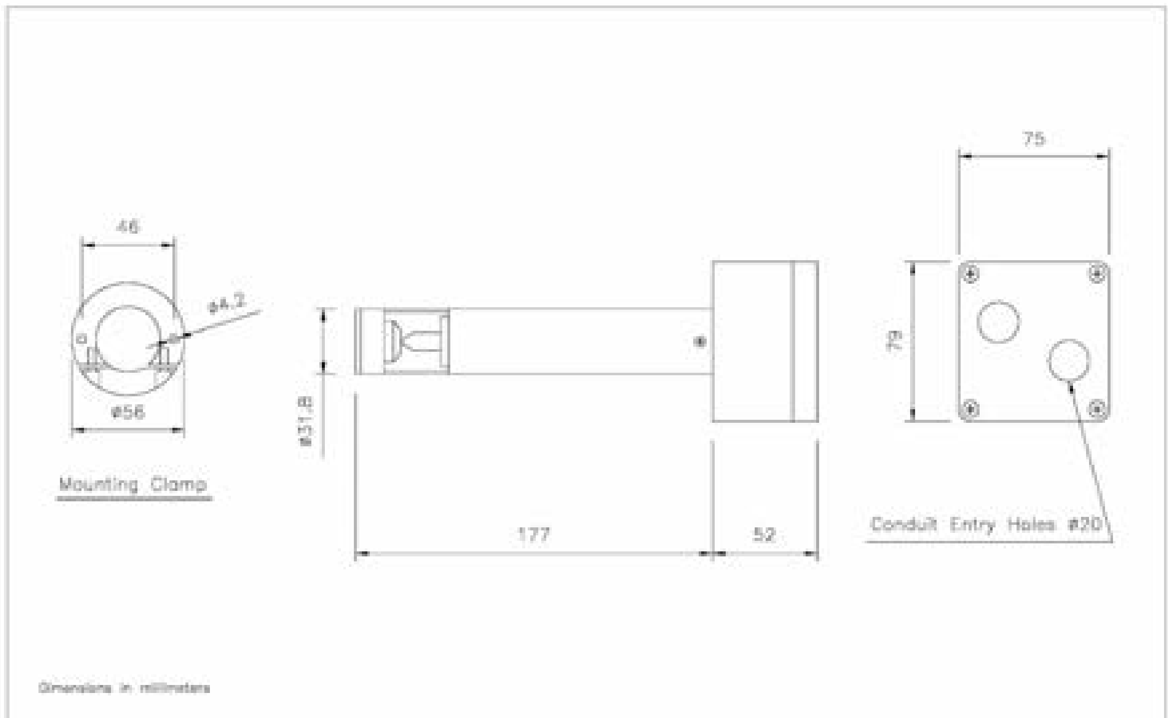
1.6.6 Mounting arrangements for NX6094 CANbus flame detector.

The NX6094 flame detector is a self-checking UV flame detector for continuous operation (>24hrs). The detector is for radial view of the flame. For full technical specifications of sensors, see “Specifications” in section 6.

Mounting the flame detector to the burner is by way of a clamp ring around the sight tube. The maximum torque that may be applied to the clamp screws is 0.3 Nm. Over-tightening of the clam screws may damage internal components and degrade the performance of the device.

If there is any doubt that the burner casing is not a good electrical Earth, then the clamp ring must be connected to electrical 'Earth' using suitable cable.

FIREYE recommended that the detector is mounted in a horizontal attitude.



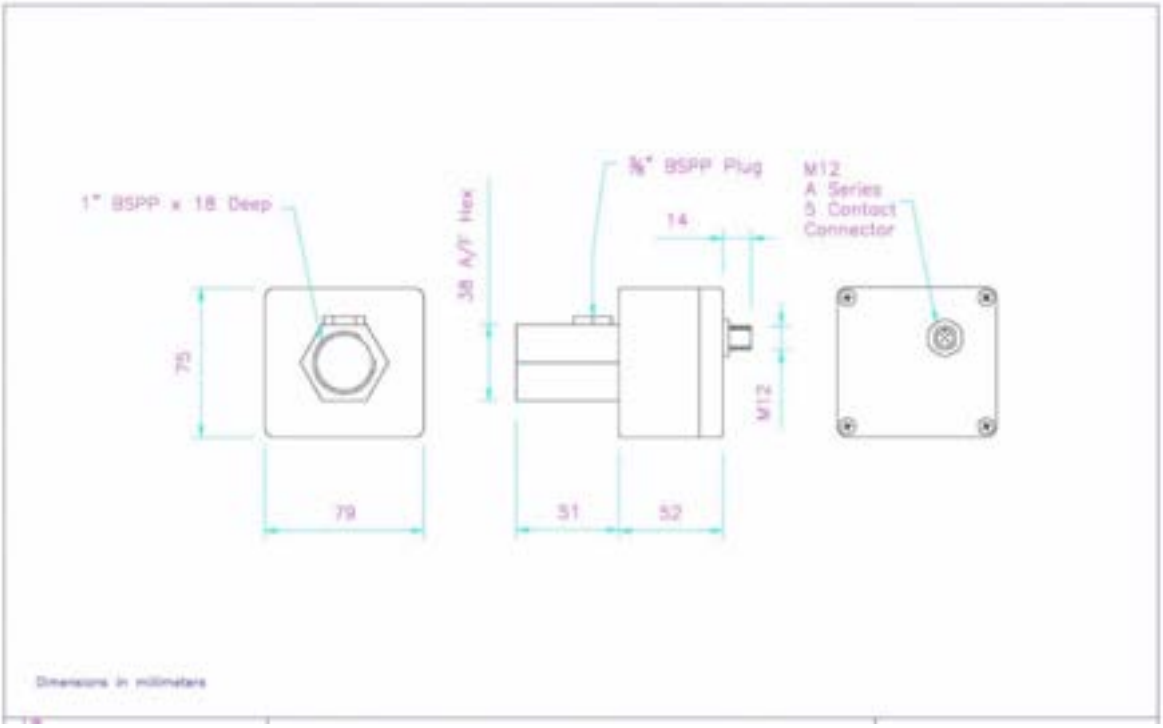
Electrical connection is by way of a 12mm plug and socket on the square section of the body.
The ambient operating temperature range for this device is 0 to 60 °C (32 to 140 °F).

1.6.7 Mounting arrangements for NX6095 CANbus flame detector.

The NX6095 flame detector is a self-checking UV flame detector for continuous operation (>24hrs).
The detector is for axial view of the flame. For full technical specifications of sensors, see "Specifications" in section 6.

Mount the flame detector to the burner by way of a 1"BSP thread to a sighting tube on the front of the burner. There is provision for an air purge/cooling connection on the hexagonal section of the body.

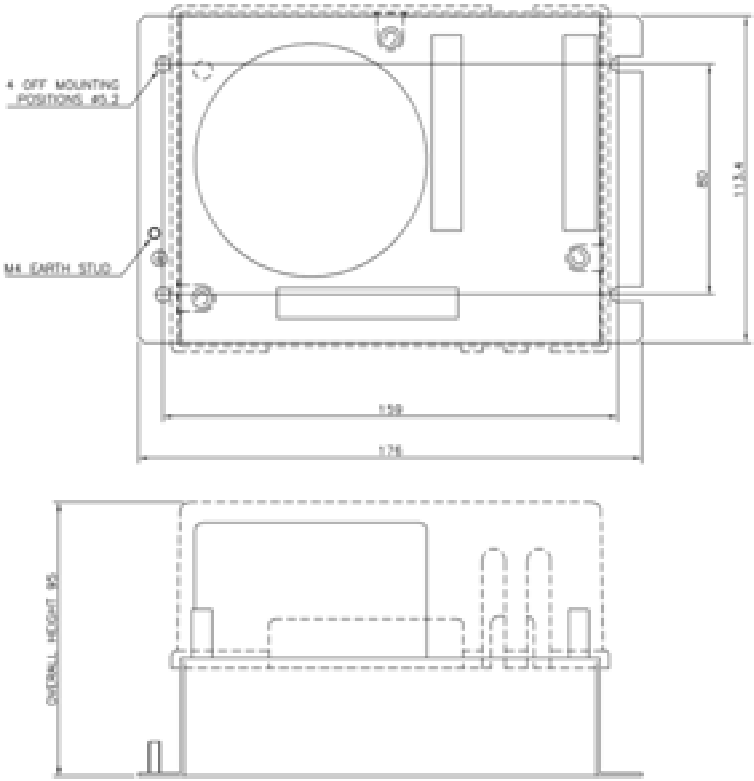
Although the connection is 1" BSP there is sufficient thread to securely fasten to 1" NPT pipe.



Electrical connection is by way of a 12mm plug and socket on the square section of the body.
The ambient operating temperature range for this device is -20 to 60 °C .

1.7 Mounting details for the NXCBH CANbus Hub and PSU.

The NXCBH CANbus Hub may be required when the peripheral loading to the CAN Bus exceeds 45VA (this excludes the HMI). The NXCBH provides an additional 60VA of power to the CANbus with continuity for the CAN data lines.



The NXCBH MUST be installed in a PD1 or PD2 environment, according to EN6730-1, and the ambient operating temperature range of the equipment is 0 to 60°C. (32 to 140 °F).

Allow 100mm (4 in) for the depth of the unit including the lid, and LED window.

The device MUST be electrically earthed, using the largest cross-section area cable possible, to maintain electrical safety and ensure reliable operation.

The device MUST be installation inside a burner control cabinet. The cabinet should have a minimum protection level of IP40 for indoor use, or IP54 for outdoor use.

The NXCBH may be mounted in any attitude; clearances of a least 30mm should be left around the unit to allow sufficient space for wiring and to ensure reliable operation.

1.8 Option Link Selection in the Main Controller

1.8.1 General

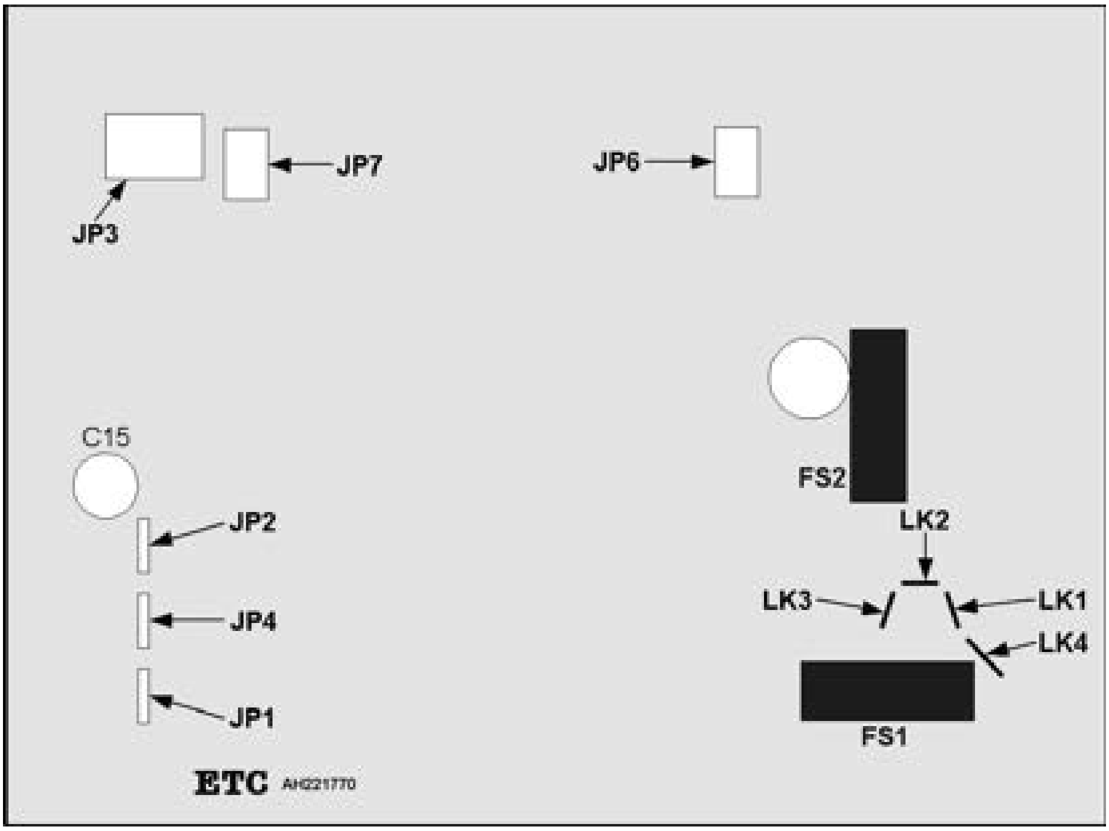
The main controller has a number of option selection links, located on the circuit board.

Note: You cannot access these option links after the controller is mounted in the burner cabinet.

The functions and settings of the links are given below and are marked on the circuit board beside each link. These links **must** be set to the correct position **before** power is applied to the controller.

Below is a diagram of the circuit board layout showing the fuse and jumper locations.

Main controller

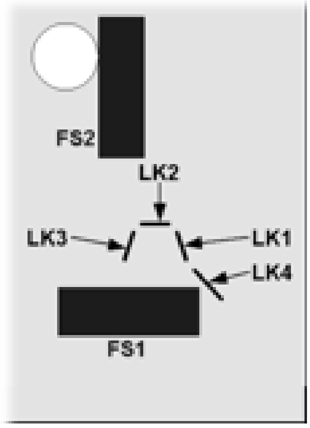


Main controller: option selection jumpers (JP), links (LK) and fuses (FS).

1.8.2 NX6100 Line supply voltage (LK1 - 4)

CAUTION

- Incorrect setting of the Links **WILL** damage or destroy the unit.



The supply voltage configurations are shown below, together with the necessary fuse rating.

Important: Incorrect setting of the 'supply selection links' will damage the unit.

You must fit the correct fuse (type and rating). Failure to do so may damage the controller.

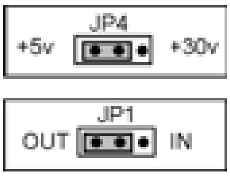
Supply voltage (VAC)	Links required	Fuse rating(mA)
120	LK1 and LK3	630 anti-surge
230	LK2 and LK4	315 anti-surge

The manufacturers of this equipment recommend the fuse type Bussmann S506 series.

1.8.3 SENS IN and SENS SUPP for Analog Input 6 (main controller)

To control boiler pressure or temperature, the NX6100 can accommodate a range of sensor types. You need to configure the input hardware to accept the correct signal type.

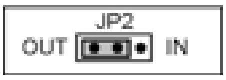
Set links JP4 (supply) and JP1 (current burden resistor) to suit the type of sensor and voltage requirement as follows:



- For a 4-20 mA loop-power sensor, set JP4 for +30 V and JP1 to the IN position.
- For a 0-5 V modulation signal, set JP4 for +5 V and JP1 to the OUT position.
- For an FIREYE 1030 or 1040 sensor, set JP4 for +30 V and JP1 to the OUT position.

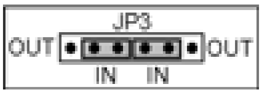
1.8.4 REMOTE SET POINT - Analog Input 5 (main controller)

If you use a remote set point or modulation signal to modulate the burner, then you must set JP2 to suit the type of signal input type, as follows:



- For a current input, set JP2 to the (IN) position, to make sure the burden resistor is connected.
- For a voltage input signal, set JP2 to the (OUT) position, to make sure the burden resistor is not connected.

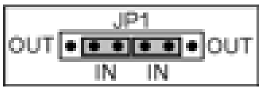
1.8.5 RS485 serial communications termination resistor *(main controller)*



- On the two controllers at the end of the communications bus, set both of the JP3 links to the IN positions.
- On all other controllers, set the links to the OUT positions.
- If only two controllers are on the communications bus, set the links on both controllers to the IN positions.

1.8.6 RS485 serial communications termination resistor *(Daughter Board)*

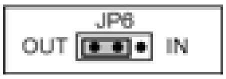
The optional daughter board is available with an isolated RS485 serial communication function. The JP1 jumpers on the daughter board select the termination resistors, but the terminals are provided as part of the main controller.



- On the two controllers at the end of the communications bus, set both of the JP1 links to the IN positions.
- On all other controllers, set the links to the OUT positions.
- If only two controllers are on the communications bus, set the links on both controllers to the IN positions.

1.8.7 UV / Ionisation Selection (JP6) (main controller)

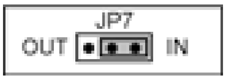
JP6 is used to select the sensitivity of the UV / Ionisation input PF1-2.
If an **ionisation probe** is used for flame detection, then select the highest sensitivity by setting JP6 to the OUT position.



- For UV and ionisation input signal, set JP6 to the (OUT) position to ensure the ionisation current is high enough to be detected.
- Some UV scanners may require a special jumper link for the IN position – check with the manufacturer.

1.8.8 CANbus Termination Link

Use JP7 to select a CANbus termination resistor in or out of circuit.



- In most (if not all) applications, set this link to the IN position.

1.9 NXCBH Line Supply Voltage links (LK1 - 4)

CAUTION

- Incorrect setting of the Links **WILL** damage or destroy the unit.

The supply voltage configurations are shown below, together with the necessary fuse rating.

Important: Incorrect setting of the ‘supply selection links’ will damage the unit.

You must fit the correct fuse (type and rating). Failure to do so may damage the controller.

Supply voltage(V)	Links required	Fuse rating (mA)
120 VAC	LK1 and LK3	500 mA anti-surge (IEC 127)
230 VAC	LK2 and LK4	250 mA anti-surge (IEC 127)

The manufacturers of this equipment recommend the fuse type Bussmann S506 series.

1.10 Wiring Requirements

Please pay particular attention to the wiring requirements for each unit. These will protect the equipment from electrical interference, earth loop problems, and damage to the controller and modules.

1.10.1 General

CAUTION

- Disconnect the power supply before beginning installation, to prevent electrical shock, equipment and/or control damage. More than one power supply disconnect may be involved.
- Wiring must comply with all applicable codes, ordinances, and regulations.
- Loads connected to the NX6100 series control and optional daughter board must not exceed those listed in the specifications given in this manual.
- Make sure the maximum total load on the CANbus cabling (servo motors, display) is within the specifications for the cable being used.
- This control MUST NOT be directly connected to any part of a 'Safety Extra Low Voltage' (SELV) circuit.

WIRING INSTALLATION MUST BE CARRIED OUT BY A COMPETENT ELECTRICIAN AND IS SUBJECT TO I.E.E. WIRING REGULATIONS (BS 7671) AND/OR LOCAL STANDARDS THAT MAY PREVAIL.

HAZARDOUS VOLTAGES MUST BE ISOLATED BEFORE SERVICE WORK IS CARRIED OUT.

The main controller MUST be mounted within a 'burner cabinet' or similar panel and MUST be earthed to the overall enclosure to ensure safe and reliable operation; use the largest cross-sectional area green/yellow earth wire available. **Do not use a green/yellow conductor for any purpose other than earth.** The metal body of all other component parts MUST be connected to earth using a green/yellow conductor.

To comply with EMC requirements, the controller and any optional units must be wired using the specified cable sizes, and screen connections, observing any maximum cable length limitations. Cabinet designers MUST segregate Line voltage and Extra Low Voltage (ELV) cables within the burner cabinet, distribution panels and conduits.

The manufacturer of this equipment recommends the use of bootlace ferrules on all wire ends, as a "best practice".

Bootlace ferrules

All cabling that operates at more than 50 V must be multi-strand, single core, PVC insulated, 16/0.2 mm (0.5mm^2) (AWG 20) and must meet the requirements of IEC 227 or IEC 225.

For cables carried in conduit, secure all cables at both ends, using a suitable anchorage method in the cabinet.

Connect all signal cable 'braid' screens to earth using the screen termination clamps provided on the controller. Connect all cable screens to earth at the **controller only**, unless stated otherwise in section 1.10. Where CANbus wiring connects through one device to connect to another, terminals 5 and 6 are provided to maintain screen continuity.

If the power supply is known to be electrically noisy, or suffer from occasional brownouts or blackouts, then use a correctly rated "direct on-line" un-interruptible power supply (UPS) to make sure a clean continuous mains power supply to the NX6100. No rating for the supply is given here, as this will need to include the power requirement of the safety valves connected to and routed through the controller. Locate the UPS as close as possible to the controller(s).

The equipment described in this manual has been tested for compliance to the CE directives listed in the section headed 'approvals. However, after it has been connected to a burner and other associated controls, it is the responsibility of the installer to make sure the complete installation meets the requirements of the CE directives relevant to the particular installation.

1.10.2 Earth Connection – Main Controller

The main controller **MUST** be connected to earth. Make the connection to the controller at the 'stud' showing the Earth symbol. This connection is required to maintain the overall electrical safety of the installation and to ensure the EMC performance of the equipment.

Failure to comply with this wiring requirement will affect the performance of the system and may cause a hazardous condition to occur.

Make sure there is a good electrical connection between the controller and the burner panel, and then between the burner panel and earth. Where necessary, scrape any paint away from connection points and use shake-proof washers to ensure a reliable electrical connection.

Always use the largest cross-sectional area earth wire possible.

1.10.3 Earth Connection – Display Units

The display unit **MUST** be connected to earth. Make the connection at the tag showing the Earth symbol. This connection is required to maintain the overall electrical safety of the installation and ensure the EMC performance of the equipment.

Failure to comply with this wiring requirement will affect the performance of the system and may cause a hazardous condition to occur.

Make sure that a good electrical connection is made between both the display unit and the burner panel, and then between the burner panel and earth. Where necessary, scrape any paint away from connection points and use shake-proof washers to ensure a reliable electrical connection.

DO NOT use the screen of the signal cable to provide the electrical safety earth. There must be a separate connection using the largest cross-sectional-area earth wire possible.

If the display unit is mounted into a burner cabinet door, make sure there is a good electrical connection between the door and the main cabinet, in addition to a good electrical contact between the display unit and the door.

1.10.4 Earth Connection (oxygen probe interface)

The Oxygen probe interface MUST be connected to earth to maintain electrical safety and ensure reliable operation. The Earth connection point is symbolized on the mounting 'ears' of the enclosure.
This connection is required to maintain the overall electrical safety of the installation and ensure the EMC performance of the equipment. Use a 1.5mm^2 (AWG 16) conductor for this connection. Failure to comply with this wiring requirement will affect the performance of the system and may cause a hazardous condition to occur.

1.10.5 Earth Connection (servomotors and sensors)

All sections of the control system with metal enclosures **MUST** be connected to earth. Connect at the tag showing the **Earth** symbol, or to the body of the device. These connections are required to maintain the overall electrical safety of the installation and ensure the EMC performance of the equipment. Failure to comply with the wiring requirements will affect the performance of the system and may cause a hazardous condition to occur.

Where necessary, remove any paint from connection points and use shake-proof washers to ensure a reliable electrical connection. **DO NOT** use the screen of the signal cable to provide the electrical safety earth. You **MUST** make a separate earth connection using the largest cross-sectional area earth wire possible.

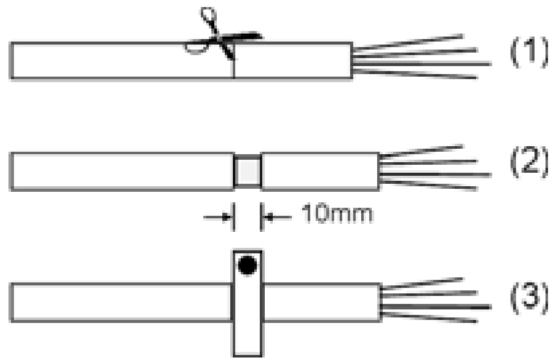
1.10.6 ELV signal cable Screen Connection

**ELV (low voltage) signal cables MUST have a screen of the 'tinned copper braid shield' type.
The manufacturers of this equipment recommend Belden type 9927 or 3084A, Alpha type 3233 or 6352, or Harting type 094560001x2.**

These types of cable may also employ a 'foil with drain wire'. This is **not** suitable as a screen because the cross section of the drain wire is insufficient to provide correct screening of the signals. Also, there is no provision to connect the foil or drain at the main controller.

You must connect the ELV signal cable screens at the screen termination clamps only, unless stated otherwise in this manual. The screen termination clamps on the controller are only provided to allow connection of the cable screens to the main controller - they do not provide strain relief.

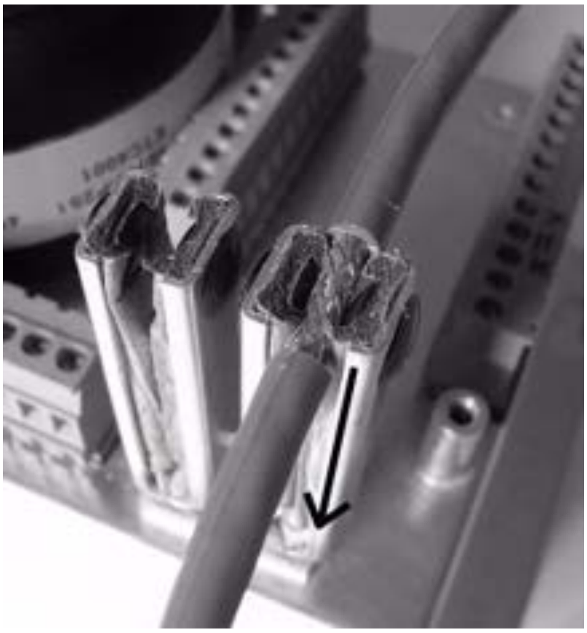
Screen termination clamps are provided on the main controller for termination of cable screens (tinned copper braid type). If the controller is used with a daughter board, the screens of these cables must also be terminated to the cable clamps. It is important to make sure that the screen and associated insulation cover the cable cores as close as possible to the terminals to which they are connected and **not** cut back to where the cable passes through the screen termination clamp.



1. Prepare the screened cable by cutting around the outer insulation, taking care not to damage the screen.

2. Pull the insulation apart to expose 10 mm of the screen braid.

3. Press the exposed length of screen braid down between the conductive strips attached to the cable 'clamps', to make sure a 'good' electrical connection between the screen and the 'clamp' is achieved (3 and photograph).



Note 1: These ‘clamps’ are **not** intended to provide strain relief for the cables.

Note 2: Where screened cables are required to run through one device to connect to another, terminals are provided to allow the screens to be connected, by forming a ‘tail’ with the braided screen of each cable, the length of unscreened cable short be kept as short as possible, but in any case, **MUST NOT exceed 30 mm (1.25 in.)**, per cable ‘tail’.

Note 3: Where screened cables are required to connect to a **terminal rail**, screens **MUST NOT** be connected to Earth at the terminal rail but must pass to the screens of onward connecting cables in insulated terminals. Screen ‘tails’ and each cable core **MUST not exceed 30 mm (1.25 in.)**, per cable ‘tail’.

1.10.7 Labelling of Terminal Connections

All terminals within the system have unique terminal labelling, to reduce the possibility of wiring errors. This information is in the table below:

Terminal No.	Module	Function	Voltage Range
PA1	**Main Controller**	24 Vac Supply for Servos, Display.	24 – 40 Vac
PA2	Main Controller	24 Vac Supply for Servos, Display.	24 – 40 Vac
PA3	Main Controller	CAN +	0 – 5 V
PA4	Main Controller	CAN –	0 – 5 V
PA5 *3	Main Controller	IR/Photocell +	5 Vdc
PA6 *3	Main Controller	IR/Photocell –	0 – 5 Vdc
PA7	Main Controller	Analog Input 1(4-20 mA)	0 – 5 Vdc
PA8	Main Controller	Analog Input 2 (4-20 mA)	0 – 5 Vdc
PA9	Main Controller	Analog Input 3 (4-20 mA)	0 – 5 Vdc
PA10	Main Controller	Sensor Test	0 – 5 Vdc
PA11	Main Controller	0 Vdc for input signals	0 Vdc
PA12	Main Controller	Analog Input 4 (Gas pressure)	0 – 5 Vdc
PA1	Main Controller	Sensor Supply (+30 Vdc)	24 - 30 Vdc
PA14	Main Controller	0 Vdc for input signals	0 Vdc
PA15	Main Controller	Analog input 5 (remote set point)	0 – 5 Vdc
PA16	Main Controller	+30 Vdc supply for sensor/signals	24 - 30 Vdc
PA17 *1	Main Controller	Sensor Test	0 – 5 Vdc
PA18 *2	Main Controller	0 Vdc for input signals	0 Vdc
PA19	Main Controller	Analog input 6 (Boiler sensor)	0 – 5 Vdc
PA20	Main Controller	Sensor Supply (+5 Vdc or +30 Vdc)	24 - 30 Vdc
PB1	Main Controller	24 Vac Supply for Servos, Display.	24 – 40 Vac
PB2	Main Controller	24 Vac Supply for Servos, Display.	24 – 40 Vac
PB3	Main Controller	CAN +	0 – 5 V
PB4	Main Controller	CAN –	0 – 5 V
PB5	Main Controller	Digital low-test 2	0 – 5 V
PB6 *4	Main Controller	Digital input 8	0 – 5 V
PB7 *4	Main Controller	Digital input 9	0 – 5 V
PB8	Main Controller	Digital high test	0 – 5 V
PB9	Main Controller	Digital low-test 1	0 – 5 V
PB10	Main Controller	Digital input 1	0 – 5 V
PB11	Main Controller	Digital input 2	0 – 5 V
PB12	Main Controller	Digital input 3	0 – 5 V

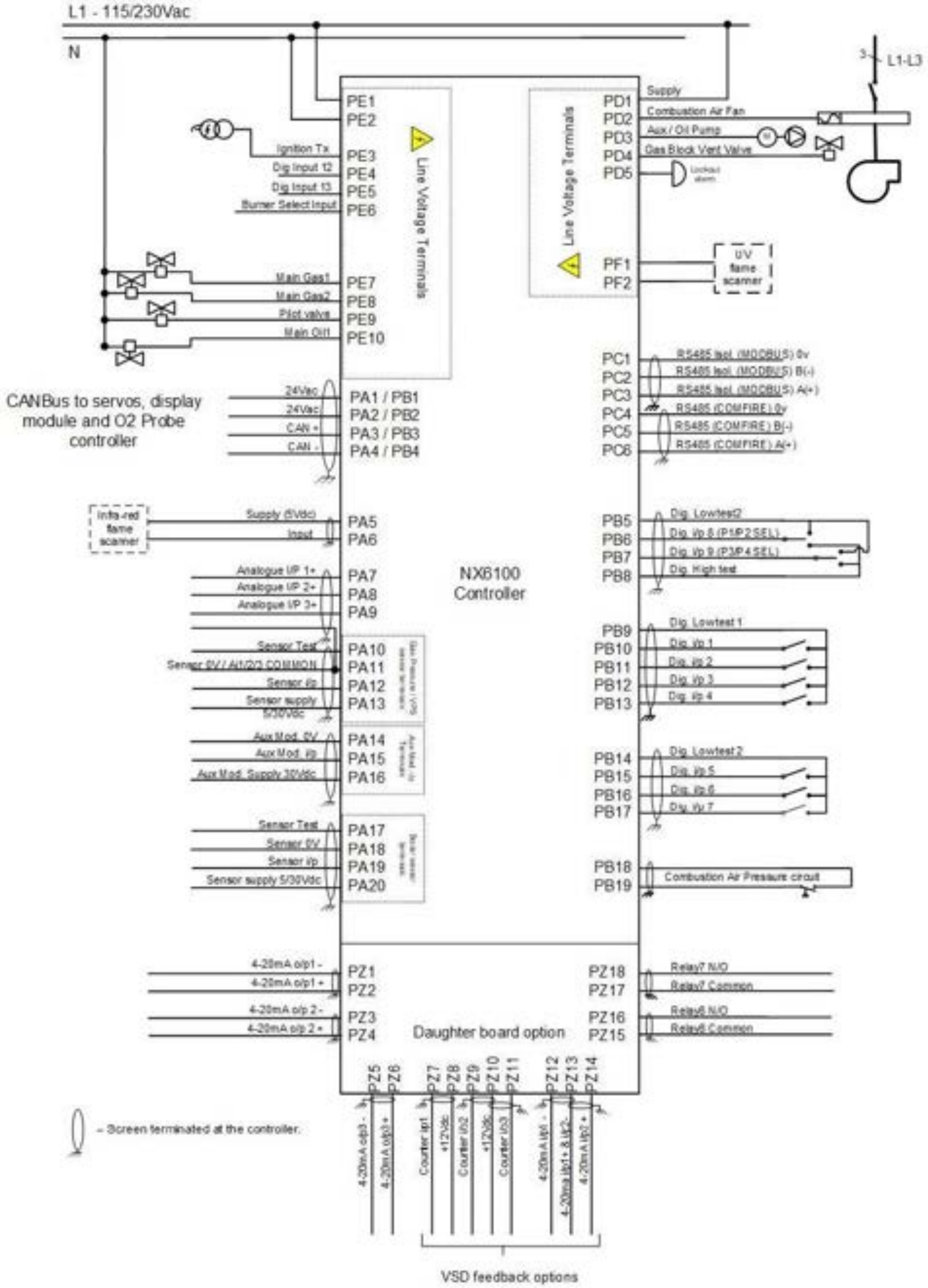
Terminal No.	Module	Function	Voltage Range
PB13	Main Controller	Digital input 4	0 – 5 V
PB14	Main Controller	Digital low-test 2	0 – 5 V
PB15	Main Controller	Digital input 5	0 – 5 V
PB16	Main Controller	Digital input 6	0 – 5 V
PB17	Main Controller	Digital input 7 (leak test switch i/p)	0 – 5 V
PB18	Main Controller	Airflow	0 – 5 V
PB19	Main Controller	Airflow	0 – 5 V
PC1	Main Controller	Isolated comms ground	0 – 5 V
PC2	Main Controller	Isolated comms –	0 – 5 V
PC3	Main Controller	Isolated comms +	0 – 5 V
PC4	Main Controller	RS485 ground	0 – 5 V
PC5	Main Controller	RS485 B (–)	0 – 5 V
PC6	Main Controller	RS485 A (+)	0 – 5 V
PD1	Main Controller	Vent, Fan, Pump Relay Supply	115 -230 Vac
PD2	Main Controller	Fan relay output	115 -230 Vac
PD3	Main Controller	Aux/Pump relay output	0 – 250 V
PD4	Main Controller	Vent relay output	0 – 250 V
PD5	Main Controller	Alarm output	0 – 250 V
PE1	Main Controller	Controller Supply (live)	0 – 230 Vac
PE2	Main Controller	Controller Supply (neutral)	0 – 230 Vac
PE3	Main Controller	Ignition relay output	0 – 230 Vac
PE4	Main Controller	High voltage digital input (input 12)	0 – 230 Vac
PE5	Main Controller	High voltage digital input (input 13)	0 – 230 Vac
PE6	Main Controller	Burner Select	0 – 230 Vac
PE7	Main Controller	Main Gas Valve 1 relay output	0 – 230 Vac
PE8	Main Controller	Main Gas Valve 2 relay output	0 – 230 Vac
PE9	Main Controller	Pilot Valve relay output	0 – 230 Vac
PE10	Main Controller	Main Oil Valve relay output	0 – 230 Vac

PF1 *5	Main Controller	UV / Ionization Flame sensor	560 Vac
PF2 *5	Main Controller	UV / Ionization Flame sensor	560 Vac
PG1	**O2 Trim Interface**	CAN 24Vac Supply	24 – 32Vac
PG2	O2 Trim Interface	CAN 24Vac Supply	24 – 32Vac
PG3	O2 Trim Interface	CAN + (High)	0-5V
PG4	O2 Trim Interface	CAN – (Low)	0-5V
PG5	O2 Trim Interface	GND (4-20mA Input 0V)	0V
PG6	O2 Trim Interface	4-20mA Input 1	0-5V
PG7	O2 Trim Interface	4-20mA Input 2	0-5V
PG8	O2 Trim Interface	4-20mA Input 3	0-5V
PG9	O2 Trim Interface	GND (4-20mA Input 0V)	0V
PH1	O2 Trim Interface	Probe 1 (Black)	0-14V
PH2	O2 Trim Interface	Probe 2 (Red)	0-14V
PH3	O2 Trim Interface	Probe 3 (Yellow)	0-14V
PH4	O2 Trim Interface	Probe 4 (Green)	0-14V
PH5	O2 Trim Interface	Probe 5 (Blue)	0-14V
PH6	O2 Trim Interface	Probe 6 (White)	0-14V
PH7	O2 Trim Interface	Flue gas thermocouple White	0-5V
PH8	O2 Trim Interface	Flue gas thermocouple Green	0-5V
PK1	**Servomotor**	24 Vac Supply	24 – 40 Vac
PK2	Servomotor	24 Vac Supply	24 – 40 Vac
PK3	Servomotor	CAN +	0 – 5 V
PK4	Servomotor	CAN –	0 – 5 V
PK5	Servomotor	Screen connection	Not applicable
PK6	Servomotor	Screen connection	Not applicable
PR1	**Text Display Unit**	Relay output 1 normally open	0 – 250 V
PR2	Text Display Unit	Relay output 1 normally closed	0 – 250 V
PR3	Text Display Unit	Relay outputs 1 common	0 – 250 V
PR4	Text Display Unit	NO CONNECTION	
PR5	Text Display Unit	Relay output 2 normally open	0 – 250 V
PR6	Text Display Unit	Relay output 2 normally closed	0 – 250 V
PR7	Text Display Unit	Relays 2 & 3 common	0 – 250 V
PR8	Text Display Unit	Relay output 3 normally closed	0 – 250 V

PR9	Text Display Unit	Relay output normally open	0 – 250 V
PT1	Text Display Unit	24 Vac Supply	24 – 40 Vac
PT2	Text Display Unit	24 Vac Supply	24 – 40 Vac
PT3	Text Display Unit	CAN +	0 – 5 V
PT4	Text Display Unit	CAN –	0 – 5 V
PT5	Text Display Unit	Screen connection	Not applicable
PZ1	**Daughter Board**	Channel 1 output [4–20 mA] (–)	0 – 20 V
PZ2	Daughter Board	Channel 1 output [4–20 mA] (+)	0 – 20 V
PZ3	Daughter Board	Channel 2 output [4–20 mA] (–)	0 – 20 V
PZ4	Daughter Board	Channel 2 output [4–20 mA] (+)	0 – 20 V
PZ5	Daughter Board	Channel 3 output [4–20 mA] (–)	0 – 20 V
PZ6	Daughter Board	Channel 3 output [4–20 mA] (+)	0 – 20 V
PZ7	Daughter Board	Encoder Feedback 1	0 – 12 V
PZ8	Daughter Board	Encoder Supply	12 Vdc
PZ9	Daughter Board	Encoder Feedback 2	0 – 12 V
PZ10	Daughter Board	Encoder Supply	12 Vdc
PZ11	Daughter Board	Encoder Feedback 3	0 – 12 V
PZ12	Daughter Board	Channel 1 Feedback [4–20 mA] (–)	0 – 5 Vdc
PZ13	Daughter Board	Channel 1 (+) & Channel 2 (–)	0 – 5 Vdc
PZ14	Daughter Board	Channel 2 Feedback [4–20 mA] (+)	0 – 5 Vdc
PZ15	Daughter Board	Relay output 8 common	0 – 40 V
PZ16	Daughter Board	Relay output 8 normally open	0 – 40 V
PZ17	Daughter Board	Relay output 7 common	0 – 40 V
PZ18	Daughter Board	Relay output 7 normally open	0 – 40 V
L (PE1)	**CANbus PSU Hub**	Line supply	115/230V ac
N (PE2)	CANbus PSU Hub	Neutral supply	115/230V ac
CANbus In 1	CANbus PSU Hub	24Vac Supply for Servos, Display Fireye.	24 – 40Vac
CANbus In 2	CANbus PSU Hub	24Vac Supply for Servos, Display Fireye.	24 – 40Vac
CANbus In 3	CANbus PSU Hub	CAN +	0 – 5V
CANbus In 4	CANbus PSU Hub	CAN -	0 – 5V
CANbus Out 1	CANbus PSU Hub	24Vac Supply for Servos, Display Fireye.	24 – 40Vac
CANbus Out 2	CANbus PSU Hub	24Vac Supply for Servos, Display Fireye.	24 – 40Vac

CANbus Out 3	CANbus PSU Hub	CAN +	0 – 5V
CANbus Out 4	CANbus PSU Hub	CAN +	0 – 5V
***Notes**			
1	Fireye self-test sensors NX103x/NX104x		
2	Fireye self-test NX103x/NX104x and external powered 4-20mA sensors		
3	Fireye Approved Integrated scanners type: Phoenix/Insight Scanners		
4	See section 1.11.17 for details		
5	Do not use shielded wire on this circuit		

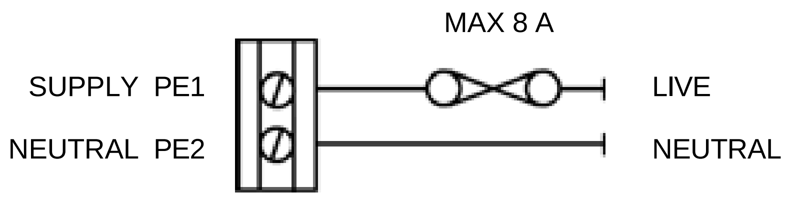
1.10.8 System Connection Diagram



1.10.9 LIVE and NEUTRAL supply *(NX6100)*

CAUTION

- Incorrect setting of the Supply Voltage Links **WILL** damage or destroy the unit.



Connect the LIVE and NEUTRAL using multi-strand single core PVC insulated 0.5mm^2 wire (16/0.2 mm) (16 AWG)

The live connection must be fused, with a **maximum rating** as shown.

Note: If a fuse greater than 4 A is fitted, each relay (pump, fan and vent) output supplied via this terminal must be separately fused at 4 A maximum, to protect the relay contacts from 'welding'.

1.10.10 Burner Fan Output *(main controller)*

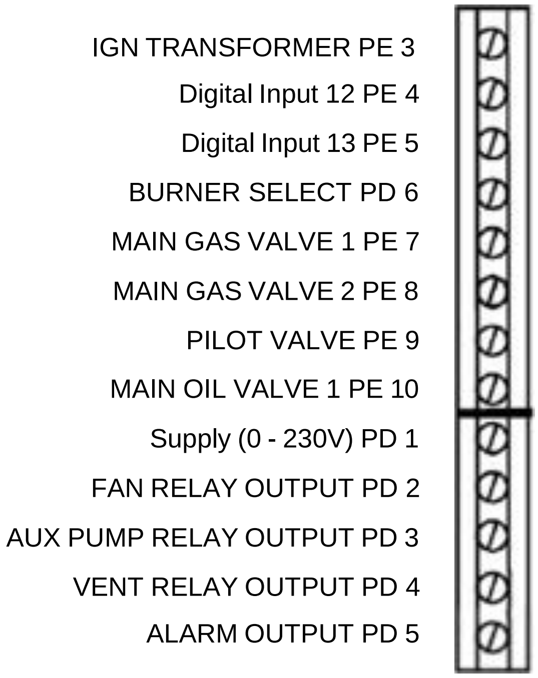
The burner fan output must be connected to the external motor contactor using multi-strand single core PVC insulated 0.5mm^2 wire (16/0.2 mm) (AWG 20).

This output may also be used to supply an inverter 'RUN' signal.

If a fuse greater than 4 A is fitted in the supply to the control panel, the burner fan output terminal must be separately fused at 4 A maximum, to protect the relay contacts from 'welding'.

1.10.11 Ignition, main valves, pilot valve, vent and pump *(main controller)*

To minimize electrical interference, the manufacturer of this equipment recommends that the ignition transformer be mounted as far away from the controller as possible. In addition, the EARTH terminal/wire for the ignition transformer must be as short as possible, connecting to the earthed burner chassis or panel using the transformer mounting screws.



Fuses not exceeding 4 A must protect all relay outputs.

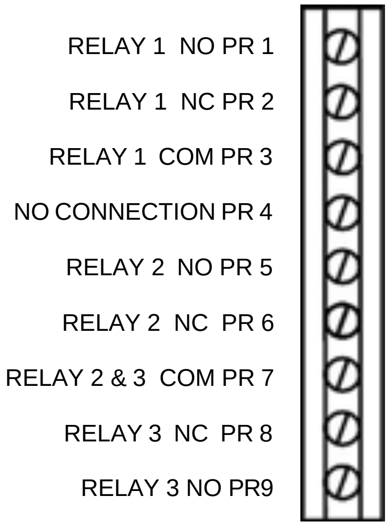
Fit a 4 A fuse to the Burner Panel Supply or controller supply/burner select input or, where the total current exceeds 4 A, fit an 8 A fuse to protect the controller and fit separate fuses on each relay output.

Please note that the fuel valve outputs are supplied from the Burner Select input.

These outputs must be connected using multi-strand single core PVC insulated 0.5mm^2 wire (16/0.2 mm) (AWG 20). In most cases, you can connect the outputs directly to the designated devices without the use of external relays.

When using proof-of-closure switches for fuel valves, make sure that you wire them to the relevant **auxiliary inputs**, and set the corresponding option parameter.

1.10.12 Auxiliary Relay Outputs *(text display)*



Fuses not exceeding 4 A must protect all relay outputs. Fit a 4 A fuse to the Burner Panel Supply, relay common or, where the total current exceeds 4 A, fit a separate fuse on each relay output to achieve this.

Connect these outputs using multi-strand single core PVC insulated 0.5mm^2 wire (16/0.2 mm) (AWG 20). As this cable may lay adjacent to, and/or in the same conduit as high voltage wiring, the cable voltage rating must exceed the maximum voltage carried by any other cable connected to the controller or run in the same conduit.

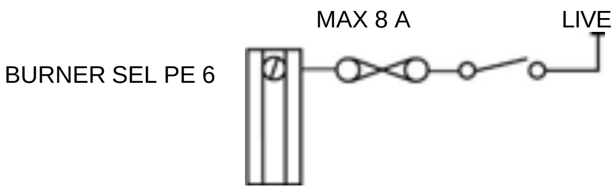
The 3 auxiliary relays provide volt free change-over contacts. However, 2 of the relays share a common terminal connection. The relays are separated on the circuit board to allow either the pair sharing the common or the single relay to operate at Line voltage while the other(s) operate at ELV (low voltage).

The relay functions are set by option parameter 17.x.

1.10.13 Burner select input *(main controller)*

CAUTION

- If an external limit device is fitted, then it must be connected into the Burner Select line, unless connected into the auxiliary inputs and the correct function selected.
- If a limit device is fitted into the Burner Select line, it must be capable of supplying the total current required by the main and pilot valves.
- Any limit device connected to the NX6100 series control must be approved for the specific purpose for which it is being used.
- If a limit device connected to this input removes power to the input, then the NX6100 will shut down, **NOT** Lock out.
- Wiring must comply with all applicable codes, ordinances and regulations.



Connect this input to the Burner Select switch and/or external limit stat circuit, using multi-strand single core PVC insulated $0.5mm^2$ wire (16/0.2 mm) (AWG 20).

This cable may run adjacent to, and/or in the same conduit as high voltage wiring. Therefore, the cable voltage rating must exceed the maximum voltage carried by any other cable connected to the controller or run in the same conduit.

The device connected to this input must be capable of supplying the current required by the main and pilot valves, and fused up to a maximum of 8 A. If a fuse greater than 4 A is fitted, each fuel valve output must be separately fused at 4 A maximum, to protect the relay contacts from 'welding'.

1.10.14 Cable Voltage Rating Rule

Important

Some cables may lay adjacent to, and/or in the same conduit as Line voltage wiring.

Therefore, the cable voltage rating must exceed the maximum voltage carried by any other cable connected to the controller or run in the same conduit.

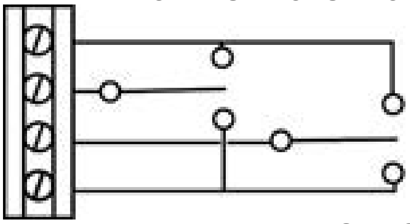
- **This rule applies where referred to in the text.**

1.10.15 Profile Select Inputs (Digital inputs 8 and 9) (main controller)

The profile select functions can be set from the keyboard or from digital input functions.

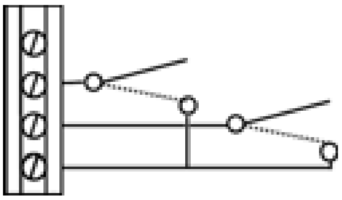
Note: These inputs are designed for low-voltage (0-5 V) signals only and must be powered from the terminals provided. Under no circumstances should these inputs or outputs be connected to Line potential. Connection of any voltage above 5 V to these terminals will damage or destroy the controller.

If profile selection by switch is required, then the inputs must be wired to a changeover switch to ensure the controller receives an input signal for either position of the switch, this allows a single input to be used for profile selection rather than using an input to select Oil and a separate input to select Gas.



These inputs MUST be connected using multi-strand overall 'braid' screened, PVC insulated, 2,3 or 4 core (as required), 0.25mm^2 wire (7/0.2 mm) (AWG 24). See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Connection from	To	Fuel Profile Selected
PB6	PB5	Profile 1
PB6	PB8	Profile 2
PB7	PB5	Profile 3
PB7	PB8	Profile 4



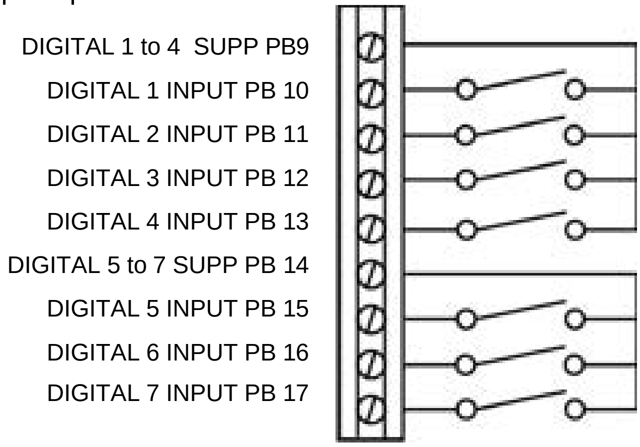
Either or both inputs can be used as safety or non-safety digital inputs, wired in the configuration shown here.

Connect these inputs using multi-strand overall 'braid' screened, PVC insulated, 2 or 3 core (as required), 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

1.10.16 Low Voltage Digital Inputs 1 to 7 *(main controller)*

These Low Voltage digital inputs can be used for safety related functions and their function is programmed by option parameters 18.1 to 18.7 inclusive.

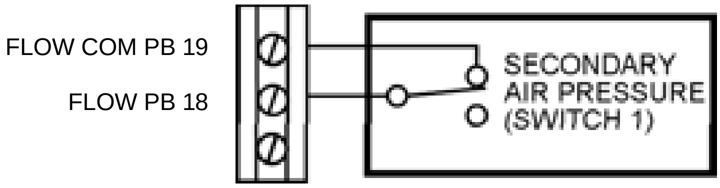


Connect these inputs using multi-strand overall 'braid' screened, PVC-insulated, 2-core, 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Note: These inputs are for low-voltage (0-5 V) signals only and must be powered from the terminals provided. Under no circumstances must these inputs, or outputs, be connected to Line potential. Connection of any voltage above 5 V to these terminals will damage or destroy the controller.

1.10.17 Flow Input (main controller)



Connect these terminals to the appropriate terminals on the burner's air pressure switch using multi-strand overall 'braid' screened, PVC insulated, 2-core, 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

If a second air pressure switch is required, then connect it using one of the digital inputs described in 1.10.16 and configure it using the relevant option parameter.

Never connect the Flow input or output to Line potential. Connection of any voltage above 5 V dc to these terminals will damage the controller.

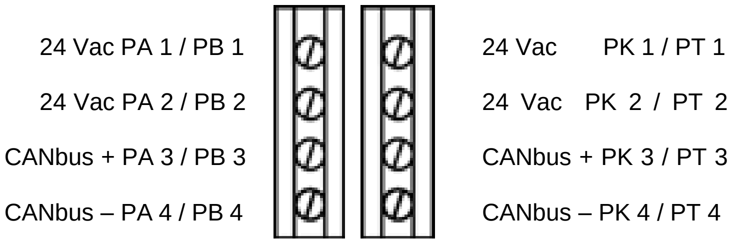
1.10.18 Main Controller CANbus output wiring

CAUTION

- The total electrical load for all CANbus devices connected to the FIREYE 6000 controller MUST NOT exceed 40 VA.
- Incorrect connection may damage or destroy the devices connected to the CANbus.

Terminals

There are 2 sets of terminals available for the CANbus connection; both sets are identical.



CANbus allows several options for connecting the devices together, based on the physical position of each device relative to the main controller, and the current required by each device.

Routing the cable

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

After the location of each device is defined (usually by the mechanical construction of the burner and boiler), you can select the ‘best’ cable route to each device. If required, you can run several cables directly from the main controller, or a single cable can be ‘looped through’ all the connected devices, provided the load does not exceed the maximum current rating of the cable.

Connect the braided screen of each cable with the use of the screen termination clamp, at the main controller or CANbus PSU. For CANbus connections to Display modules, terminate the screen at the display to the Earth point on the display enclosure.

When wiring is being ‘looped through’ servo devices, ensure that the screen of the cable is connected to terminal 5 provided, to ensure continuity of the screen in the chain.

Recommended cable and electrical loading

The minimum cable size recommended for smaller applications is overall ‘braid’ screened, PVC insulated, 4-core, 0.25mm^2 wire (7/0.2 mm), which has a maximum current rating of 600 mA at 60 °C (140°F). This will limit the number of devices that can be connected via a single ‘bus’. The table on the next page gives the current requirements for each peripheral type, so that the correct CAN cable size can be determined for each application. If the maximum load exceeds 600 mA (for example when using IP65 rated servomotors which are rated at 18 VA), then use 4-core, 0.5mm^2 cable (16/0.2 mm) (AWG 20) instead. **DO NOT** use separate cables for CANbus power and data.

If the loading on the CANbus is greater than 40VA (excluding the HMI), then the NXCBH must be added to the wiring configuration to add more power capacity. The following table is a ‘quick reference’ to the VA ratings for the peripheral devices.

Device type	VA rating	Supply Current
NXC20 (IP65) Servo	5	210mA
NXC40 (IP65) Servo	10	416mA
NXC04 (IP40) Servo	3	125mA
NX604X-x PSI sensor	0.3	13mA
NX6087-x Comb Air PSI Sensor	0.3	13mA
NXO2TRIM O2 probe interface	8	300mA
NXIATS Ambient temp. sensor	0.1	-
NXESI120 Line servo interface	1	42mA
NX609X Flame detector	2	84mA

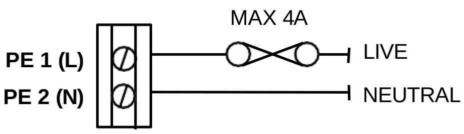
Using the data above, the total load on the CANbus can be calculated for different combinations of peripheral devices. Where the total load on the CANbus exceeds 40VA, the NXCBH will be required to provide extra power for the load.

1.10.19 Wiring to the NXCBH CANbus PSU and Hub

1.10.19.1 LIVE and NEUTRAL supply.

WARNING

Incorrect setting of the Supply Voltage Links **WILL** damage or destroy the unit.



The LIVE and NEUTRAL supplies must be connected using multi-strand single core PVC insulated (16/0.2) 0.5mm wire (AWG 20). The live connection MUST be fused with a **maximum rating** as shown.

1.10.19.2 CANbus connection

CAUTION

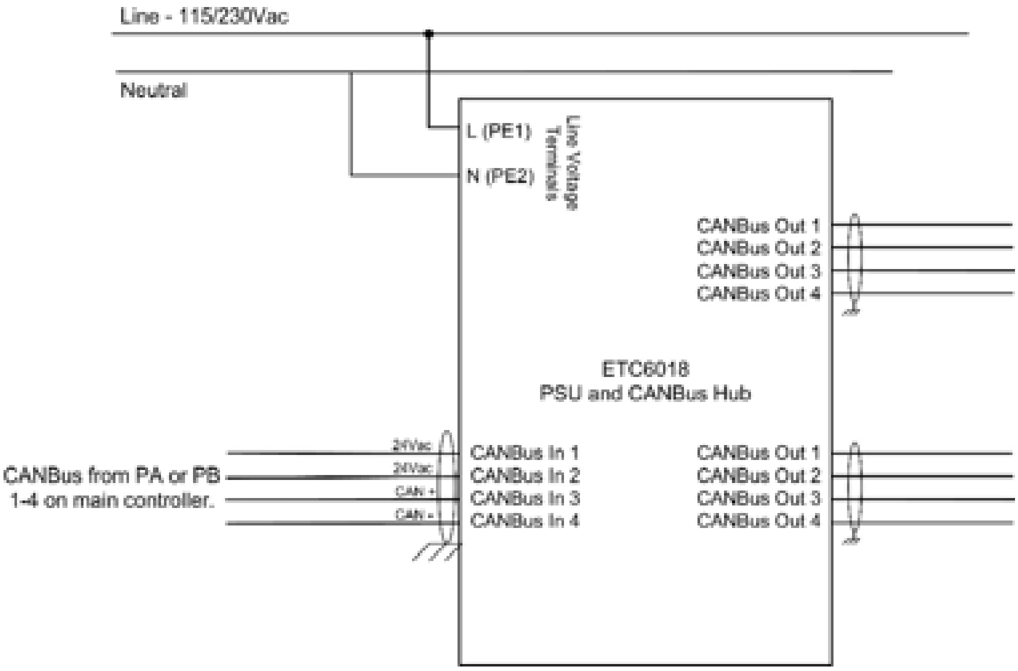
- **The total electrical load for the devices connected to a single PSU hub MUST NOT exceed 60VA.**
- **Incorrect connection may damage or destroy the units being connected.**

There are 3 sets of terminal blocks for the CANbus connections on the NXCBH. These terminal blocks are labelled as ‘CANbus In’ or ‘CANbus Out’. Each terminal block set has terminals 1 to 4 labelled and the ‘CANbus Out’ terminals have internal connections between the terminal numbers.

The connection terminal positions are shown in the picture below.

Connect the braided screen of each cable with the use of the screen termination clamp, at the NXCBH.

The electrical scheme for the connections is shown below.



1.10.20 Wiring to the Touch Screen Display

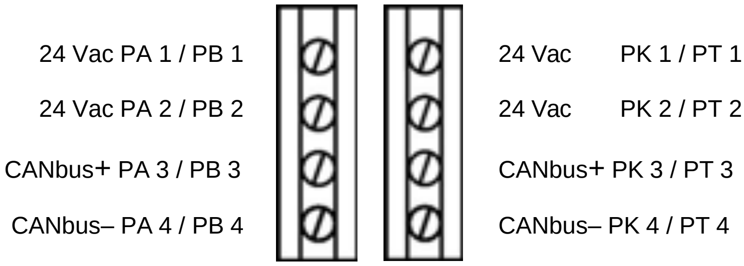
The Touch screen connects to the NX6100 via the CANbus, which supplies both power and signals on the same cable. Refer to section 1.10.18 "Main Controller CANbus output wiring" for further information.

Terminal no.	Location	Function	Voltage
PR1	Touch screen Unit	*Relay output 1 common	0 – 250 V
PR2	Touch screen Unit	*Relay output 1 normally closed	0 – 250 V
PR3	Touch screen Unit	*Relay output 1 normally open	0 – 250 V
PR4	Touch screen Unit	*Relay output 2 common	0 – 250 V
PR5	Touch screen Unit	*Relay output 2 normally closed	0 – 250 V
PR6	Touch screen Unit	*Relay output 2 normally open	0 – 250 V
PR7	Touch screen Unit	*Relay output 3 common	0 – 250 V
PR8	Touch screen Unit	*Relay output 3 normally closed	0 – 250 V
PR9	Touch screen Unit	*Relay output 3 normally open	0 – 250 V
PR10	Touch screen Unit	*Relay output 9 common	0 – 250 V
PR11	Touch screen Unit	*Relay output 9 normally closed	0 – 250 V
PR12	Touch screen Unit	*Relay output 9 normally open	0 – 250 V
PT1	Touch screen Unit	24 Vac Supply	24 – 40 Vac
PT2	Touch screen Unit	24 Vac Supply	24 – 40 Vac
PT3	Touch screen Unit	CAN +	0 – 5 Vdc
PT4	Touch screen Unit	CAN -	0 – 5 Vdc
Earth tag	Touch screen Unit	CANbus screen connection	

Note that all the relay outputs on the Touch screen are isolated.

1.10.21 Wiring Text Display

The 2-line text display connects to the NX6100 via the CANbus wiring, which provides both signals and power. Refer to section 1.10.18 for further information.



Terminal no.	Location	Function	Voltage Range
PR1	Text Display Unit	Relay output 1 normally open	0 – 250 V
PR2	Text Display Unit	Relay output 1 normally closed	0 – 250 V
PR3	Text Display Unit	Relay outputs 1 common	0 – 250 V
PR4	Text Display Unit	NO CONNECTION	
PR5	Text Display Unit	Relay output 2 normally open	0 – 250 V
PR6	Text Display Unit	Relay output 2 normally closed	0 – 250 V
PR7	Text Display Unit	Relays 2 & 3 common	0 – 250 V
PR8	Text Display Unit	Relay output 3 normally closed	0 – 250 V
PR9	Text Display Unit	Relay output normally open	0 – 250 V
PT1	Text Display Unit	24 Vac Supply	24 – 40 Vac
PT2	Text Display Unit	24 Vac Supply	24 – 40 Vac
PT3	Text Display Unit	CAN +	0 – 5 V
PT4	Text Display Unit	CAN -	0 – 5 V
PT5	Text Display Unit	Screen connection	Not applicable

1.10.22 NX604x and NX608x CANbus pressure sensors.

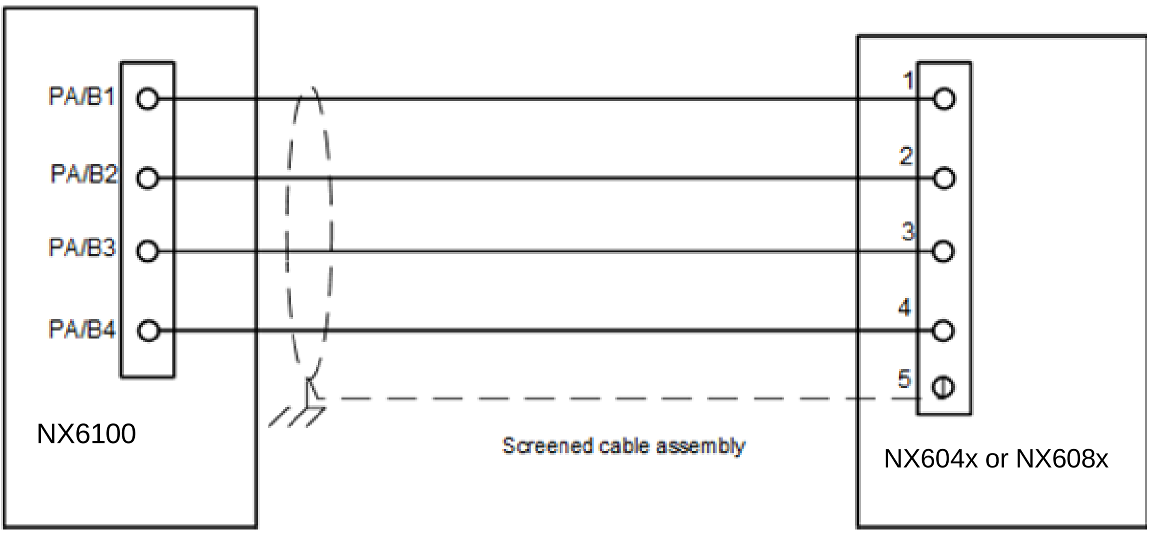
Connection is to the CAN Bus using a single M12 interconnection system shown below.

The sensor cabling MUST be overall ***'braid' screened*** PVC insulated 0.25 mm^2 (AWG 24). (Number of cores as required by the relevant sensor).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Connect the cable 'braid' screen to earth at an Earthed DIN terminal in the panel or terminal 5 on a distribution board. Ensure that the screen covers the signal wires until 30mm from the terminal rail or distribution board terminals.

The connection details are as follows:



Pre-assembled wiring cables.

Suitable connection wires are available from FIREYE.

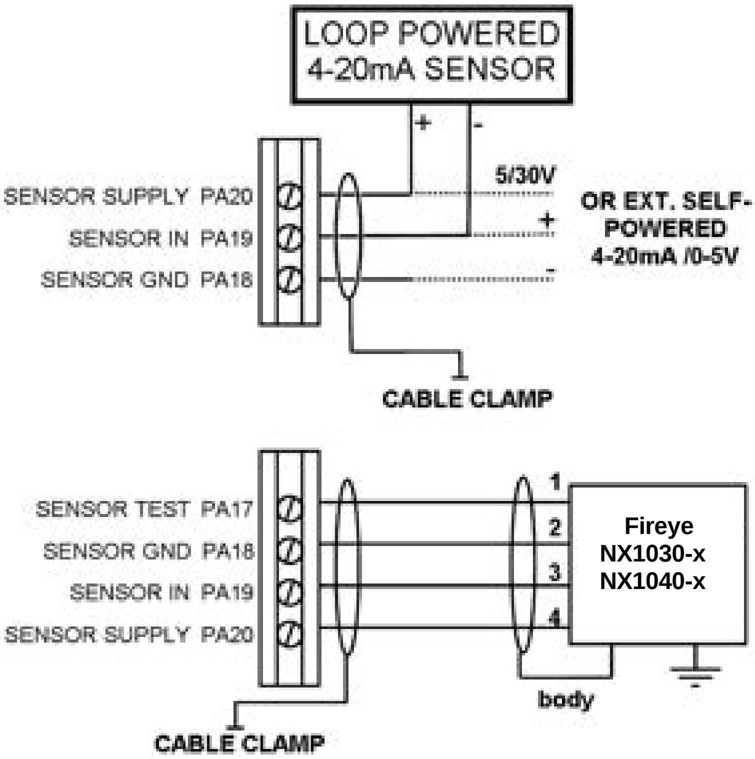
NX224760-0050, 5m (15') CANbus quick disconnect connection cable for pressure sensors and scanners.

Refer to paragraph **Error! Reference source not found.** for details on CANbus wiring.

1.10.23 Pressure/Temperature Sensor Input *(main controller)*

CAUTION

- Incorrect connection or application of excess voltage to sensors may damage or destroy the sensor or controller inputs.



The pressure/temperature sensor cabling MUST be overall 'braid' screened PVC insulated 0.25mm^2 wire (7/0.2 mm) (AWG 24) - number of cores as required by the relevant sensor.

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

The input is suitable for use with:

- 0-5 V or 4-20 mA sensors (externally or internally powered)
- the NX102x steam pressure sensor, or
- the NX104x boiler temperature sensor.

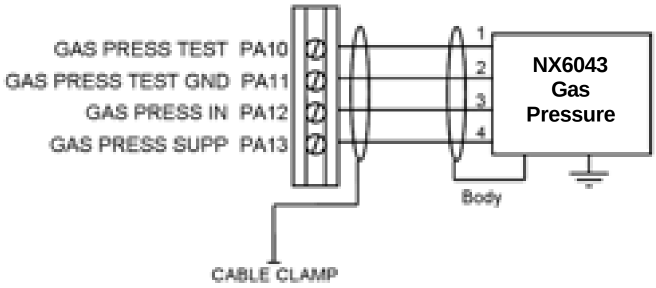
Refer to "SENS IN and SENS SUPP for Analog Input 6 (main controller)" section 1.8.3 for details on setting the option links for the correct voltage and input type.

Connect the cable 'braid' screen to the controller with the use of the screen termination clamp. In the case of the NX102x or NX104x sensors, the cable 'braid' screen must also be connected at the sensor. Make all connections at the sensor/transmitter first.

The manufacturer supplies the NX104x sensor with a 2m tail of cable, which has the core wires and screen terminated within the head. These are the connections:

Terminal	Function	Color
1	Test	Red
2	Ground	Yellow
3	Signal	Green
4	Power	Blue

1.10.24 Gas Pressure Sensor input *(main controller)*



The pressure/temperature cabling MUST be overall 'braid' screened, PVC insulated, 4-core 0.25mm^2 wire (7/0.2 mm) (AWG 24).

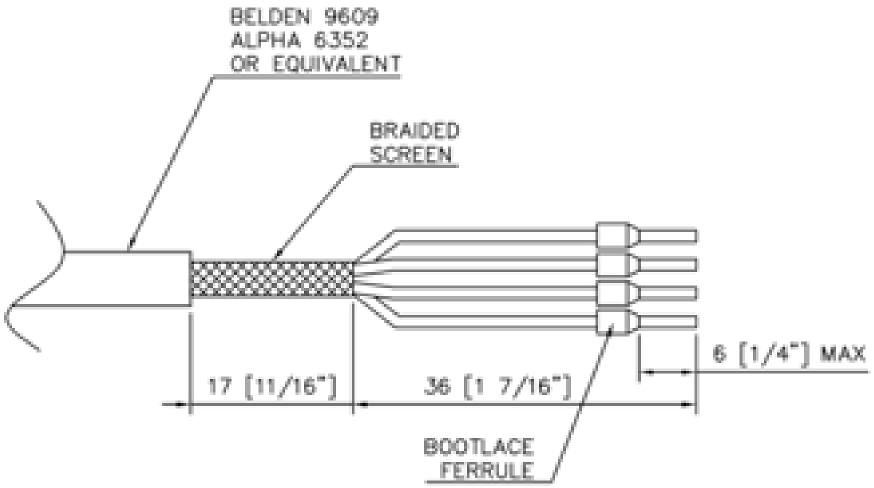
See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Connect the cable 'braid' screen at both ends, using the screen termination clamps provided at the sensor and at the controller. Make all connections at the sensor first.

Incorrect connection or application of excess voltage may damage or destroy the devices being connected.

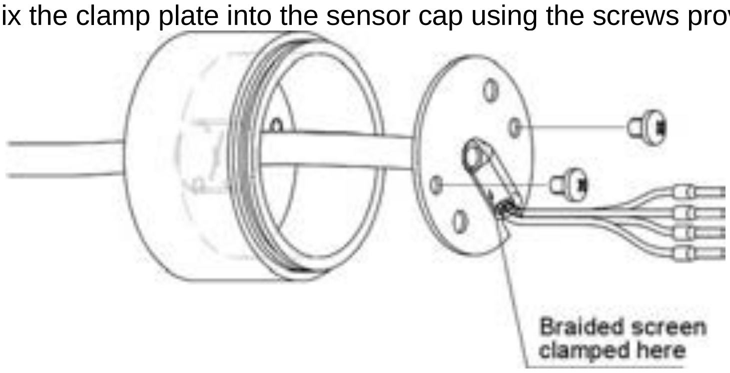
1.10.25 Pressure Sensor screen termination

1) Prepare the wiring as shown below:



Dimensions in mm [inches]

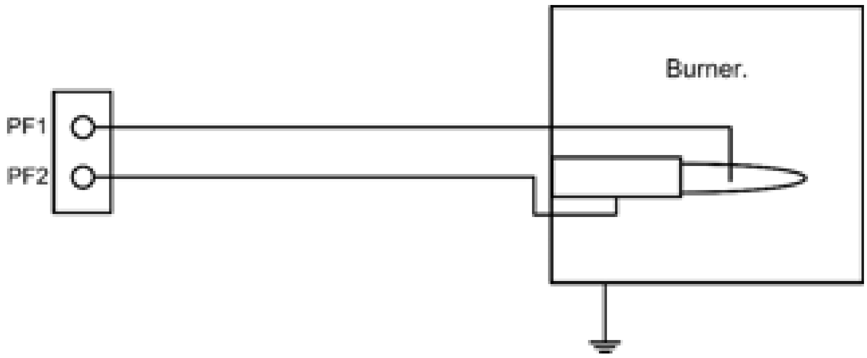
2) Clamp the braided screen between the lid and the clamp plate, with the wire tails protruding from the 'D' cutout as shown below. Fix the clamp plate into the sensor cap using the screws provided.



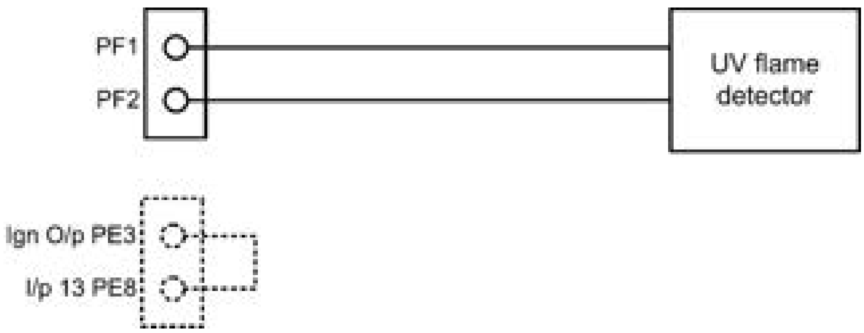
1.10.26 Ionization / UV flame sensor input

Install and wire the Ionization probe or UV sensor (and shutter device, if fitted) according to the instructions supplied with the sensor. The signals associated with these types of flame sensor are high voltage, therefore **DO NOT use screened cable**. The cable voltage rating must exceed the maximum voltage carried by any other cable connected to the controller or run in the same conduit.

. When an Ionization probe is fitted, PF2 must be connected to earth at the burner head. .



For UV flame detection mount the sensor in such a way that an ignition spark will not trigger the presence of a flame during pre-ignition. The controller will 'Lockout' if this occurs. **Where there is risk of the detector interpreting the spark as a flame, set option 8.0 to check the ignition output, and add the wire shown by the dotted detail.**



The UV scanner (and shutter device, if fitted) should be installed and wired according to the instructions supplied with the sensor. Since this cable may be run adjacent to, and/or in the same conduit as high voltage wiring, its voltage rating must exceed the maximum voltage carried by any other cable connected to the control or run in the same conduit. Do **NOT** use shielded wire on the UV Scanner.

1.10.28 NX6094 / NX6095 CANbus self-checking UV flame detector connections

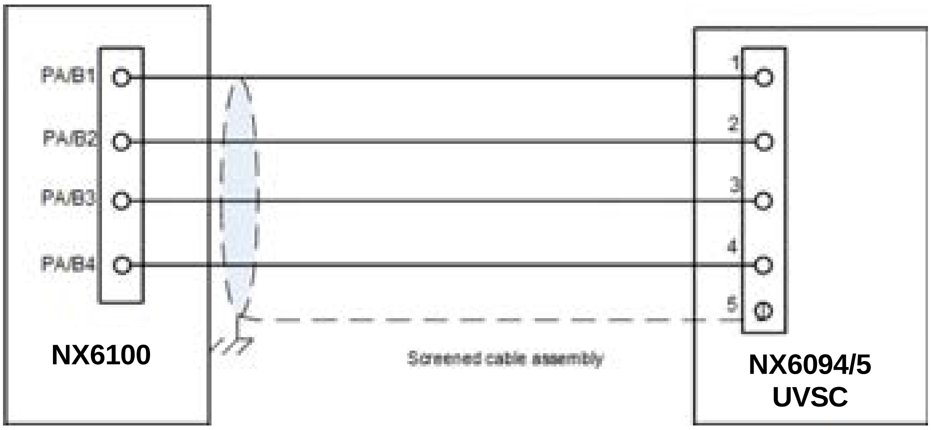
Connection is to the CANbus only using the M12 interconnection system shown below.

The sensor cabling MUST be overall ***'braid' screened*** PVC insulated 0.25 mm^2 (number of cores as required by the relevant sensor).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Connect the cable 'braid' screen to earth at an Earthed DIN terminal in the panel or terminal 5 on a distribution board. Ensure that the screen covers the signal wires until 30mm from the terminal rail or distribution board terminals.

The connection details are as follows:



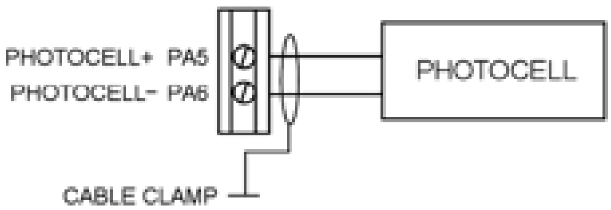
Pre-assembled wiring looms.

Suitable connection wires are available from FIREYE.

NX224760-0050, 5m (15') CANbus quick disconnect connection cable for pressure sensors and scanners.

Refer to paragraph 1.10.18 for details on CANbus wiring.

1.10.29 Photocell, I.R. Flame sensor or Volt-Free-Contact flame indication

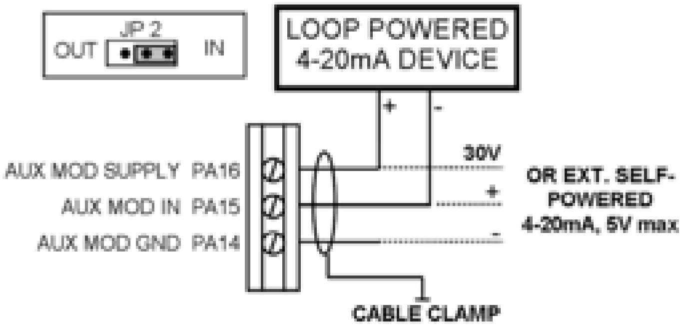


Install and wire the photocell/I.R. or VFC according to the instructions supplied with the sensor device. The flame sensor MUST be connected using multi-strand overall 'braid' screened, PVC insulated, 2-core of 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Mount the sensor in such a way that an ignition spark will not trigger the presence of a flame during pre-ignition. The controller will 'Lockout' if this occurs. **Where there is risk of the detector interpreting the spark as a flame, set option 8.0 to check the ignition output and wire the system as in 1.10.26.**

1.10.30 Auxiliary Modulation Input - Analog Input 5



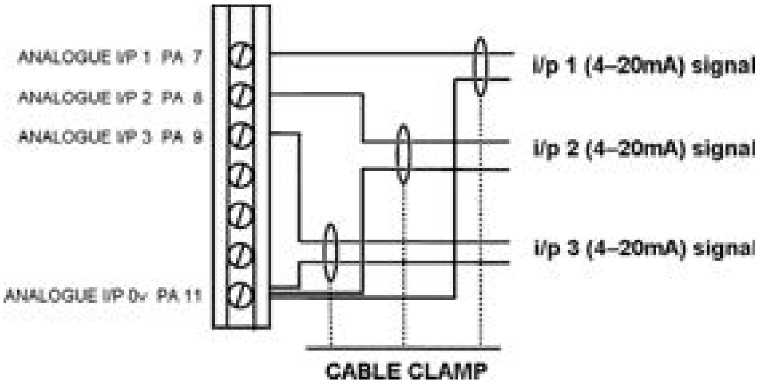
The cabling to Analog input 5 MUST be overall 'braid' screened, PVC insulated, 0.25mm^2 wire (7/0.2 mm) (AWG 24).- number of cores as required by the relevant sensor.

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Make sure link JP2 is set to the 'I' position if the input is being connected to a device with a 4-20 mA output.

Incorrect connection or application of excess voltage may damage or destroy the controller.

1.10.31 Analog Input 1 to 3



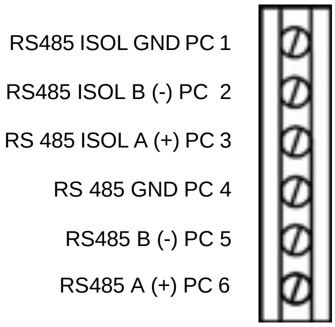
The cabling to Analog inputs 1 to 3 must be 2-core overall 'braid' screened PVC insulated 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Important: There is no provision on the controller to supply power for external devices. Under no circumstances must the +30 Vdc supply be used for this purpose. Incorrect connection or application of voltage over 5 V may damage or destroy the devices being connected.

1.10.32 RS485 interface

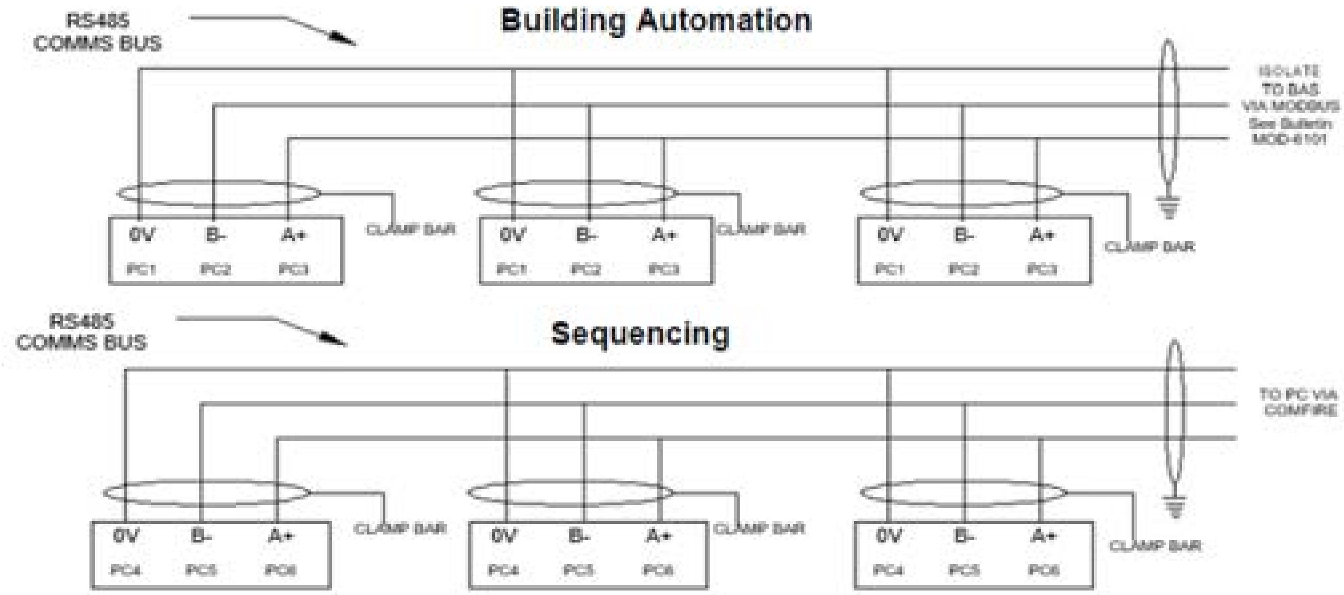
The RS485 interface included in the basic controller is for interconnecting several FIREYE controllers for boiler sequencing or for connecting a laptop computer during commissioning. If it is intended to make a permanent connection to a BCS or non-FIREYE equipment, then the optional daughter board should be installed, which provides communications via an isolated RS485 interface using the Modbus protocol. For details on connecting NX6100 series controllers to a PC on the communications bus, refer to the on-line Help within the FIREYE ComView software.



The RS485 cabling MUST be overall ‘braid’ screened, PVC insulated, 3-core of 0.25mm^2 wire (7/0.2 mm) (AWG 24).

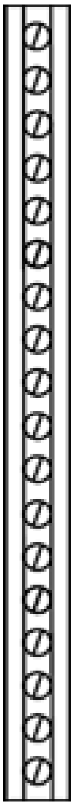
See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Terminate the screen **at each controller** using the cable clamps provided. **Incorrect connection or application of excess voltage may damage or destroy the controllers being connected.**



1.10.33 NX6100 Daughter Board (optional)

4-20 mA Output Channel 1 –ve PZ 1
4-20 mA Output Channel 1 +ve PZ 2
4-20 mA Output Channel 2 –ve PZ 3
4-20 mA Output Channel 2 +ve PZ 4
4-20 mA Output Channel 3 –ve PZ 5
4-20 mA Output Channel 3 +ve PZ 6
Counter Input 1 PZ 7
+12 Vdc PZ 8
Counter Input 2 PZ 9
+12 Vdc PZ 10
Counter Input 3 PZ 11
Input Channel 1 -ve PZ 12
Input Channel 1 +ve & 2 -ve PZ13
Input Channel 2 +ve PZ14
Relay 8 common PZ 15
Relay 8 normally open PZ 16
Relay 7 common PZ 17
Relay 7 normally open PZ 18



The cabling for all of these terminals MUST be overall ‘braid’ screened, PVC insulated, 2-core of 0.25mm^2 wire (7/0.2 mm) (AWG 24).

See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Some installations use motor devices that are controlled by an inverter connected to a 4-20 mA output on this daughter board. Typically, there is only a requirement to connect the cable screen to earth at the controller. However, in some instances the screen may need to be connected to earth at the inverter.
The Counter Inputs are for use with an inductive sensor and encoder wheel, for motor speed feedback.

The Analog inputs are for 4-20 mA signals, which must be electrically isolated at the source.

You can set the function of relays 7 & 8 by option parameters. **Note:** the maximum rating of these relays is 100 mA at 50 Vdc.

Note: Incorrect connection or application of excess voltage may damage or destroy the devices being connected.

1.10.34 Cable routing for the Daughter Board

The daughter board extends the capability of the main controller board to allow for a speed control option.

Insulation and the screen cover the conductors as much as possible.

◄— Route the screened signal cables through the clamps before terminating at connectors, as shown on the left.

1.10.35 NXO2TRIM Oxygen Probe Interface Connection

CAUTION

- Unlike the earlier NXO2INT, which is Line voltage supplied, the NXO2TRIM only requires CANBus power. **Connection of Line voltages to the NXO2TRIM will damage the product beyond repair.**
- The interconnection system between the NXO2TRIM and the NX6083-x probes is considerably different to the wiring system for the original NXO2INT interface and the NXO2PK-x probe.
- Incorrect connection may damage or destroy the devices connected to the CANBus.

The electrical connection between the NX6100 series controller and NXO2TRIM must meet the CANbus 4-core screen cable specification. Connect the CAN cable 'braid' screen at the controller, using the screen termination clamps provided.

Terminate the 'braid' screen for all other connections in the NXO2TRIM enclosure, at ring terminal point inside the enclosure. The length of the screen connection must be as short as possible.

Incorrect connection or application of excess voltage will damage or destroy the device(s).

Internal view of NXO2TRIM.

Probe connection terminals. PH1 to PH8

CAN and 4-20mA connection terminals PG1 to PG8

Ring terminal point for screen termination.
NOTE: Cable screen terminations are as short as possible

Cable entries points are provided on this face.

1.10.35.1 *Terminal connections.*

Terminal No.	Module	Function	Voltage Rating
PG1	O2 Trim Interface	CAN 24Vac Supply	24 – 32Vac
PG2	O2 Trim Interface	CAN 24Vac Supply	24 – 32Vac
PG3	O2 Trim Interface	CAN + (High)	0-5V
PG4	O2 Trim Interface	CAN – (Low)	0-5V
PG5	O2 Trim Interface	GND (4-20mA Input 0V)	0V
PG6	O2 Trim Interface	4-20mA Input 1	0-5V
PG7	O2 Trim Interface	4-20mA Input 2	0-5V
PG8	O2 Trim Interface	4-20mA Input 3	0-5V
PG9	O2 Trim Interface	GND (4-20mA Input 0V)	0V
PH1	O2 Trim Interface	Probe 1 (Black)	0-14V
PH2	O2 Trim Interface	Probe 2 (Red)	0-14V
PH3	O2 Trim Interface	Probe 3 (Yellow)	0-14V
PH4	O2 Trim Interface	Probe 4 (Green)	0-14V
PH5	O2 Trim Interface	Probe 5 (Blue)	0-14V
PH6	O2 Trim Interface	Probe 6 (White)	0-14V
PH7	O2 Trim Interface	Flue gas thermocouple White	0-5V
PH8	O2 Trim Interface	Flue gas thermocouple Green	0-5V

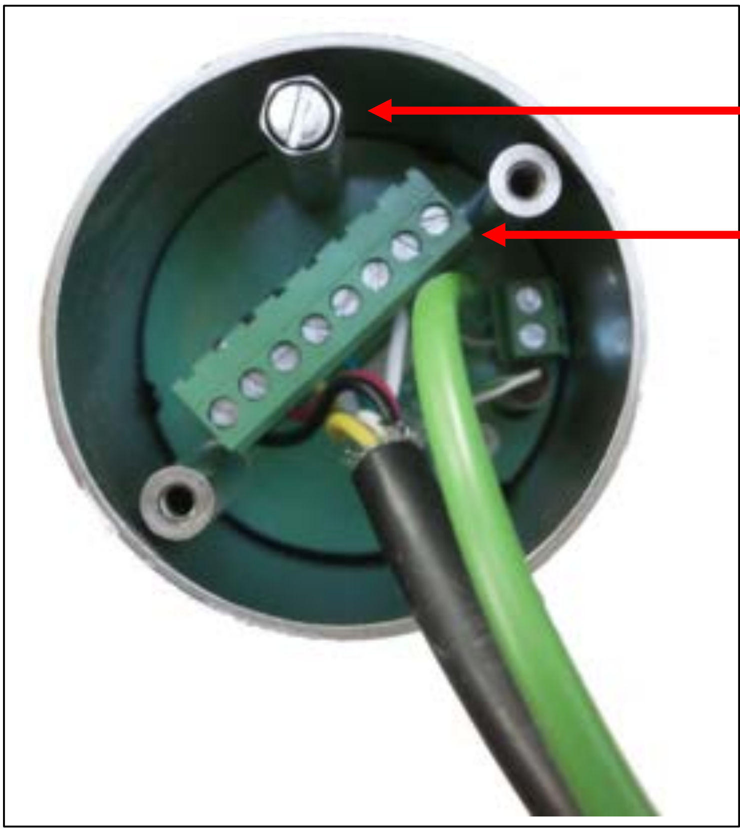
The connection scheme between the NXO2TRIM and NX6083-x is by direct connection of PH terminal1 to Probe terminal1, PH terminal 2 to Probe terminal 2 and so on up to terminal 8. See the reference to PH above.

The screen of the probe heater and signal cable MUST be terminated, using a ‘ring terminal’, to the termination point inside the NXO2TRIM enclosure.

The electrical cable specification for connections between the NXO2TRIM and NX6083-x probe must follow the description below:

Cell heater and Oxygen measurement.	**Max Voltage in use 14V d.c.** • 6-core cable with each core 0.5 mm^2 (20 AWG) and with overall braided screen. Cable covered in PVC sheath. • Resistance per core 40 milliohms/meter. • Maximum working voltage 440V rms. • Maximum length between the probe and controller is 10m (33ft).
Flue Gas temperature measurement.	**Max Voltage in use 5V d.c.** • Type ‘K’ compensating cable. • 2-core PVC insulated cable with 0.25 mm^2 (24 AWG) conductors, covered in overall PVC sheath.

View of NX6083 oxygen probe terminals.



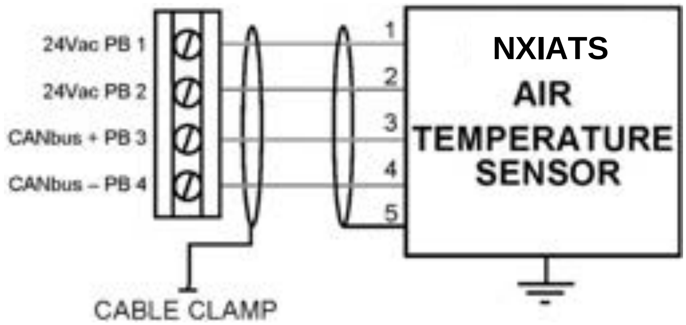
Calibration port.

Removable terminal block

NOTE: There is no screen termination point. The screen in the 6-way cable must be cut short to the PVC outer cover.

Make sure all connectors are correctly fitted and then secure the probe cap on the probe.

1.10.36 Inlet Temperature sensor



The system allows direct connection of an NXIATS inlet temperature sensor. The unit is connected via CANbus in the same way as for the servo motors and display and MUST be connected using overall 'braid' screened, PVC insulated, 4-core, 0.25mm^2 wire (7/0.2 mm) (AWG 24).

This cable may also provide power to the servomotors; if this is the case, and the current exceeds 600 mA, then you need to use a 4-core, 0.5mm^2 cable (16/0.2 mm) (AWG 20) For details, refer to section 1.10.6 "ELV signal cable Screen Connection".

- See **Cable Voltage Rating rule** in paragraph 1.10.14 on page 31.

Incorrect connection may damage or destroy the devices being connected.

1.11 Final Checks

CAUTION

- Incorrect setting of the Supply Voltage Links **WILL** damage or destroy the controller module. This is not covered by the product warranty.

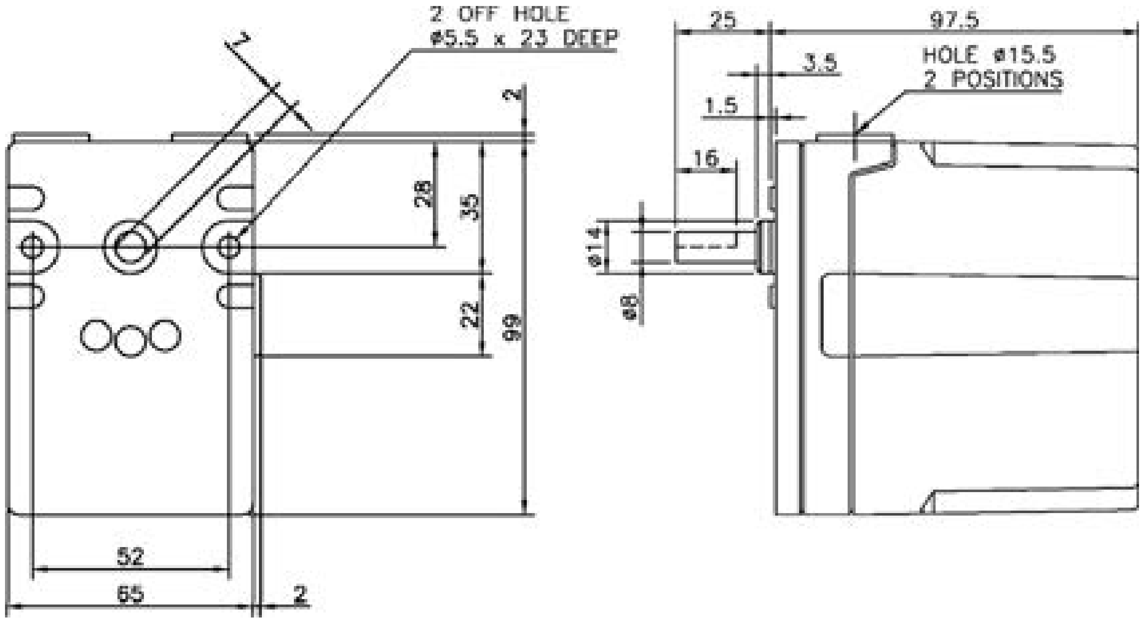
Before applying power:

- Check the controller supply voltage link is correctly set.
- Check all other link positions are correct.
- Check the supply fuse(s) are of the correct type and value.
- Check that all wiring and connections are in accordance with the specifications detailed in this manual.
- Check you have fitted the enclosure lid(s) before applying power to the controller(s).
- Check all metal 'bodied' parts of the system are correctly connected to earth.
- Check that all cables where required are of the correct 'braided screen' specification and terminated as defined in this manual.

2. How to select and install the Actuators

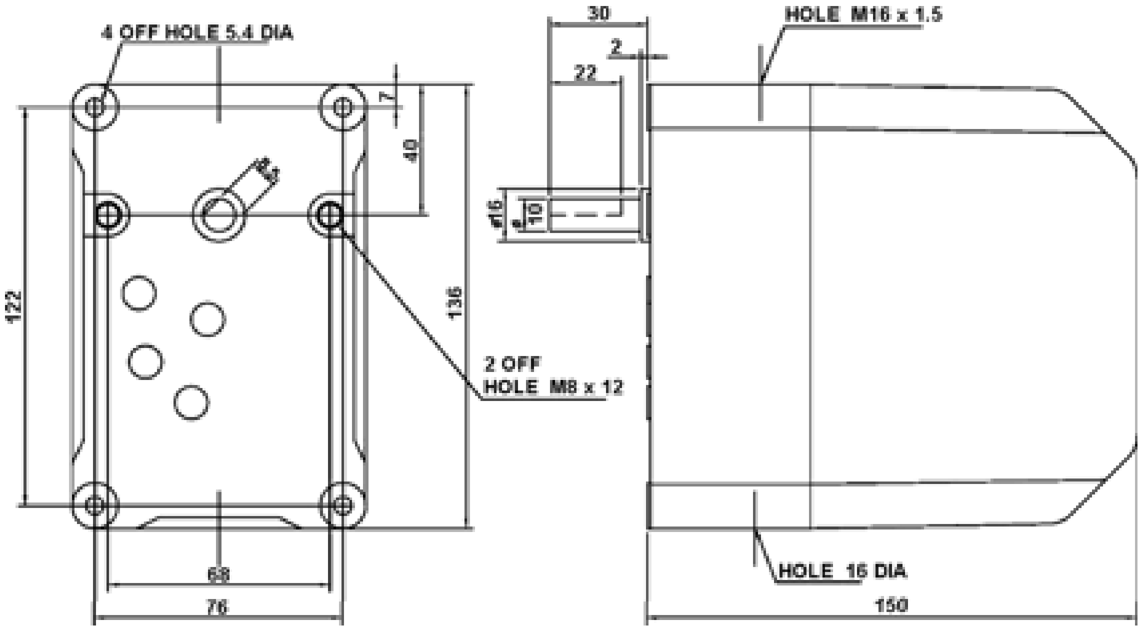
2.1 Actuator (Servo Motor) Models

2.1.1 NXC04 4 Nm Actuator (3ft pd)



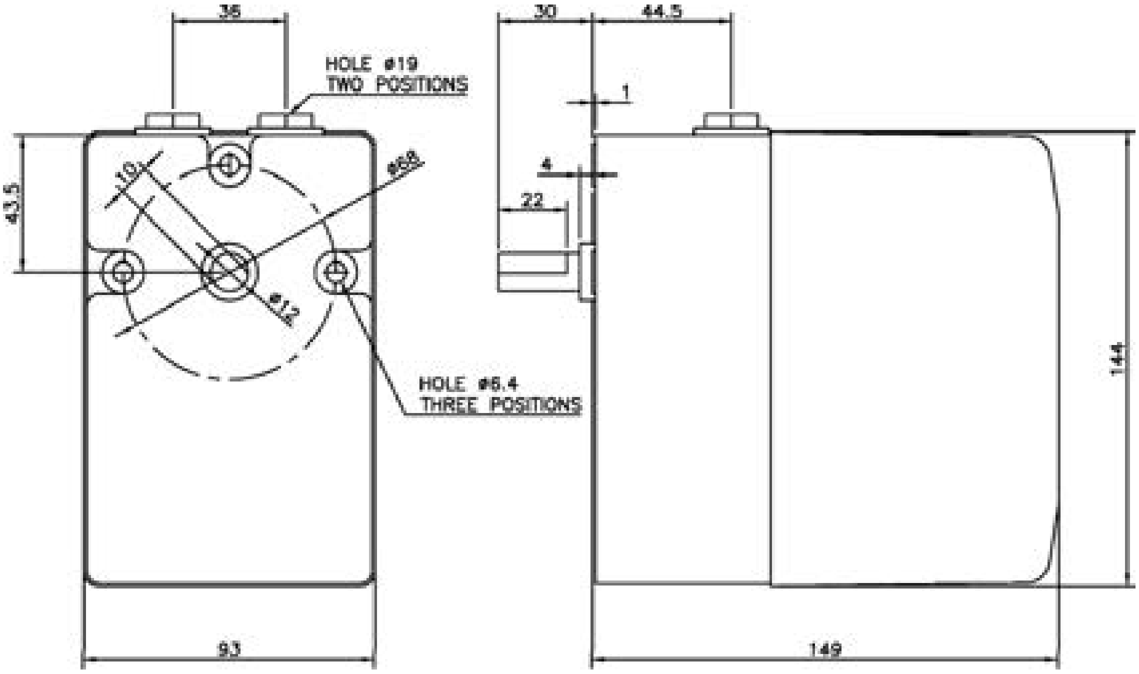
Dimensions and mounting holes

2.1.2 NXC12 12 Nm Actuator (9ft pd)



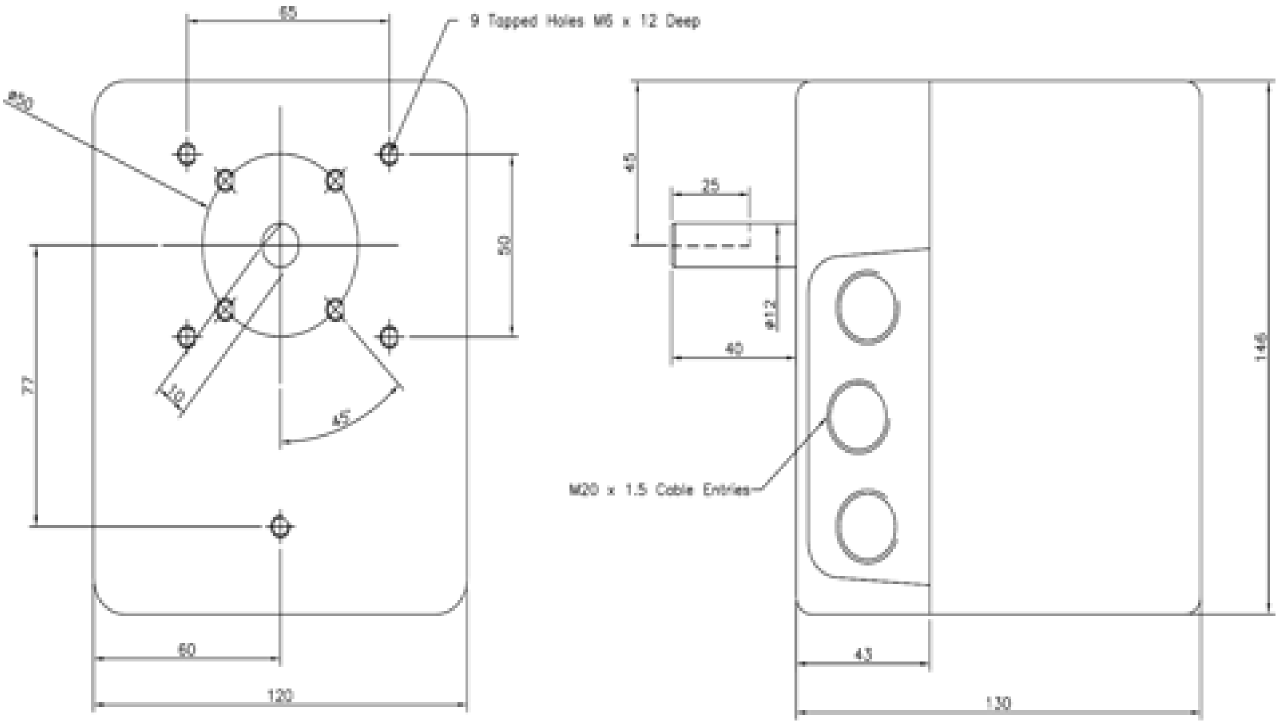
Dimensions and mounting holes

2.1.3 NXC20 20 Nm Actuator (14.75ft pd)



Dimensions and mounting holes

2.1.4 NXC40 40 Nm Actuators (29.5ft lb)



Dimensions and mounting holes

2.3 Locking the Actuator to the Valve Shaft

CAUTION

- After the position of the actuator shaft relative to the valve or damper shaft is correctly set, each actuator **must** be locked to its valve shaft for all air damper(s) and fuel valve(s).
- In order to prevent the joint between actuator and shaft moving, it is recommended that the device used to link the two items is pinned together. See the picture below.
- The actuator zero point cannot be adjusted. Before connecting to the valve shaft, first make sure the actuator direction is set, and the unit is driven to its minimum point.
- It is essential that the actuator and valve remain securely connected, to ensure safe operation of the equipment, because the valve position feedback is only taken from the actuator.

The Coupling and shaft have been drilled to size then a roll pin has been pressed into the holes to fix the angular position.

Actuator or Valve Shaft

Coupling

2.4 Valve Control Direction

Make sure that each actuator travels in the correct direction to match the mechanical configuration of the burner. The default setting is for a servo to move anticlockwise from the zero to 90-degree position (viewed facing the output shaft).

You can reverse this by setting Option parameters 5.0 to 5.9 to a value of 1.
DO THIS BEFORE ALIGNING SETTING THE ZERO POSTION FOR THE VALVE OR DAMPER SERVO MOTOR.

2.5 Selecting and Calibrating Actuators

CAUTION

- All actuators connected to the NX6100 control system **must** be approved as part of system.
- The total electrical load for any controller is 18 VA. When the total actuator power exceeds this limit a NXCBH CANbus Hub must be included into the panel design to provide the additional power requirement.
- Valve and motor alignment and calibration must be set in **Commission Ratio mode** before commissioning any profile set points.

2.5.1 Motor requirements

Only actuators supplied by FIREYE may be used with this equipment; various actuators/servomotors are available to suit different applications.

The information below is intended as a general guide only. When installing or adjusting the actuators fitted to the appliance, make sure you refer to the correct instruction manual.

- All actuators must be connected via CANbus directly, or via a CANbus interface unit.
- CANbus actuators operate at 24 Vac supplied from the main controller unit or the NXCBH CANbus PSU and Hub.
- All have a 90° maximum movement, with an operating time of approximately 30 seconds for 90° of travel.
- Two types of actuator/servomotors are available:
  – The first type uses a potentiometer to provide feedback of the output shaft position,
  – The second type uses magnetic encoder to detect the position of the output shaft.
  These can be identified by the letter “M” following the model number.

The FIREYE actuator/servomotors which use potentiometers for position feedback all have internal limit switches, which must be adjusted during commissioning. This will allow the Close Position check to be performed and will protect the burner/boiler against damage if there is an electronic fault.

2.6 Aligning the potentiometer type actuator

CAUTION

- The servomotor internal feedback potentiometer must be secured within the servomotor, to make sure that there is no possibility that the potentiometer can become disconnected from the motor output shaft.
- For direct-drive servomotor potentiometers (all servomotors except 4 Nm), make sure the potentiometer body is secured to the flexible mounting, to prevent any movement between output shaft and potentiometer. Do not adjust the ‘nuts’ retaining the flexible mounting to the metalwork.
- For gear-driven servomotor potentiometers (4 Nm servomotor), make sure the potentiometer is secured to its mounting bracket and that the bracket is correctly attached to the servomotor body, to prevent any backlash between the potentiometer and the output shaft.

For each motor, it is necessary to adjust the servomotor position relative to the valve or damper shaft that it is driving (e.g., gas valve) in order to obtain the correct open and closed positions on the display. To do this, follow the procedure below:

1. Make sure that the correct servomotor direction is set before connecting the servomotor to the relevant valve. If the servomotor direction is incorrect, use the relevant option parameter to reverse.
2. Move the valve to its fully closed position and adjust the servomotor position by driving the motor so that approximately 1° is shown on the display.
3. Move the valve to its fully open position by driving the servomotor and check that the display reads approximately 90° or the maximum angular opening required from the servomotor if this is less than 90°.

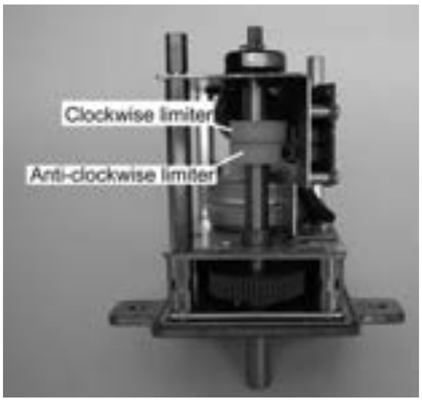
2.6.1 Adjusting the micro-switch positions

Each time a burner start-up sequence is initiated, the controller will move the fuel and air damper motors to their respective closed positions, to prove correct motor and potentiometer operation. Each motor has microswitches fitted to set the close position during this proving operation and limit the maximum ‘open’ position to prevent burner/boiler damage in the event of a system failure. To set the microswitch positions, follow the procedure below.

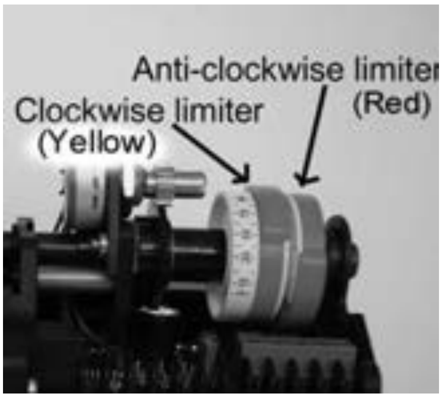
1. Enter Commission Ratio mode – see “Commissioning” in Section 3.
2. Move each motor to approximately 45°, using the **UP/DOWN** keys; this is to make sure the **DOWN** key will drive the motor.
3. Holding the **DOWN** key, tighten up the low limit microswitch until the motor will no longer move down.
4. Holding the **DOWN** key, gradually slacken off the low limit microswitch until the motor starts moving down. Continue to slacken off the microswitch until the motor stops with a reading on the display of approximately 1°. Verify that the valve is in the ‘closed’ position.
5. Move the motor up and down a few times to check that the motor stops each time at approximately 1° and re-adjust the microswitch if necessary. This position will allow for some tolerance in microswitch operation.
6. Hold the **UP** key and tighten up the high limit microswitch until the motor will no longer move up.
7. Holding the **UP** key, gradually slacken off the high limit microswitch until the motor starts moving up. Continue to slacken off the microswitch until the motor stops in the desired purge position. This position does not have to be 90°, but we recommend that it is in the range 45° to 90°. Verify that the servomotor is being stopped by the micro-switch, and not by being stalled by some mechanical limit on the valve that it is operating.

8. Move the motor, up and down a few times to check that the motor stops each time at the desired limit position. Repeat steps 3 to 7 for all servomotors.

2.6.2 Actuator micro-switch movement limiters



NXC20/40 M



NXC04
NXC12
NXC20

2.7 Aligning the magnetic feedback actuators

For each actuator, it may be a requirement to adjust the actuator output shaft position relative to the valve or damper shaft that it is driving (e.g., gas valve) in order to obtain the correct Closed (P0) position on the display.
Make sure that the correct rotation direction for each actuator is set in option 5.x then follow the steps below:
.

1. With the controller in the P0 state, move the jumper link on the actuator circuit board to connect across pins 1 and 2, like this...

2. In this setting mode the position feedback value will indicate zero degrees on the HMI.

3. Wait for 5 seconds, then adjust the motor shaft position to align with the Closed position on the valve or damper using the ▲ and ▼ keys on the HMI, making sure that the motor is not driving against a mechanical stop at the Closed position.
   Notes:
   1. *During this step the HMI will show a zero value for the position feedback.*
   2. *If you adjust the position in a negative direction, compared to the previous Closed position, then the motor will move very slowly for the first few degrees of movement, then pick up to normal speed.*

4. When the actuator is correctly aligned to the Closed position of the valve or damper remove the jumper link from pins 1 and 2 and "park" it on pin 1, like this….

5. Wait for 5 seconds, then check that the position feedback value for the actuator is within the limits of -0.5 to +0.5 degrees.

6. Check the full movement range for the actuator and ensure that it can return to the zero position consistently.
   Note: *The motor speed will change and move very slowly as it approaches the fully Open or fully Closed positions.*

7. If the Closed position is outside of the limits in 8, then repeat steps 4 to 8.

8. Continue to set other actuator zero positions, then commission profiles/curve sets as normal.

CAUTION

If the jumper is left in the programming position (Pins 1-2) when the controller exits to run mode, an ERR3 will be shown for the drive position, and the controller will move to Lockout. In this case you may need to repeat the Closed point setting process.

3. Section 2 Update History

New version	Date		Changes in brief
V1pt4D	June 2022	GFS	Minor text amendments. Addition of the description for the Service Schedule function.
V1pt4D	June 2024	RAL	Created Fireye Document.

——— End of Section 2 ———

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1. Commissioning

These general comments about commissioning the controller apply to both the **Touch Screen Display** option and the **Text Display** option.

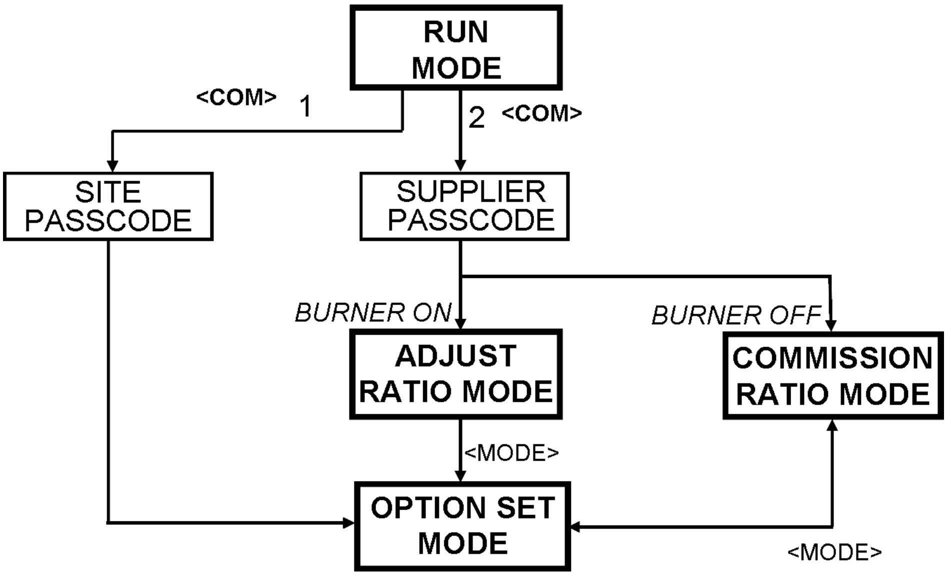
WARNINGS

- This manual may cover more than one model from the 6000 series. Check for additional information at the end of this chapter.
- While the control is operating in Commission mode, certain safety checks cannot be performed by the control. Therefore, the safety of the system operation is the sole responsibility of the commissioning engineer.
- Do not allow fuel to accumulate in the combustion chamber.
  If fuel is allowed to enter the chamber for more than a few seconds without igniting, an explosive mixture could result.
- If a flame failure occurs at any point, the control will not attempt a re-start until the fault is cleared. Before moving to the ignition position to attempt a re-start the system will perform any selected pre-purge.
- Where operating times are adjustable, make sure that those selected are acceptable for the appliance being controlled.
- Make sure that a purge position is entered for each drive as required. Failure to enter a purge position will mean all drives remain at their ‘closed’ positions.
- After selecting all safety times, it is the responsibility of the commissioning engineer to verify that the times entered are correct for the appliance being controlled.
- After entering and/or adjusting any profile points for any profile, it is the responsibility of the commissioning engineer to verify that the resulting fuel: air ratio is acceptable for the application being controlled.

1.1 Passcode Access

To set up or change any settings in the controller, you will need to go into Commission mode. Two passcodes are available for this purpose:

- **Supplier passcode** - allows entry to all Commission modes.
- **Site passcode** - allows adjustment of some Option Parameters.



1.2 The Commissioning Process

The process may vary according to the burner and the application, but here are general guidelines that apply whether you have the Touch screen or the OLED text display.

1.2.1 Typical Programming Steps for a simple Burner System

These are the most likely parameters that you will need to set up:

1. Set the values in options 2.x, 3.x, 4.x and 5.x if necessary.
2. Set the values in options 6.x to assign the Safety Valve sets to the Burner Profiles.
3. If special start-up times are required, then set option 1.7=0 and then adjust options 7.x accordingly.
4. If Variable Speed Drives (VSDs) have been defined in the burner configuration, then review and set options 9.x.
5. For Gas burners, set option 10.x parameters to enable the safety valve leak test system.
6. Set either 12.x or 13.x parameters to suit the flame detection system on the burner.
7. Set 14.0 to assign the alarm output – refer to the electrical panel drawings. Review other 14.x options e.g., for pump or gas booster functions.
8. Set option 15.x parameters to configure the modulation input response and then options 21.x to configure PID loop 1. N.B. Hardware links may need to be set correctly for correct signal interpretation.
9. If the electrical configuration requires interlocks to digital inputs on the FIREYE6000, then set options 16.x, 18.x and 19.x to configure the response of the input and the display message.

1.2.2 Profiles

A **Profile** defines the operating positions for the fuel and air valves for the burner at different modulation levels, to suit different fuel types, fuel: air ratios, heat output and so on. It is sometimes called a "**Profile Curve Set**".

You can have up to four separate Profiles stored in the Fireye system, but it is not common to use all four. For example, you might have one Profile for gas and one for oil; or you may set up a full-power profile for 10MW output, and a reduced-power profile for 6MW output.

Within each profile, you can have up to 24 steps (called Set points); but typically, you would use between 15 and 18 Set points.

Your combustion engineers will need to know about the burner type; the kind of process that you are heating; technical information from the burner maker; fuel: air ratios to meet target emission figures, Fireye., before commissioning the system. Based on this information, they will need to work out the Profile information to program into the Fireye Controller system.

1.2.3 Option Parameters

To configure the Fireye 6000 series, you would program the Option Parameters (stored in memory) that describe the configuration of the burner and the boiler. You can set and adjust certain Option Parameters in Option Set mode, but there are some that you cannot change if the burner is ON - you will need to stop the burner first.

Here is an outline of the Option Parameters that are available:

Option Parameter Quick Reference List:

In this table, the options are grouped to help you refer to them. For a full listing and details of the Option Parameters, please refer to the Appendix.

Option group	Description
0.xx	Digital Communications settings
1.xx	Burner Panel POC (Proof of Closure) 2nd air switch Safety time configuration.
2.x 3.x 4.x 5.x	Drive (servo or VSD) channel configuration
6.x	Safety Valve assignment for each profile
7.x	Special safety time programming
8.x	Flame detection safety timing
9.x	VSD control characteristics
10.x	Gas pressure measurements and Safety Gas Valve leak test configuration.
11.x	Reserved, not available.

Option group	Description
12.x	Flame 1 detection configuration.
13.x	Flame 2 detection configuration.
14.x	Alarm relay configuration and Pilot/Main flame configuration.
15.x	Modulation and process input configuration
16.x	Profile change, High Volt input and Oil control configuration.
17.x	Auxiliary relay o/p functions.
18.x	Fail Safe digital inputs functions.
19.x	Fail Safe digital inputs messages.
20.x	Non-critical digital input functions.
21.x	P.I.D. loop 1 configuration.
22.x	P.I.D. loop 2 configuration.
23.x	Process Warming configuration.
24.x	Simple boiler sequencing options
25.x 26.x 27.x	Unused – reserved for Customer programs.
28.x	Analog input configuration.
29.x	Analog output configuration.
30.0 to 42.6	Oxygen probe and trim options.
42.7 to 42.9	Air pressure profiling options
43.x	CAN Bus burner and boiler sensor - serial numbers
44.x	FGR Hold-off options
45.x	Erase and Restore options.

1.2.4 Set points

Within a Profile, the Set points contain information about the required servomotor positions. A Set point can refer to the desired running pressure/temperature of the boiler/process, or a set of position data for air and fuel on the profile curve, or a desired Oxygen level that the oxygen trim function will try to attain if configured.

There are four profiles (or tables) of set points available in the standard controller. The profiles may be represented using the table below:

Gas servo position (°)	Air servo position (°)		Oil servo position (°)	Air servo position (°)
2.1	1.9	CLOSE(P0)	1.7	1.9
2.1	88.9	PURGE(P1)	1.7	88.9
24.6	30.6	IGNITION(P2)	10.6	28.7
21.3	25.8	LOW FIRE(P3)	10.6	28.7
...	...		...	...
76.8	85.6	HIGH FIRE(PX)	50.2	83.5

You can enter up to 24 set points for each profile, including close, purge, and ignition.

You can only enter new set points in **Commission Ratio** mode.
You can adjust existing set points in **Adjust Ratio mode** or **Commission Ratio** mode.

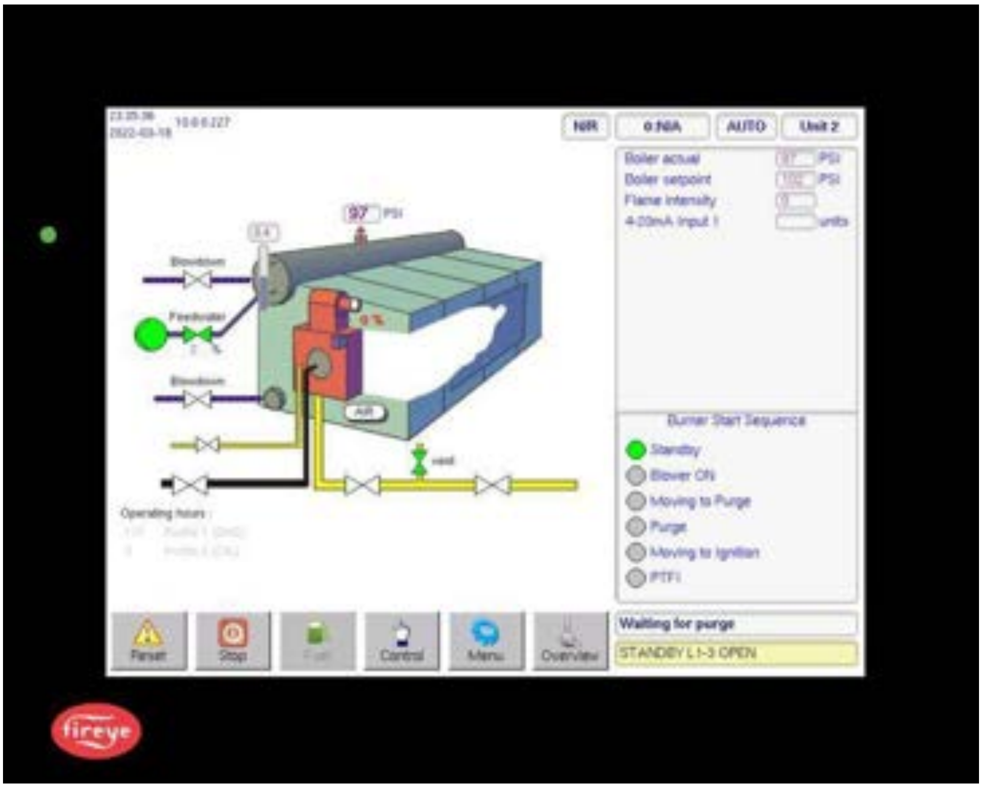
Where Air Pressure Profiling is enabled (Options 42.7 to 42.9), the air pressure at each profile point is stored when the profile set points for the drives are stored.

Summary:

1: You would set up the Profile numbers in Commissioning Ratio mode, with the burner OFF. You work through the sequence for one profile set point after the other, right through the sequence. You cannot step backwards to make a correction.
If you make a mistake and miss out a step, you need to start again, using the [NEXT] key to step through to where you made the mistake. Do the correction and store it. Then you can proceed through the other profile set points until you have entered all your data.

2: Then you can test and fine-tune the profile in Adjust Ratio mode with the burner ON. In this mode you can then go to any set point in the sequence as required.

2. How to Commission using the Touch screens



The Touch Screen used on many installations of the FIREYE system.

The Touch-screen option is a more advanced interface than the text display and is much easier to use.

Note: never use a sharp object such as a biro, pencil or metal stylus to operate the touchscreen. This could damage the screen, which would then not be covered by warranty.

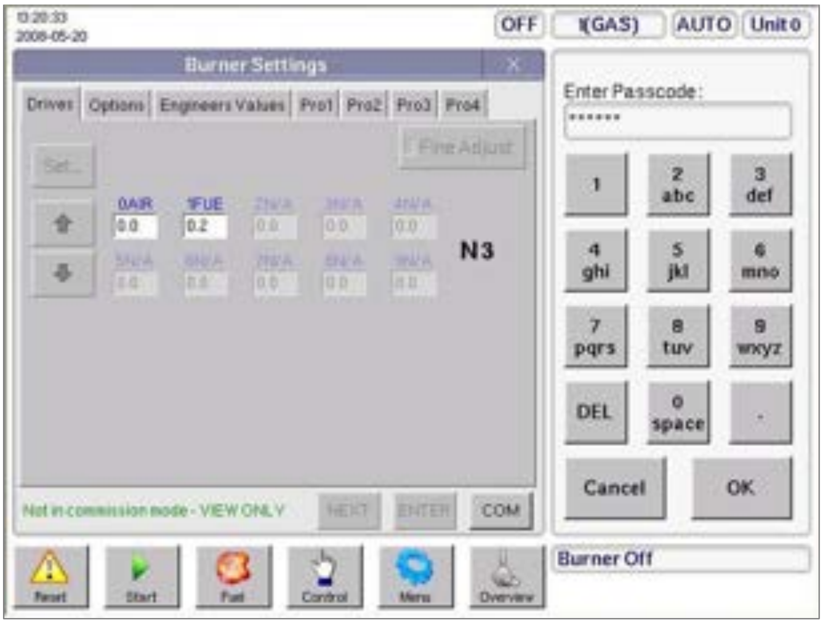
Please read this section of the manual carefully before you try to program any settings. The instructions and images use the NXTSD104 (10.4”) as an example but you may consider that the instructions for the NXTSD007 (7”) touchscreen are very similar with some menu and screen layout differences.

2.1 How to go into Commission mode (Red)

Note: If the burner is ON, you cannot go into Commission mode (red background), you can only go into Adjust Ratio mode (yellow background). To You can only access Commission mode, if the burner must be is **OFF**.

Burner must be OFF. If burner is ON, use > Stop button

Menu button > Burner settings > COM > enter passcode > OK



Signing into Commission mode

Stop the burner as follows:

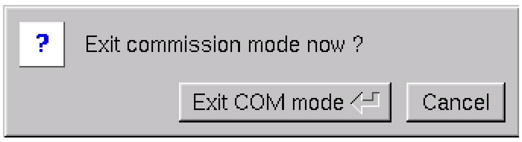
- If the burner is **ON**, tap bottom row > **Stop** button.
- Wait for the burner to cycle through to **OFF**, which will then be confirmed at the top of the screen ("OFF") and at bottom right ("Post Purge" then "Burner Off").

To adjust **Option Parameters** or **Drives** you will need to enter the relevant access passcode and go into **Commission mode** (COM) as follows.

- Tap the bottom row > **Menu** button > right **Burner Settings** button > bottom **COM** button. The keypad then appears on the right.
- Enter the passcode for Commission mode and press **OK**. The screen background now goes RED to confirm Commission mode, and the word COM is displayed at the top center of the screen. The X 'X' at the top right corner of the Burner Settings panel will be greyed out and inoperative.

Yellow background?

- If the background is YELLOW instead of red, then the burner is still ON, and you are in **Adjust Ratio mode**, not Commission mode.
- To exit from **Adjust Ratio mode**, tap the **RUN** button. A small confirmation screen pops up:



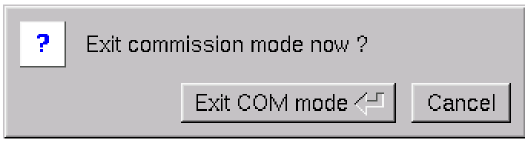
- Tap the **EXIT COM mode** button to confirm.

You will return to the main screen.

- Stop the burner and log in to Commission mode, as described above.

How to Exit from Commission mode

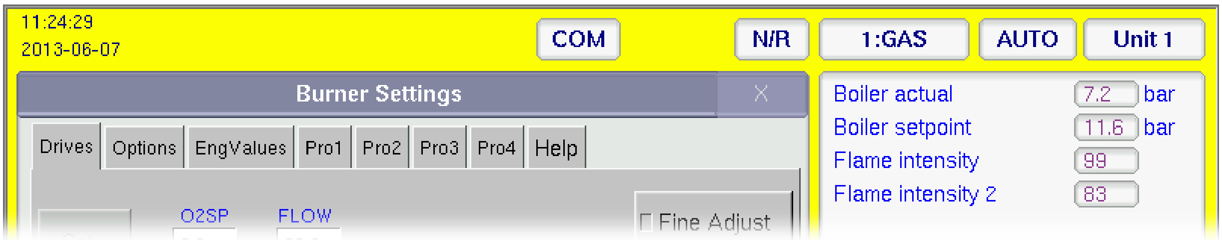
- To exit from Commission mode, tap the **RUN** button. A small confirmation screen pops up:



- Tap the **EXIT COM mode** button to confirm.

You will return to the main screen, and the red background becomes white.

2.2 How to go into Adjust Ratio mode (Yellow)



Note: You can only access **Adjust Ratio mode** if the burner is **ON**.

If burner is OFF, use > Start button

Menu button > Burner settings > COM > enter passcode

Start the burner as follows:

- If the burner is **OFF**, tap bottom row > **Start** button. Wait for the burner to cycle through to **ON**, which will then be confirmed at the top of the screen - the OFF indicator is replaced by a different indicator such as N/R Fireye.

Go into **Commission mode** (COM) as follows:

- Tap the bottom row > **Menu** button > right **Burner Settings** button > bottom **COM** button. The keypad then appears on the right.
- Enter the passcode for Commission mode and press **OK**. The screen background now goes YELLOW to confirm **Adjust Ratio mode**.

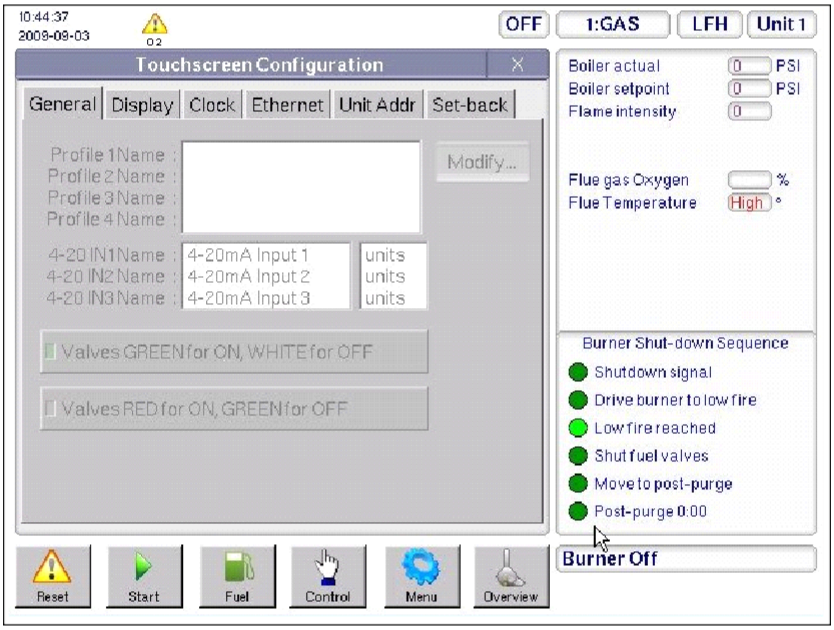
Red background?

If the background is RED, then the burner is still OFF, and you are in **Commission** mode, **not** Adjust Ratio mode.

- Exit from Commission mode as described above. You will then return to the main screen.

2.3 Touch Screen Unit Settings

Menu button > Screen Configuration button



Example after tapping **Menu > Screen Configuration**

After you tap the **Screen Configuration** button, a panel appears on the left giving you a choice of options. You can modify the Display, Clock and Ethernet tabs at any time. You may need a passcode to make changes on other tabs.

In the **General** tab, you can enter a name for each profile in use by tapping the white box; this may be passcode dependent.

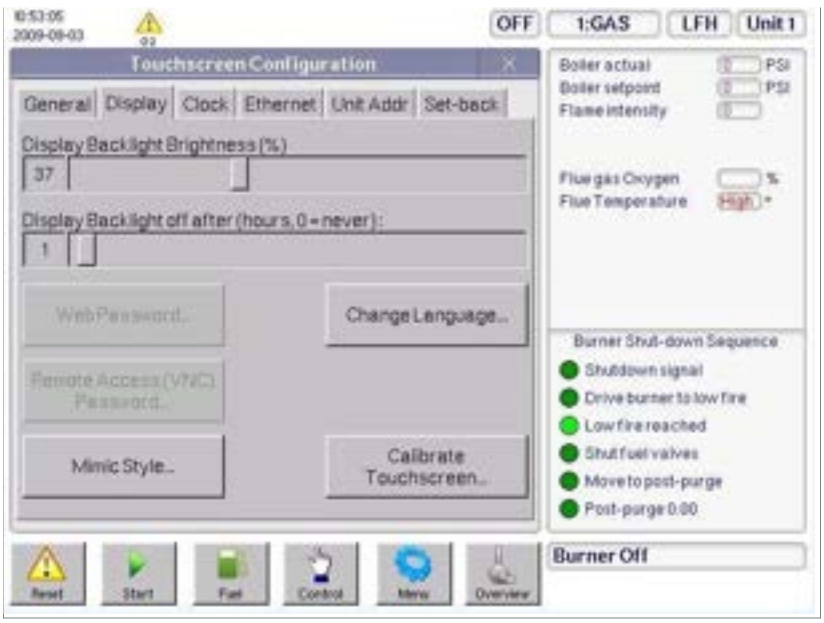
You can also set the color scheme for valves in the mimic panel.

When all changes are complete, you can return to the **Overview** screen either by tapping the 

'**X**' button in the top right corner of the **Touch screen Configuration** panel, or by tapping the **Overview** button.

2.3.1 Display Brightness / Contrast

Menu button > Screen Configuration button > Display tab



Example after tapping **Menu > Screen Configuration > Display** tab

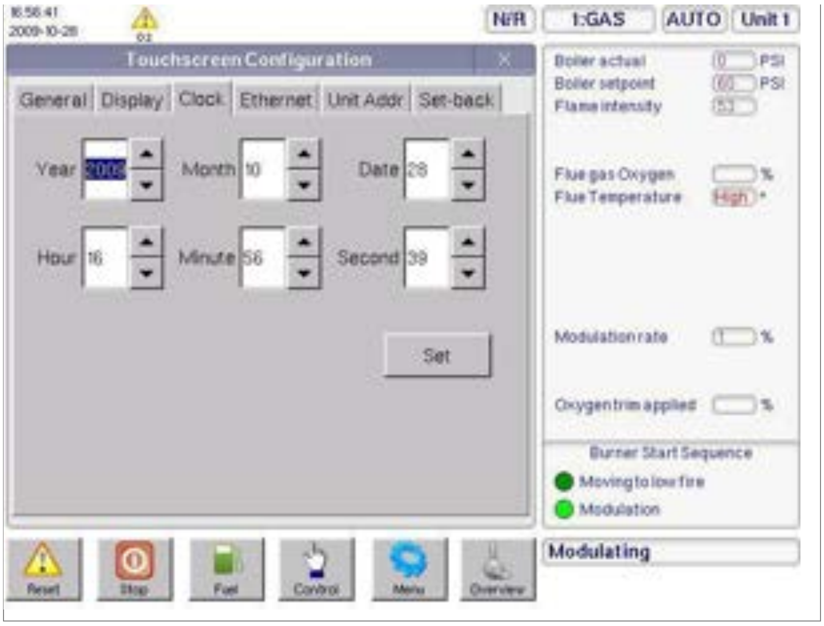
The **Display** tab allows you to change the brightness and contrast of the display.

From this tab the mimic type can be changed and also an alternative language – these changes may require a passcode.

Also, the Touch screen calibration process can be initiated from this tab.

2.3.2 Set Date and Time on the Clock tab

Menu button > Screen Configuration button > Clock tab



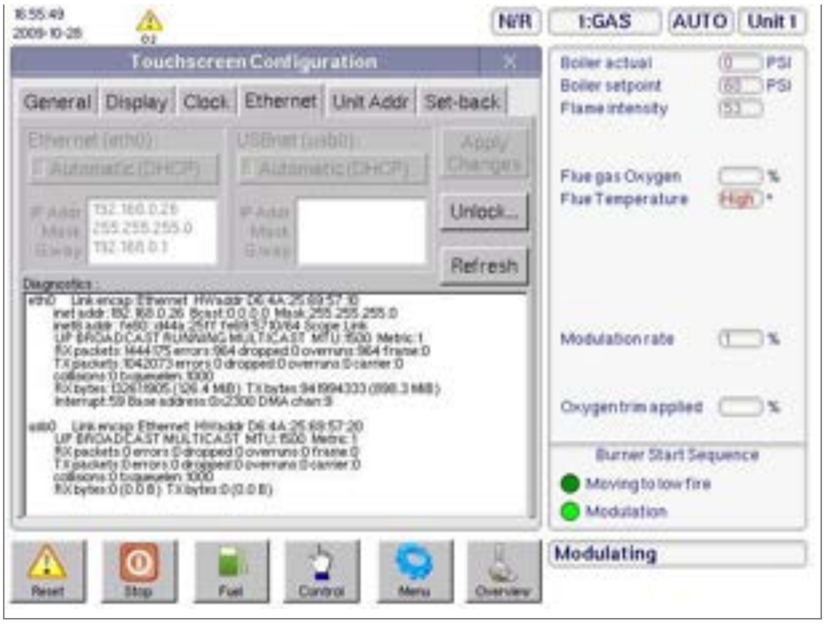
Example after tapping **Menu > Screen Configuration > Clock** tab

The **Clock** tab allows you to set or adjust the date and time.

- Tap the UP/DOWN arrow buttons to adjust the date and time, then tap the Set button.

2.3.3 Ethernet Settings

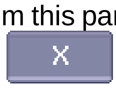
Menu button > Screen Configuration button > Ethernet tab



Example after tapping **Menu > Screen Configuration > Ethernet** tab

The **Ethernet** tab allows you to set and adjust settings to allow Ethernet access to the Touch screen.

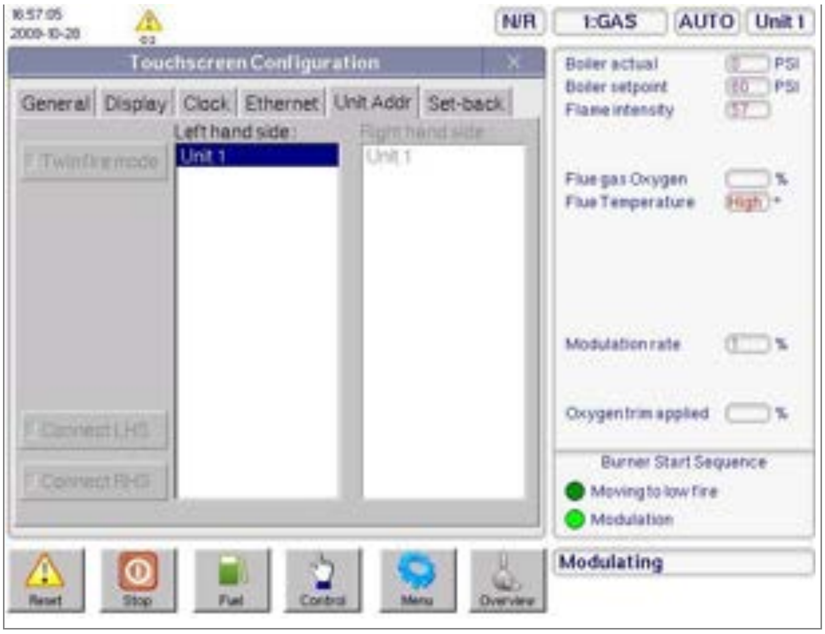
This function may be hardware dependent.

Always exit from this panel by tapping the 

' button in the top right corner of the **Touch screen Configuration** panel. This will ensure the changes are saved correctly.

2.3.4 Set the Controller Unit Address

Menu button > Screen Configuration button > Unit Addr tab



Example after tapping **Menu > Screen Configuration > Unit Addr** tab

The **Unit Addr** tab allows you to set / adjust the controller Unit address that the Touch screen data relates to, for example, 'Unit 1'.

This is set in the option parameters during commissioning.

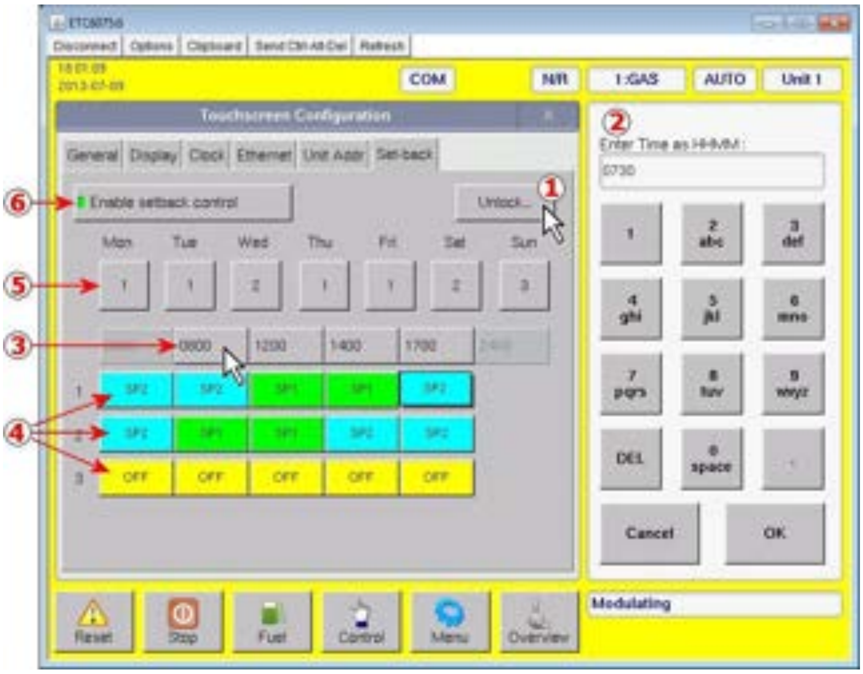
When the unit address is set away from the default of 0 during commissioning, the Touch screen will become disconnected. Use this screen to reconnect.

2.3.5 Scheduled Operation: Set-back tab (Standby)

Menu button > Screen Configuration button > Set-back tab

The **Set-back** tab allows you to set a schedule for Standby operation over a 7-day period, allocating the required operating Set Point through different time zones in each day.

For example, this allows you to put a boiler on Standby SP2 for scheduled time zones during the week when full output is not required, then bring it up to full output SP1 during other time zones, and OFF if you don't need output on Sundays.



Example after tapping Menu > Screen Configuration > Set-back tab

This tab allows you to specify when a boiler comes online at Set Point 1, Set Point 2 or OFF.

The Set-back scheduler allows for 3 different schedules, labelled 1, 2 and 3 to the left of the colored buttons.

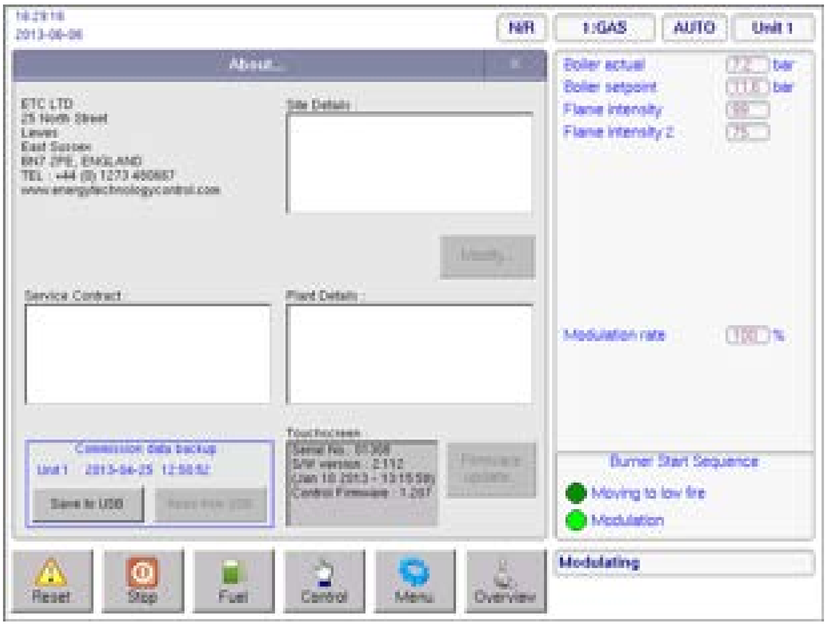
Setting a schedule may require Site passcode access.

Set the schedule of time slots and set points as follows:

1) Press **Unlock** to enable the Set-back screen control buttons and the keypad on the right.
2) If the screen buttons are not enabled, enter the site access passcode and tap **OK**.
3) Set the first-time band. (You cannot change the 0000 and 2400 times.) Tap on a time button and the keypad appears. Enter the new time in 24-hour HHMM format, then tap **OK**.
4) If you selected the wrong time button, tap **Cancel** and then select the required time button.
5) Repeat for the other time band buttons as required.
6) Next, set schedule 1. Tap a colored Event button beneath the time buttons to set the action for that time, e.g., OFF, SP1 or SP2.
7) Repeat for schedules 2 and 3 as required.
8) Day buttons: Now select the schedule number required for each day: 1, 2 or 3.
9) Enable the system by tapping the ‘Enable setback control’ button . The green indicator will show when the system is ON. To switch off, tap again.
10) When you have finished, tap the **X** button at the top right of the tab pane. This returns you to the Burner Settings > Drives tab.

2.4 System and Site Info: the ‘About’ button

Menu button > About button



Example after tapping **Menu > About**

You can back up Commission data to a USB memory stick.
You can also install a firmware update from a USB memory stick.

In Run mode, you can view the System and Site Information on the **About** screen.

This shows you:
1. Manufacturer details
2. *Site details
3. *Service Contract details
4. *Plant details
5. Commission data backup date (if any)
6. Touch screen serial no., software version, Controller firmware version.

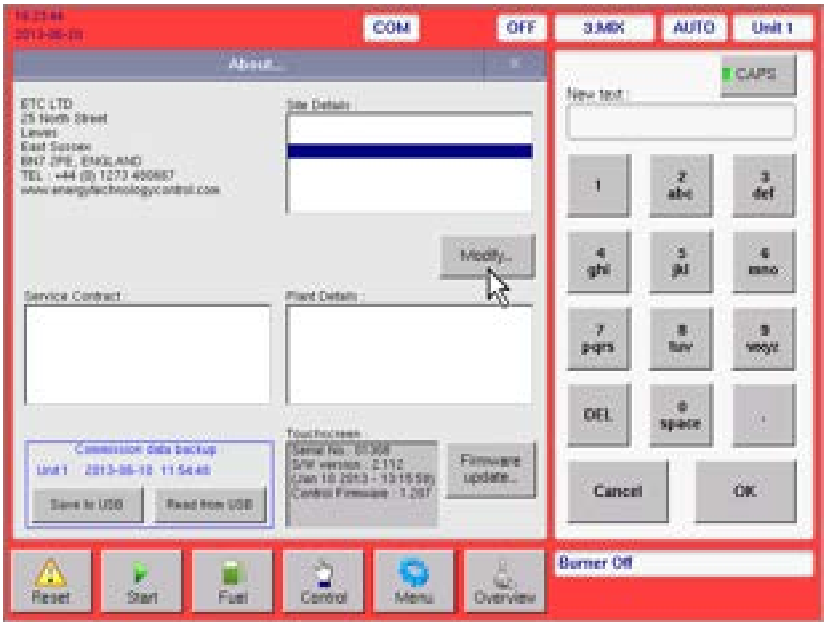
* To change or enter these local details about the site address, service contract and plant details, you need to use Commission mode. See 2.5.

2.5 Entering the Local Site Details

You would normally enter the site information during commissioning.

Stop the burner and go into COM mode

Menu button > About button



Example in COM mode, after tapping **Menu > About**

In Com mode, you can enter:

- Site details
- Service Contract details
- Plant details.

Setup:

- Tap in the required box on the required row: a blue line appears. Your new text will appear here.
- Tap **Modify**; the keypad appears on the right.
- Use the keypad to enter the required text. See “Description of Operation” in section 1.
- Tap and enter text in the other boxes as required.
- Tap **OK** to finish.

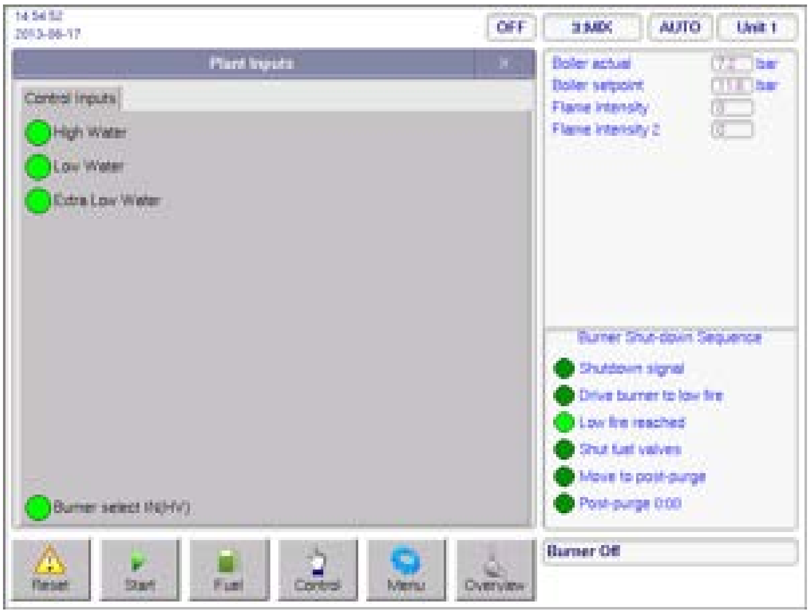
- To return to Run mode, tap **Menu > Burner Settings > Run > Exit COM Mode**.

2.6 Plant Inputs button

The Plant Inputs screen shows you the status of the inputs from various items in the boiler system itself, such as High Water, Low Water, Extra Low Water, Burner Select (In) Alarm Input Open, and so on – as in the example below.

Each terminal on the Touch screen represents a connection to a line voltage electrical point within the boiler plant system, and the on-screen indicator shows the digital status of the input – ON or OFF. These inputs are for indication only, unlike the digital inputs on the main controller, which you can set to shut down or lock out the burner system.

Menu button > Plant Inputs button



Example after tapping **Menu > Plant Inputs**

This displays the status of the digital inputs.

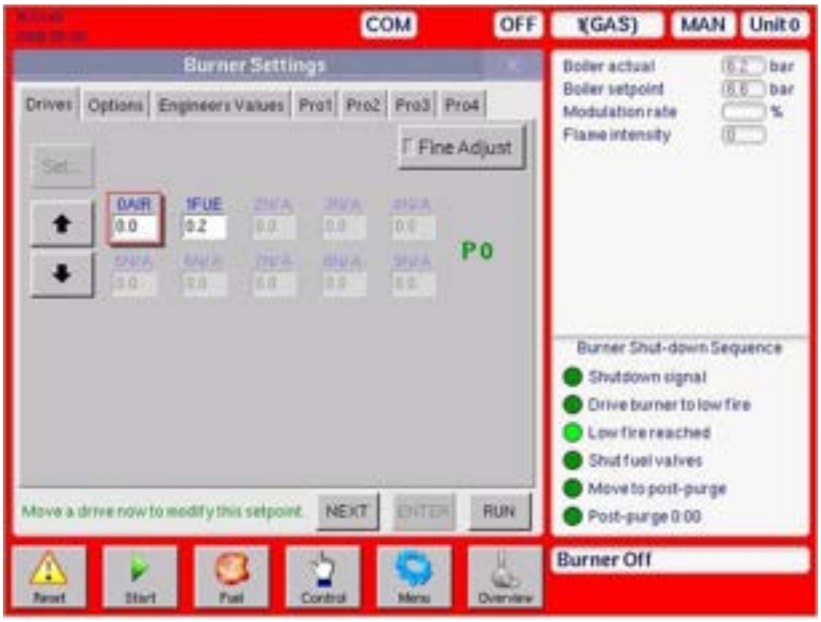
The format of the panel is set by selecting this button in Commission mode.

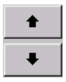
For configuring and labelling these indications, see section 2.8, "Custom Naming of Plant Control Inputs".

2.7 Make the Drive Settings

Burner OFF > COM mode

Menu button > Burner Settings button > Drives tab



- To enter or adjust Drive positions, tap the **Drives** tab.
- Tap the relevant drive that you want to set (i.e., where the number box is white).
- Use the  up/down arrow buttons to change the drive setting to the required value.
- Set all the drive positions for each profile point.
- To store the values, tap the **ENTER** button. You will then move to the next profile point (if already entered).

- Repeat the procedure for this profile point and any others required, up to High Fire.

You can toggle a Fine Adjustment mode ON or OFF using the 

Fine Adjust button. A small green indicator shows in the button when in **Fine Adjust** mode.

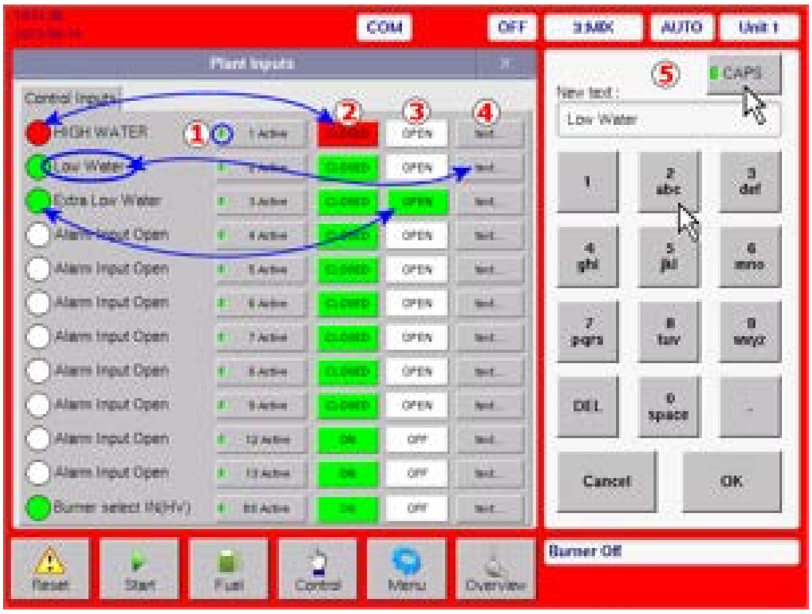
After you have entered or changed the required values, you can exit to **Run** mode by tapping **RUN** followed by **ENTER**.

2.8 Custom Naming of Plant Control Inputs

Burner OFF > Commission (COM) mode

Menu button > Plant Inputs button

A **Plant Input** is the on-screen indication of a connection to a line voltage electrical point within the boiler plant system. The digital status of the input (ON or OFF) is only for indication, unlike the digital inputs on the main controller, which can be set to shut down or lock out the burner system.



- Go into Commission mode.
- Tap **Menu** and then tap the **Plant Inputs** button.

You can now see the **Plant Inputs** setup screen.

See Instructions 1 - 5 below.

1 Active button

The Active button sets whether each Plant Input status will display on this screen in the normal operating mode. Tap an "Active" button to enable this indicator ON (green 'light' on the button) or OFF (green 'light' goes grey). If any inputs are spares, i.e., not connected, then we recommend that you switch them OFF, to avoid confusing the user.

2 and 3 Set Indicator color

Each status indication on the left has a small colored disk, which shows you quick indication of the CLOSED or OPEN status for this measurement point. The color may be pre-defined at the factory, but you can change the color if you wish.

For example, to change the "HIGH WATER" **red** color indicator for CLOSED status, tap the **CLOSED** button 2 to step through the color available.

In a similar way, you can select the color for the OPEN status: tap the **OPEN** button (3) until you have the color that you want.

4 Description 'text' button

On the left of the screen is the name of the Control Input, e.g. HIGH WATER, Low Water Fireye., which describes the measurement point on the plant.
The **text** button sets the text for each on-screen indication on the left. In the screen shot above, the text for the first indicator is "HIGH WATER"; you can change the text if you wish.

- Tap the required **text** button, and a keyboard panel appears on the right.

5 Using the Touch Screen Keypad

- See "Description of Operation" in Section 1.

2.9 How to Program the Controller via Touch Screen

1. How to set or modify the Option Parameters.

When we "set the Option Parameters", this means that we program into the controller the Burner options and the Process Control options. These are the steps to go through:

- On the touch screen, stop the burner and go into Commissioning mode.
- Select the **Options** tab.
- Scroll down to the required Option number, then tap to select the required **Value** box. The **Set** button appears.
- Tap the **Set** button, and the keypad appears.
- Tap the numbers to enter the new value.
- To make a correction, tap **DEL** to backspace.
- If the number displayed is correct, tap **OK** to store the value. The Value box is highlighted in yellow to indicate the box you have just changed.
- Change other values as required, until you have finished your changes.

The new values are stored as you work. In the event of power loss, these numbers will be saved as part of the power-down routine.

2. Program the Profiles.

A Profile is a set of curves for the various devices such as the air damper, fuel metering valve, variable frequency drive Fireye.

- Check the tabs Pro1, Pro2, Pro3 and Pro4 to see if there are already any profiles programmed.
- If you wish to erase a complete profile, see Option 45 in the Appendix. USE THIS WITH CAUTION!
- Tap to select the **Drives** tab.
- Tap a drive box.

Set all drives to zero as follows:

- Press and hold the **Up** arrow for a few seconds; the number will increase.
- Then press and hold the **Down** arrow until the reading is zero (within ±2 degrees).
- Select the next available drive and repeat setting to zero. **Note:** If a box shows FAN or PUMP above the box, this refers to a fan control or variable frequency drive. In this case, you don't need to adjust it.
- Tap **ENTER** to store the settings.

- Fault check. Make sure there are no faults displayed on the controller, at the bottom right corner of the touch screen; e.g. **Fxxx** for a fault code, or **Cxxx** for a Cleared Fault code; i.e. the burner cannot start until it receives a **Reset** command from the user: press the Reset button for 4-5 seconds, and then the fault message should disappear.

  After a few seconds, a red **P1** appears to the right of the drive boxes, then it turns green **P1**.
- When the **P1** is green, select the AIR drive, and press-and-hold the UP arrow until a suitable Purge value for the air damper appears.
- If a VSD (Variable Speed Drive) is controlling the combustion air fan, then increase the speed of the fan to maximum. Tap to select the VSD box (labelled FAN) and use the UP arrow to increase the speed.

- When these are set OK, tap the **ENTER** key, which stores the values, and it starts the Purge timer. During this time, **P1** (green) changes to **P2** (red).
- At the end of the Purge time, the red **P2** become green **P2**. At this time, the Ignition positions for the burner are ready to be programmed.
- Reduce the AIR and FAN values and increase the FUEL value according to your "best guess" or predetermined data from the burner supplier.
- Press **ENTER** to store the values.

Start the Burner

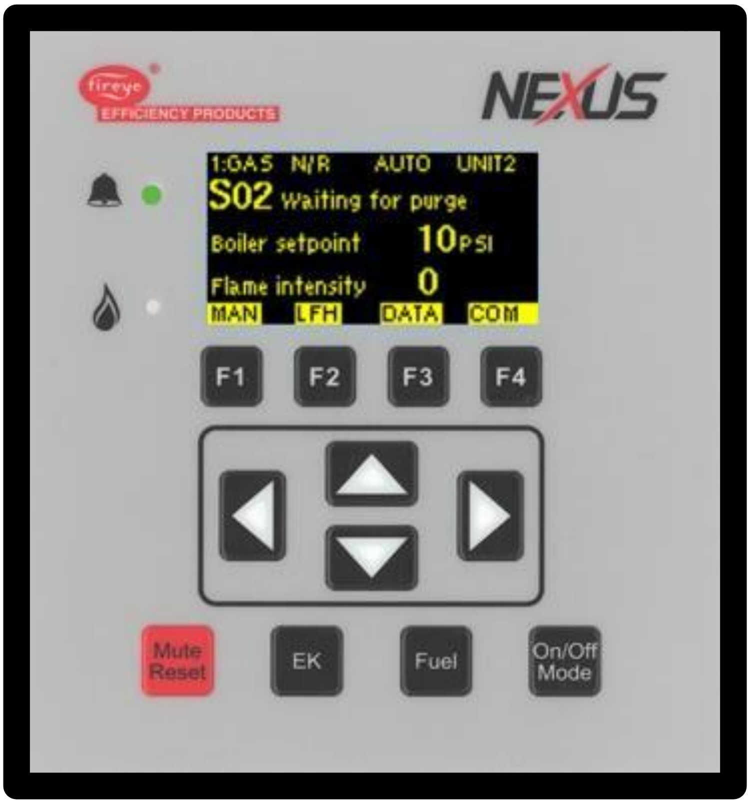
Based on these values, you are now ready to start the burner.

- To ignite the burner, press-and-hold the **NEXT** key for 3 seconds. A popup button asks you to confirm that you want to light the burner. Tap this button, and this starts the Pilot, and then the main Flame Ignition Process.
- If ignition is successful, you can adjust the main flame to a stable flame. Adjust the AIR and/or FUEL values until you have a stable flame, and then press **ENTER** to store the values. Check the flame and adjust again if required, until you are satisfied.
- To move on, tap the **NEXT** button, and the **P2** changes to a green **P3**. This is the **Low Fire** profile point.
- If necessary, adjust the flame to the required **Low Fire** position, and press **ENTER**.
  P3 changes to red **P4** for a short time, and then to green **P4** so that you can set the next position in the curve. This is for a slightly increased burner output. Set and store the values.

NOTE: *When setting drive positions for P4 through to High Fire, do not set any drive more than 20 degrees (200 VSD counts) from the previous position.*

- Move on to **P5**, **P6**, **P7**… and so on, up to **High Fire**.
- After you have completed all the profile points to build the curve, tap **RUN** and then **ENTER**. The system exits **Commission** mode back to **Run** mode, and then the system automatically modulates the burner according to the profile.

3. How to Commission using the Text Display



Example text display. The printed fascia may be
different on yours, but the display and keys are the same.

3.1 Going into Commission Ratio mode

Commissioning the Fuel/Air Ratio refers to actually entering the set point data that defines the curves of the Profile(s).

- First, stop the burner. Press [On/Off] **select 'OFF' then press ENTER** [f4].
- After the burner has completely shut down, press the **COM** key. You now have 30 seconds to enter the code numbers.
- Use the **UP/DOWN** arrow keys to scroll to the first three-digit passcode number, then press **ENTER** .
- Repeat to enter the second three numbers, then press **ENTER**.
  Here are the steps:

Run mode, burner OFF → **COM** **[f4]** → ▲/▼ → **Supplier passcode: scroll to select the first three-digit number**. Press and hold for fast scroll, then step up or down a click at a time to the number you want. → **ENTER** **[f4]**

↳ ▲/▼ → **Supplier passcode, scroll to select the second three-digit number** → **ENTER** **[f4]**

If you entered the correct passcode, the display top line will show **COM**, and the next line will show **P0**, which represents the Closed position set point.

3.1.1 Changing from Commission / Adjust Ratio mode to Option Set mode

To enter the Option Set mode, first enter Commission Ratio mode or Adjust Ratio mode (see section 0, " Going into Commission Ratio mode" or 3.5.2 "How to go into Adjust Ratio mode") and press the **OPTS** key.

Commission / Adjust Ratio mode > OPTS [f1] > Option Set mode

3.1.2 Changing from Option Set to Commission / Adjust Ratio modes

To change from Option Set mode to Commission Ratio mode, press the **EXIT** key.

Option Set mode ⟶ EXIT [f1] ⟶ Commission ratio / Adjust Ratio mode

3.1.3 Exiting from Commission mode

To exit from any Commission mode you must be in the Commission/Adjust Ratio display mode, then press the key labelled **RUN** and then **EXIT**. For example:

Commission ratio / Adjust Ratio mode > RUN [f4]> EXIT [f4] > Run mode

3.2 Using the Option Set mode

You can set up or adjust the various Option parameters given in section 3.3, "Option Parameter List and Descriptions".

- Go into Option Set mode as described in section 3.1.1 above.
- Use the ▲/▼ UP/DOWN keys to select the Option parameter to be adjusted. The Option parameter number is shown with a description on the first line, and the value in the second line:

Example at Option parameter = **1.0** and value **5**:	**1.0** **= 5**	**PowerUp Option** **(0 to 360)**

- Use the **ADJ** and **BACK** keys to toggle between the top row (Option number) and the bottom row (Option value).
- Use the ▲/▼ UP/DOWN keys to set or change the value of the option parameter. When the correct value is selected, press the **ENTER** key to store the new value.
- Repeat the process to select another Option parameter and set or adjust the values as necessary. When you have finished, exit from Option Set mode.

3.3 Option Parameter List and Descriptions

Note: the full detailed list of Option Parameters is in the Appendix

Refer to **Option Parameters** in the **Appendix** for full descriptions of how to use these option parameters.

Option	Description	Range
00.1	Sets the SITE Passcode – a 3-digit code that allows access to change a limited selection of parameters.	0-999
00.2	Used to assign a unique FIREYE serial communications address if required.	0-15
00.3	Set to 1 to reset hours run for all fuels. Hours will be reset to 0 when the burner starts to modulate.	0/1
00.4	Used to select an alternative user program if it has been installed.	0/1
00.5	Used to select languages. Only appears if different language option(s) are available.	0-4
00.6	Reserved	
00.7	Used to set a Modbus serial communications address.	0-99
00.8	Configures the Modbus communications speed.	0-3
01.0	Power Up mode	0/1 or 2-30
01.1	Keyboard Auto/Manual Enable. The default is '1' and this allows auto/manual to be set from the keypad. If parameter set to '0', this key will be disabled.	1/0
01.2	Fault Mute input assignment.	0-13
01.3	External Profile Select – Configures external fuel select inputs.	0-2
01.4	Gas Valve POC[1] input selection – uncommon on European burners.	0-13
01.5	Oil Valve POC input selection – uncommon on European burners.	0-13
01.6	Second Airflow Switch input selection – typically used for primary air on rotary burners	0-13
01.7	Safety Time Configuration – fixed or adjustable.	1/0
01.8	Force ON in LOC1 mode, input selection.	0-13
02.x	Drive Name - Assigns a name tag to a drive	0-14
03.x	Drive servo serial number, or speed feedback channel.	Text
04.x	Drive usage – defines which profiles the drive is used in.	0-15
05.x	Drive options – assigns rotation direction for servos.	0/1
06.x	Fuel options – assigns the fuel safety valve set for each profile	0-3

[1] POC Proof of Closure

Option	Description	Range
07.0	Fan ON early time.	0-120
07.1	Air proving time **t1**	5-60
07.2	Pre-Purge time **t2**	5-300
07.3	Pre-Ignition time **t3**	0-10
07.4	Pilot Ignition time **t4**	1-10
07.5	Pilot Hold time **t5**	1-10
07.6	Main Ignition time **t6**	1-10
07.7	Main Ignition Hold time **t7**	1-30
07.8	Low Fire Hold Time **t8**	0-999
07.9	Post Purge Time **t9**	0-999
08.0	Ignition Spark Output Check	0/1
08.1	Flame failure response time	0/1
08.2	Extended Failure False Flame Time	0/1
08.3	Pilot flame retries	0-2
09.0	Inverter (VSD) control accuracy	0/1
09.1	Inverter (VSD) error tolerance	0/1
09.2	Inverter (VSD) closed loop gain	15-125
09.3	Inverter (VSD) stop time	0-100
09.4	Inverter (VSD) acceleration time	25-60
09.5	Inverter (VSD) 1 – speed encoder scalar	255-999
09.6	Inverter (VSD) 2 – speed encoder scalar	255-999
09.7	Low cup speed limit	0-999
09.8	Oil warming speed	0-99.9
10.0	Gas pressure measurement selection. If greater than 0, the options 10.x marked # below are enabled.	0-4
10.1 #	Sensor Span	0-999
10.2 #	Nominal (regulated) gas pressure	0-999
10.3 #	Low gas pressure limit	0-999
10.4 #	High gas pressure limit	0-999
10.5 #	Leak test volume	0-99.9
10.6 #	Valve leak limits	0-99.9
10.7	Vent valve configuration	0-2
10.8	Valve leak test type	0/1 or 2-360

Option	Description	Range
10.9	Valve energizing time	1-6
12.0	Enable Flame 1 detection input and device type	0-2
12.1	Pilot flame threshold	0-100
12.2	Main flame threshold	0-100
12.3	Flame 1 per profile	0 - 2
12.4	CAN Bus flame sensor serial number	Text
13.0	Enable Flame 2 detection input and device type	0-3
13.1	Pilot flame threshold	0-100
13.2	Main flame threshold	0-100
13.3	Flame 2 per profile	0 - 2
13.4	CAN Bus flame sensor serial number	Text
14.0 to 14.2	Alarm and limit relay assignment	0-8
14.3	Gas pilot type on gas profiles.	0/1
14.4	Pilot - MV1 requirements	0/1
14.5	Direct ignition enable for oil	0-2
14.6	Spark termination	0-3
14.7	Auxiliary Relay (oil pump) function	0-6
14.8	Extend Oil pilot	0-20
14.9	Fan run-on time	0-999
15.0	Modulation input type. If greater than 0, then the options 15.x marked # below are enabled.	0-4
15.1 #	MV display - decimal position	0-2
15.2 #	MV sensor zero value	0-999
15.3 #	MV sensor span value	0-999
15.4 #	MV display units	0-3
15.5 #	Process High safety limit	0-999
15.6	Modulation time	0-120
15.7	Bumpless transfer selection	0/1
15.8	Low before OFF	0/1
16.1	Go Back To Pilot input assignment	0-15
16.2	Enable on-line profile swap	0-16

Option	Description	Range
16.3	Input 12 (PE7) configuration	0-488
16.4	Input 13 (PE8) configuration	0-488
16.5	Input 12 message assignment	0-27
16.6	Input 13 message assignment	0-27
16.7	Oil gun blow out time	0-999
16.8	Unused	
16.9	Oil valve switch point (FIREYE6002 only)	0-20
17.1 to 17.9	Relay output assignments	0-250
18.1 to 18.9	Digital inputs 1 through to 9: function assignment.	0-488
19.1 to 19.9	Digital inputs 1 through to 9: message assignment.	0-27
Warning:	Option parameters in the range 20.0 through to 29.9 relate to a default Customer requirements program. If a custom program is installed and enabled by Option 00.4, then the following options up to 29.9 may have different functions. Refer to the equipment supplier if this is the case.	
20.0	PID loop selection input	0-16 or 21-36
20.1	Burner shutdown input	0-16 or 21-36
20.2	Low Fire Hold input	0-16 or 21-36
20.3	Oxygen Trim ON/OFF input	0-16 or 21-36
20.4	Ignition Wait input	0-16 or 21-36
20.5	Purge Hold input	0-16 or 21-36
20.6	Purge Start input	0-16 or 21-36
20.7	Auxiliary Analog input function	0-2
20.8	Lead Boiler select input	0-16 or 21-36
20.9	Reserved	
21.0	PID control loop 1 enable	0/1
21.1	Control loop 1 Set point	0-999

Option	Description	Range
21.2	Control loop 1 proportional band.	0-999
21.3	Control loop 1 Integral time.	0-999
21.4	Control loop 1 Derivative time.	0-999
21.5	Control loop 1 Limit type.	0-2
21.5	Control loop 1 High Limit value.	0-999
21.6	Control loop 1 Low Limit value.	0-999
21.7	Control loop 1 Limit type.	0-2
21.8	Remote Set point zero (4 mA) value	0-999
21.9	Remote Set point span (20 mA) value.	0-999
22.0	PID control loop 2 enable	0/1
22.1	Control loop 2 Set point	0-999
22.2	Control loop 2 proportional band.	0-999
22.3	Control loop 2 Integral time.	0-999
22.4	Control loop 2 Derivative time.	0-999
22.5	Control loop 2 Limit type.	0-2
22.5	Control loop 2 High Limit value.	0-999
22.6	Control loop 2 Low Limit value.	0-999
22.7	Control loop 2 Limit type.	0-2
23.0	Warming Enable	0/1
23.1	Warming Limit	0-999
23.2	Warming Time	0-999
28.0	Analog input 1 value decimal	0-2
28.1	Analog input 1 zero (4 mA) value.	0-999
28.2	Analog input 1 span (20 mA) value	0-999
28.3 to 28.5	Description is the same 28.0, 28.1 and 28.2 but applied to Analog input 2	
28.6 to 28.8	Description is the same 28.0, 28.1 and 28.2 but applied to Analog input 3	
29.0	Analog Output 1 function	0-39
29.1	Output 1 zero (4 mA) value	0-999
29.2	Output 1 span (20 mA) value	0-999
29.3 – 29.5	As 29.0 to 29.2 but for Analog output 2	

Option	Description	Range
29.6 – 29.8	As 29.0 to 29.2 but for Analog output 3	
30.0 – 34.4	Oxygen trim system settings.	
35.0 – 41.4	Combustion efficiency calculation and flue gas limits.	
42.0	Second oxygen probe or CO trim selection.	0-9999
42.1 – 42.6	Second probe or CO trim settings	
42.7 – 42.9	Air pressure profiling settings.	
43.0 – 43.1.	Expansion unit function and Unit address.	
43.3 – 43.6	CANbus Burner and Boiler sensor serial numbers	
44.0	FGR Hold-off function	0-3 and 10
44.1	FGR Hold-off Limit (seconds)	0 – 999
44.9	Reset system Fault Log	0/1
45.0	Erase or Restore enable	0/1
45.1	Erase	0 – 5
45.2	Restore command	0 – 999
	END OF OPTION PARAMETERS LIST	

3.4 Set or Adjust the Fuel/Air Ratio

3.4.1 Description

You would use the Commission Ratio mode to enter a new profile or Adjust Ratio mode to change an existing profile.

Using Commission Ratio mode, you can step through each set point including Close, Purge and Ignition. After a set point has been entered, you cannot go back and modify it again in the same commissioning session. To do this, you must enter all the required set points first and then use the Adjust Ratio mode.

3.4.2 Using Commission Ratio mode

WARNING

- Use extreme care when you commission the system. While operating in Commission mode, the safety of the system is the sole responsibility of the commissioning engineer.
- Make sure you enter a pre-purge position for the relevant drives.
- Incorrect positioning of either fuel or air could cause a hazardous situation to occur.
- If the servomotor positions have been uploaded, it is essential to verify combustion at each firing position, to make sure a hazardous condition cannot occur, and for the data to be stored in the controller memory.
- It is recommended that you re-enter the Close position for each servomotor as part of the burner service regime, to compensate for wear in the servomotor micro-switch during operation.
- After you have adjusted or entered all profile positions, make sure that you validate all new profile points using suitable combustion measurement instrumentation, against published or specified performance criteria.

- To adjust the position of a servomotor or inverter-controlled motor, select the motor using the LEFT/RIGHT scroll keys, then use the UP/DOWN keys to change the value.

Each set point in the profile is referred to by a letter and number (refer to the table below).

No.	Name	Comments
P0	Close	This defines the positions the servomotors will move to when the burner is OFF and must be set to the lowest position that each servomotor can reach.
P1	Purge	This defines the positions that the servomotor will move to when the burner is purging and can be set as required for each servomotor.
P2	Ignition	Position during ignition; this may be outside the normal firing range.
P3	Low Fire	Low Fire set point, (unless limited modulation range is selected).
(others as required)	....	

No.	Name	Comments
Px	High Fire	High Fire set point, which is the last set point entered (max. P23). **Where Oxygen Trim is to be commissioned, It is recommended that a profile (curve set) has a minimum number of curve points of P12, and ideally P15 or more, at the High Fire position.**

3.4.3 How to Enter or Modify a Profile

Enter Commission Ratio mode (see "
1. Going into Commission Ratio mode" on page 21).
   P0 (close) is displayed.
2. If the close-set point has recently been entered and no change is required, press **NEXT**.
   If servicing the burner or the position has not been entered before, move each valve actuating servomotor to its lowest position and press **ENTER**. P1 (purge) is displayed (flashing).
3. Select the burner and the required profile. If the purge position has been set before the selected valve actuating motors will automatically move to their relevant P1 positions and stop, if no change is required press **NEXT**. Otherwise, move each valve actuating servomotor to its required pre-purge position and press **ENTER**. If the purge set point has not been entered before the valve actuating servomotors will remain at their respective closed (P0) positions until each valve actuating servomotor has been moved to its required position. After all selected valve actuating servomotors are at the correct position, press **ENTER**. P1 (purge) is displayed. Please note that if a purge position for a particular drive has not been entered before the drive will remain at its closed position. **The engineer must make sure that the main combustion air damper is set to open enough to purge the boiler.**
4. Wait for the pre-purge time to elapse. If the ignition set point has been entered before, the drives will move to their ignition positions after all drives stop moving P2 (ignition) will be displayed, if a change is required or the ignition set point has not been entered before, move all the valve actuating servomotors being used to their required ignition positions and press **ENTER**.
5. **To attempt ignition of the burner, hold down the NEXT key for approximately four seconds.** If you need to change the ignition position, adjust the relevant drive(s) and press **ENTER**, if the position is acceptable press **NEXT**. **After the relevant safety times have elapsed, P3 will be displayed.**

If the Low Fire set point has been entered before and no change is required, press **NEXT**. Otherwise, move each drive to the required Low Fire position and press **ENTER**. P4 (next profile set point above Low Fire) is displayed.

NOTE: *When setting drive positions for P4 through to High Fire, do not set any drive more than 20 degrees (200 VSD counts) from the previous position.*

6. Repeat step 6 for each required profile set point, up to a minimum of P4 and a maximum of P23.
7. Leave Commission Ratio mode. The last profile set point entered will become the High Fire set point.
   - If a controlled shutdown occurs, the controller will return to step 2. The set points entered in the current commissioning session are not lost and the **NEXT** key can be used to step through the start-up sequence and fire the burner.
   - If a non-volatile lockout occurs, the set points are kept in the same way as for a controlled shutdown. It will be necessary to remove all faults before moving further than step 2.

- If power is removed from the controller before the curve program is completed, then the set points entered in the current commissioning session will be lost.

3.4.4 Leaving Commission Ratio mode

To exit from any Commission mode, you must be in the Commission/Adjust Ratio display mode, then press the key labelled **RUN** and then **EXIT**. For example:

Commission ratio / Adjust Ratio mode > RUN [f4]> EXIT [f4] > Run mode

- **If P3 (or higher) has been commissioned, the existing profile will be overwritten.** If you do not wish the existing profile to be overwritten, disconnect the power to the controller without pressing **RUN** and **ENTER**.
- **Only the set points used in the current commissioning session will be stored**. For example, if an existing profile has set points up to P15 but only the set points up to P10 were viewed or altered, then only the set points up to P10 will be stored. Therefore, it is vital that **NEXT** is pressed to get to the last set point in the profile before leaving Commission Ratio mode. This does not apply if only the close, purge or ignition set points (P0, P1 or P2) are altered.

3.5 Adjust Ratio mode

3.5.1 Description

Adjust Ratio mode is used only for changing an existing profile.

- Using Adjust Ratio mode, you can modify the valve actuating servomotor positions for any set point in the firing range from low to High Fire (P3 and higher).
- You can view all set points (P0 and higher), even with the burner OFF.
- You can adjust the set points in any order.
- You cannot modify any valve actuating servomotor position so that it is higher than the High Fire set point.
- You cannot modify the close, purge or ignition positions (P0, P1 or P2 respectively). For this, Commission Ratio mode must be used.

3.5.2 How to go into Adjust Ratio mode

- If the burner is OFF then start the burner. Once the burner has started the purge cycle, press the **COM** key. You now have 30 seconds to enter the code numbers.
- Use the ▲ ▼ arrow keys to scroll to the first three-digit supplier passcode number, then press **ENTER** .
- Repeat to enter the second three numbers, then press the **ENTER** key.
  Here are the steps:

Run mode, burner OFF → **COM [f4]** → ▲ ▼ → **Supplier passcode: scroll to select the first three-digit number**. Press and hold for fast scroll, then step up or down a click at a time to the number you want. → **ENTER [f4]**

→ ▲ ▼ → **Supplier passcode, scroll to select the second three-digit number** → **ENTER [f4]**

If you entered the correct pass code, the display top line will show **COM**, and the next line will show **A3**, with the Low fire set point values. The **A3** will be flashing if the burner is still in the startup sequence, or fixed if otherwise.

3.5.3 Using Adjust Ratio mode

WARNING

- Use extreme care while commissioning the system. While operating in Adjust Ratio mode the safety of the system is the sole responsibility of the commissioning engineer.
- Incorrect positioning of any drive could cause a hazardous situation to occur.

- To adjust the position of a valve actuating servomotor or inverter, select the relevant drive using the ◄ ► keys.
- To change the set point being modified, using the scroll keys to modify the set point using the ▲ ▼ keys.
- To save the modification, press the **ENTER** key.

Each set point in the profile is referred to with a letter and number.

No.	Name	Comments
A0 A1 A2 A3	Close Purge Ignition Low Fire	You cannot change the Close set point in Adjust Ratio mode. You cannot change the Purge set point in Adjust Ratio mode. You cannot change the Ignition set point in Adjust Ratio mode. Low Fire set point.
....	....	
Ax	High Fire	High Fire set point, which was the last set point entered (max P24)

Changing a Set-Point

The procedure for modifying a set point is as follows:

1. Enter Adjust Ratio mode. The display shows '**A n**', where **n** is the number of the set point that is closest to the current firing position.
2. Use the scroll key to select the set point. Use the ▲ ▼ keys to move to the set point in the firing range to be altered.
3. Wait for the '**A x**' display to stop flashing then press the **ADJ** [f2] key and modify the drive(s) as required.
4. Press the **ENTER** key to store the new drive positions for the current set point.
5. If the modified positions are not required, then press the **Axx** [f2] key to return the drive(s) to their original positions and move the highlight to the '**A.x**' adjustment mode.
6. Repeat steps 2-5 as required. Each time step 5 is completed, the new positions will be stored permanently.
7. Leave Adjust Ratio mode.

If the '**A x**' display is flashing, you cannot adjust the position of any of the drives. This may be for one of the following reasons:

- The burner is not firing. Switch the burner ON and wait for the controller to begin modulating.
- The current set point is A0, A1 or A2. Use Commission Ratio mode to adjust these set points.
- The drive(s) are moving to the required positions. Wait for the drive(s) to stop moving.

3.5.4 Leaving Adjust Ratio mode

To exit from Adjust Ratio mode, press the key labelled **RUN** and then **EXIT**. For example:

Commission ratio / Adjust Ratio mode > RUN [f4]> EXIT [f4] > Run mode

3.6 NX6102 Additional Commissioning Data

3.6.1 Commission Ratio and Adjust Ratio modes

WARNING

- The burner to which this equipment is fitted modulates in stages when firing on oil, as opposed to continuously on gas. This introduces additional requirements when commissioning the profile points and the associated 'nozzle' switch point.
- **Make sure that the air damper position gives sufficient air into the combustion chamber to allow safe operation after the next nozzle is open, before entering the air damper value.**
- When the burner modulates from one stage to another, the air will increase/decrease continuously between the 2 points while the fuel 'nozzle' will switch at the commissioned position. It is important to operate the burner at each 'nozzle' switch point with either number of 'nozzles' open to ensure the burner operation is safe and reliable under *both* firing conditions.

The process of commissioning is very similar to other NX6100 series controllers except that when the Air Damper position is increased the Oil solenoid valves do not energize until the Air damper position is set by pressing the ENTER key. The sequence of valve outputs is as follows:

P2 and P3 are stage 1 output ON – PE13. Note that the Air damper position may be different between these points.
P4 is stage 2 output ON – PE14,
P5 is stage 3 output ON – PE6,
P6 is stage 4 output ON – PD7,
P7 is stage 5 output ON – PD4.
After P8 is displayed, press [Run] and then [Enter] to exit Commission mode. **DO NOT** adjust the air damper position for P8.

In **Adjust Ratio mode**, the controller operates in a similar manner to other NX6100 series controllers, but the number of Solenoids is fixed for each set point position. The Air Damper position can be adjusted Open or Closed at each set point position.

After the Oil profile has been commissioned, you must do the following checks in Adjust Ratio mode, to allow the burner to be 'held' in the required positions to enable the combustion to be monitored.

1) After the burner is firing select A3 (Low Fire). The burner will modulate to this position.
2) Confirm the combustion is safe and repeatable.
3) Move all air drives up to the position at which the next oil 'nozzle' will open, (note this will not be the next profile point unless the option 16.9 Oil Valve Switch Point is set to zero).
4) Confirm the combustion is safe and reliable.
5) Modulate to the next profile position, which will also open the next 'nozzle'.
6) Move all air related drives down to the position at which the new oil 'nozzle' opened, (note this will be the current position if the option 16.9 Oil Valve Switch Point is set to zero).
7) Confirm the combustion is safe and reliable.
8) Repeat steps 3 to 7 for all stages including High Fire.

4. Commissioning Data backup and restore.

4.1 The backup process.

After commissioning is completed the burner plant will be called upon to run and modulate according to demand from the process. Whilst the burner is modulating in status 16 the controller will send a backup (mirror image) of the commissioning data to the HMI via the CANbus. The backup data is stored in non-volatile memory and may be *restored* to the controller using a sequence of option parameter settings.

The backup process is initiated whenever there have been changes made to either option or curve data. Even a simple change like modifying the application running set point will cause a new backup to be saved.

Users can interrogate the status of the backup process in several ways as follows:

1. When the burner is running check the value of EK92. If it is less than 999 then a backup is in progress.
2. On the touch-screen HMI the backup status is indicated on the 'About' panel from the Menu.
3. On the multi-line OLED display push the **DATA** then **BKP** keys to view the backup status screen.

4.2 Restoring commission data from the HMI.

In order to restore commissioned data to the controller ensure that you know the CAN unit address of the controller from which the backup was stored. This is stored as option parameter 00.2.

To restore a commission data backup the procedure is as follows:

1. Enter commissioning mode and - Option set mode.
2. Ensure that the option parameter 0.20 is set to the value of the controller from which the backup was made.
3. Set option parameter 45.0 to a value of 1.
4. Set option parameter 45.2 to a value of 100.
5. Exit commission mode and monitor the restore progress on the HMI. It should take between 20 and 30 seconds.

If the CAN addresses of all devices on the bus match those in the restored backup, then the controller will allow the burner to start and run without further intervention.

5. The Service Schedule system.

5.1 Introduction

The touch screen HMIs have a Service Schedule system to prompt when burner system maintenance is required. The system allows the service technician to schedule alarms to ensure that service activities, such as fire the standby fuel or replace safety related devices. The detail for the service/replacement interval is based on manufacturer's recommendations.

The following items can be tracked by the Service System via the 'due date' within the History log:

- Burner Service
- Standby Fuel
- Flame detector(s)
- O2 Probe filter
- O2 Probe Calibration
- Sensors (gas pressure, oil pressure, boiler pressure/temperature)
- Flexible hoses

The service intervals will be dependent on the fuel being used and the plant operating conditions. The intervals could typically be as follows:

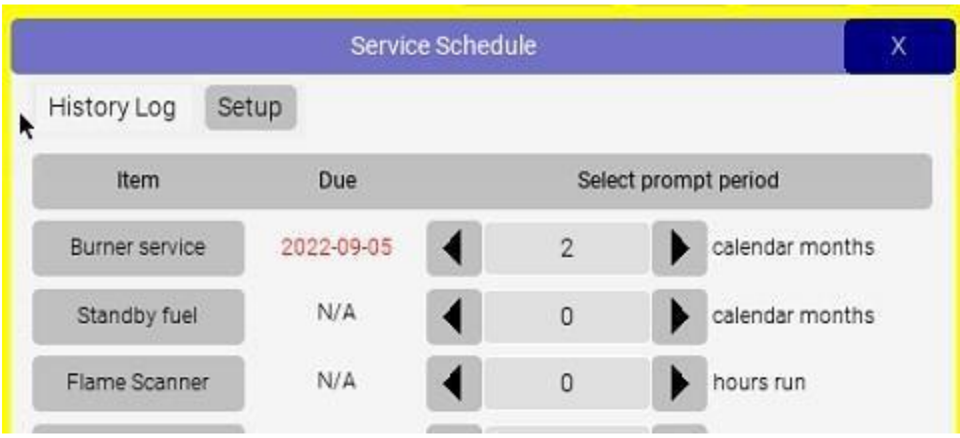
- Burner Service - minimum of every six months.
- Standby Fuel - minimum of every month.
- Flame detector - maximum life span of 10000 hours
- O2 Probe Filter - Gas 12 months, LFO 12 months, HFO 6 months.
- Sensors – annually
- Flexible hoses – 24 months

With the Service System activated and an item due date reached a 'Service Due' message will appear in the banner line at the top of the screen.

This is a prompt to the user to call for a service visit.

5.2 Using the Service Schedule system.

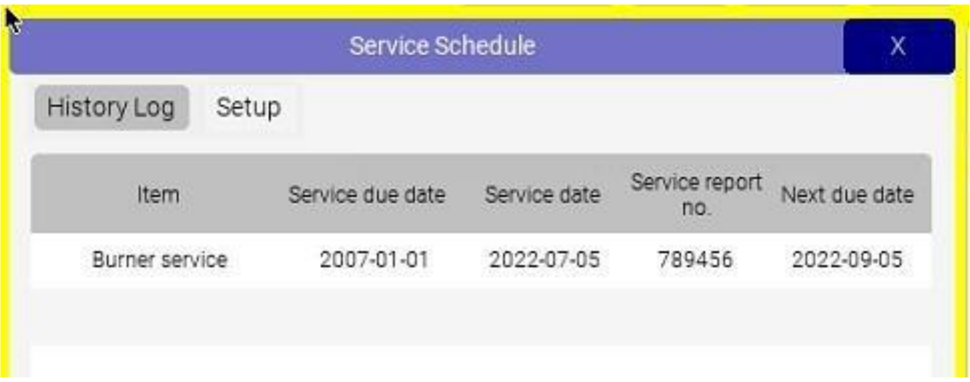
To set the Service Schedule and to view the Service History log, tap the Menu button at the bottom or side of the touchscreen and then select Service Schedule from the list of options. This will open the Service Schedule window which will look like this:



In this example the ‘Burner service’ item is overdue and so the due date is shown in red on the list. There are two buttons in the top left of the image.

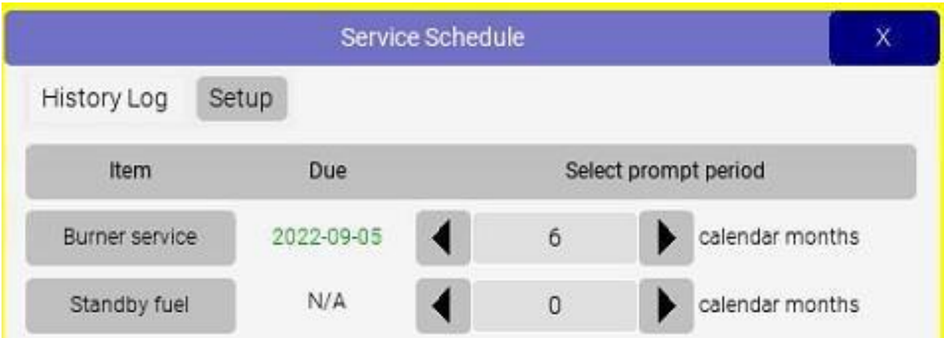
History Log:

The history log shows the last service due date, the actual service date, the service report number and the next service due date.



Setup:

In the Setup screen the service items are shown along with the service due date and the time period in which the item should be checked. These can only be adjusted if the Commission or Adjust passcode has been entered in the burner adjust screen.

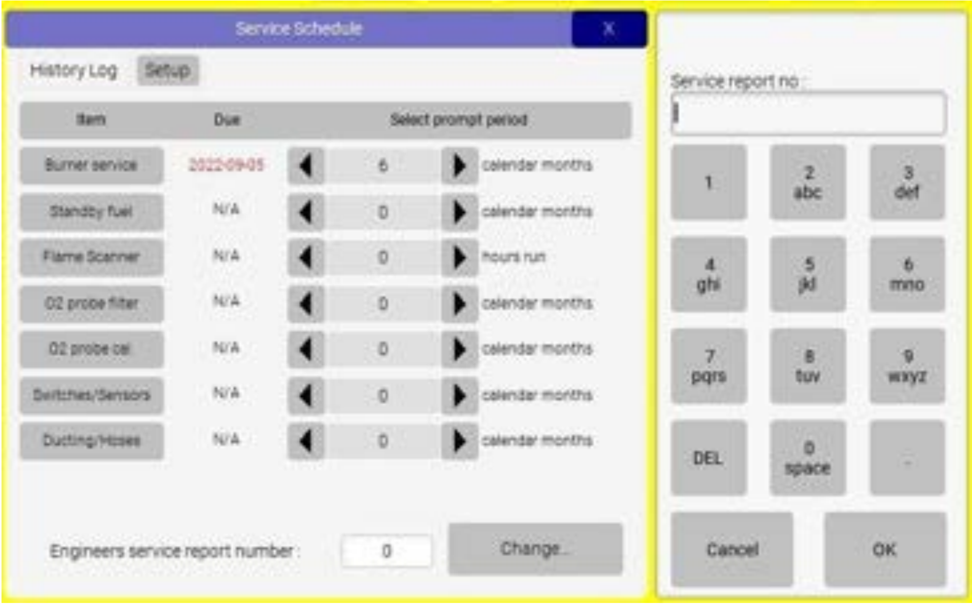


In commission mode the time intervals for each service item can be set by tapping the arrow buttons to increase or decrease the value. When all of the intervals have been set, a date will be shown next to the item in green to show when the Service Due message will prompt the user. To save and exit the Service Schedule screen tap the X button.

Updating the service History Log:

When a service has been completed the Service log should be updated, this will remove the ‘Service Due’ message from the main screen and a new due date will automatically be set. To update the log:

Enter the passcode in the burner adjust screen, then in the service Set Up screen tap the ‘Change’ button to bring up the keypad, like this.



Enter your service report number and tap the OK button. The new report number will be displayed in the box next to the ‘Change’ button.

Next, tap the service item button (e.g., Burner service). A pop-up message will be displayed, like this…

Tap the ‘Reset Interval’ button and then the due date and history log will be updated.

Repeat the update procedure for any other schedule items covered during the service.

To save and exit the Service Schedule screen tap the X button. Exit commission mode from the ‘Burner adjust’ screen.

6. Section 3 Update History

New version	Date		Changes in brief
V1pt4D	June 2022	GFS	Minor text amendments. Addition of the description for the Service Schedule function.
V1pt4D	June 2024	RAL	Created Fireye Document.

——— End of Section 3 ———

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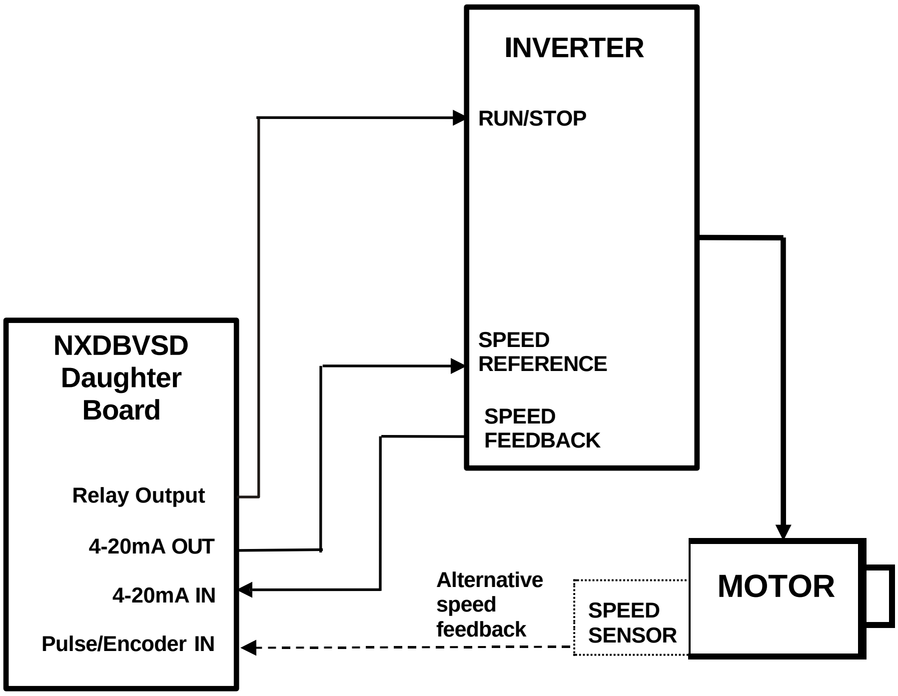
1. Inverter (Variable speed drive) units.

This manual may cover more than one model in the NX6100 series. Check for additional information at the end of this chapter.

1.1 System Configuration

The NX6100 series controllers can control one or two inverter drive unit(s) to control a fuel and/or air motors(s) using a daughter board (fitted within the main controller enclosure). The daughter board controls the inverter drive unit(s) using 4-20 mA output channel(s). The output(s) are the speed reference signal to the inverter drive unit(s). A 4-20 mA or encoder pulse input is used to monitor the feedback signal from each inverter drive unit, representing the speed of the valve actuating servomotor(s).

In addition to the 4-20 mA signals, the inverter drive unit(s) also require start signal(s), which can be taken from the volt-free relay contacts on the daughter board. Make sure its function is set correctly using the relevant option parameter.



1.2 How does the Controller work?

During the start-up of the burner and before the boiler can be purged, the NX6100 series controller drives all valve actuating servomotors to their minimum positions and sets an output current of 4 mA to each inverter drive unit. The controller waits for the inverter stop time (see Appendix > Option Parameters > Option 09.3), and then monitors the feedback signals of all inverter drive units and compares them to the values stored in memory at commission time. If the values do not match those stored in memory, a positioning fault is given, and the controller performs a non-volatile lockout.

If the test is successful, the controller moves all selected drives to their commissioned pre-purge positions. If the drives cannot achieve their pre-purge positions as set during commissioning, a positioning fault is given, and the controller performs a non-volatile lockout.

If the burner start-up is successful, the controller will control the frequency of the inverter during modulation. A closed loop method is employed, where adjustments to the speed reference signal are made based on the value of the feedback signal.

If the feedback signal from the drive is lost during a run condition (e.g., the loop current drops below 3.5 mA or encoder feedback fails) the NX6100 series controller will perform a non-volatile lockout.

1.3 Setting up the Inverter for use with the NX6100 series

The NX6100 series will work with most inverter drive units provided they meet the following criteria:

- 4-20 mA speed reference input.
- 4-20 mA speed feedback output or use a separate encoder system.
- Remote run/stop command.
- The inverter must be powerful enough to accelerate / decelerate the motor as required. A good industrial inverter drive unit will have a significant overload capability, meaning that it can supply well above the rated motor load for some time. This should be 150% (or more) for 1 minute.

CAUTION

- An HVAC inverter typically will have no (or very limited) overload capability and may not be able to accelerate / decelerate the motor and fan quickly without current limiting. This can cause drive position faults when driving to purge.

Analog inputs and outputs

Configure the Analog inputs and outputs (i.e., the 4-20 mA reference and feedback signals) on the inverter in the following way:

- 4-20 mA signal (this may be an option parameter and/or a board jumper)
- Speed reference input
- Speed reference output (unless using encoder)
- Minimum frequency 0 Hz for 4 mA signal
- Maximum reference frequency as required (nominally 50 Hz) for 20 mA signal
- Maximum feedback frequency same as reference for 20 mA signal (unless using encoder)
- No filtering (time constant = 0.0) and no rate limiting

Run/Stop Digital input

Configure the inverter in the following way:

- RUN/STOP from external input (NOT inverter keyboard)
- RUN/STOP active high (i.e., energize to start).

Control characteristics

Configure the control characteristics of the inverter in the following way:

- Acceleration and deceleration time approximately 25 - 40 seconds, must be the same, values entered into (Appendix > Option Parameters > Option 09.3).
- Straight line (linear) acceleration between reference points
- Motor to coast to a stop when RUN signal is removed
- No critical frequencies
- DC braking may be needed if motor deceleration is not linear.

Motor characteristics

Enter the following motor characteristics into the inverter's option parameter list:

- Motor nominal voltage, power, current and frequency (see motor plate and/or supplier data)
- Motor current and temperature limits
- U/F ratio. Use the option for fans and pumps.
- Motor slip ratio

1.4 Setting up the NX6100 series for use with an Inverter Drive

To use an inverter drive unit with the NX6100 series, the optional VSD interface daughter board must be fitted. The following steps must then be taken:

1. Enter Commission mode.
2. Push the MODE key to select Option Set mode.
3. Set options 9.x to suit the inverter and load characteristics.
4. Set option 17.7 to a value 26 for Run/Stop from the NX6100 daughter board.
5. Push the MODE key to select Commission Ratio mode.
6. Look at the display for the inverter output. The display should show 0 for a feedback signal of zero speed (4 mA) and 999 for a feedback signal of 20 mA. If the display is flashing 'High', the feedback signal is less than 3.5 mA or more than 21.0 mA, or the polarity of the wiring is reversed, or the encoder is faulty. In all these cases, check the wiring and/or the option parameters on the inverter. If using an encoder feedback, the value displayed will depend on the frequency measured by the input on the daughter board - See note below.
7. Monitor the reference signal from the NX6100 daughter board. Select the inverter drive unit and use the UP key to increase the current gradually up to 20 mA and the DOWN key to decrease the current gradually down to 4 mA.
8. For encoder feedback signals, run the inverter drive unit to its maximum value (normally 50 Hz or 60 Hz, depending on motor rating / local mains frequency). Using Engineer's Key number 69 or 70 (depending on VSD1 or VSD2), you can determine the measured pulse frequency in Hertz. Add about 2% to 5% to this value (to ensure it is the maximum you would ever expect to get) and program the increased value into option parameter 9.5 or 9.6. The displayed value for this drive should now be 950 to 990 (i.e., 95% to 99%). For reliability, make sure the feedback cannot exceed 99.9% (999). This is why a small percentage is added to the 100% scale value entered in the option parameter. See option parameter 9.5 for a way to check this value using a calculation.
9. For the rest of the commissioning procedure, treat the inverter drive unit in the same way as a motor. The inverter drive unit has a closed position (4 mA), a maximum position (20 mA), a pre-purge position, an ignition position and up to 20 profile positions.

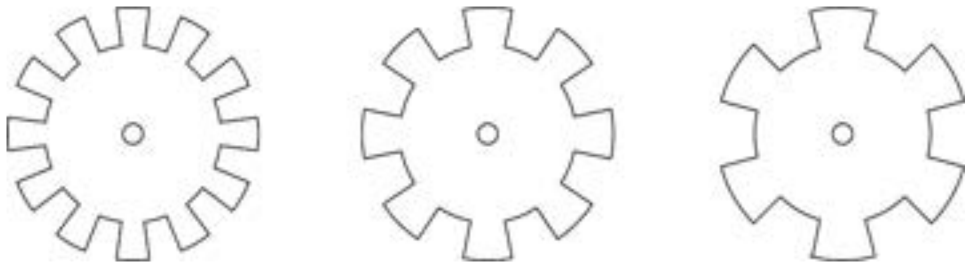
1.5 Encoder Wheel design

Encoder feedback is in the form of a series of electronic pulses, which represent the speed of the motor shaft. A toothed encoder wheel must be fixed to the motor shaft and a proximity detector positioned close to the rotating wheel. Electronic pulses will be generated by the proximity detector when the teeth of the wheel rotate next to it. The number of teeth on the encoder wheel determines the resolution of speed measurement.

The manufacturer of this equipment recommends the following relationship between the maximum motor speed and the number of teeth on the encoder wheel:

Motor speed rating for 50/60 Hz	Number of encoder teeth
1000 – 2499 rpm	12
1000 – 3750 rpm	8
3000 – 5000 rpm	6

The encoder wheel must be manufactured to close tolerances to ensure an even ON and OFF pulse width when rotating. Here are drawings of example encoder wheels:



12 teeth   8 teeth   6 teeth

Proximity Detection Devices

The following proximity detection devices are compatible with the NX6083-X daughterboard when using encoder discs of the types shown above:

- Pepperl+Fuchs NBN4-12GM50-E2-12M
- Omron E2E-X3D1-N
- Carlo Gavazzi IA12ESF02UC.

2. The Oxygen Trim option

2.1 Introduction

Oxygen trim is the process of adjusting the Fuel: Air ratio to improve the operating characteristic of the burner.

2.2 Oxygen measurement system description

The oxygen trim / monitoring function requires the optional NXO2TRIM Oxygen Probe Interface unit with an NX6083-x oxygen probe. This probe offers fast, accurate response and good reliability when mounted operated and maintained in accordance with the guidelines in this section.

The NXO2TRIM interface controls the Oxygen probe and processes the signals from the probe into CAN messages, which are transmitted to the NX6100 series controller. The interface also manages the condition of the NX6083-X oxygen probe to optimize the operating life. Part of the management function is to set the probe Off into a ‘sleep’ mode when the burner has been Off for 4 minutes and then restarting the probe as soon as the burner starts. When the probe is in sleep mode the oxygen measurement system is suspended.

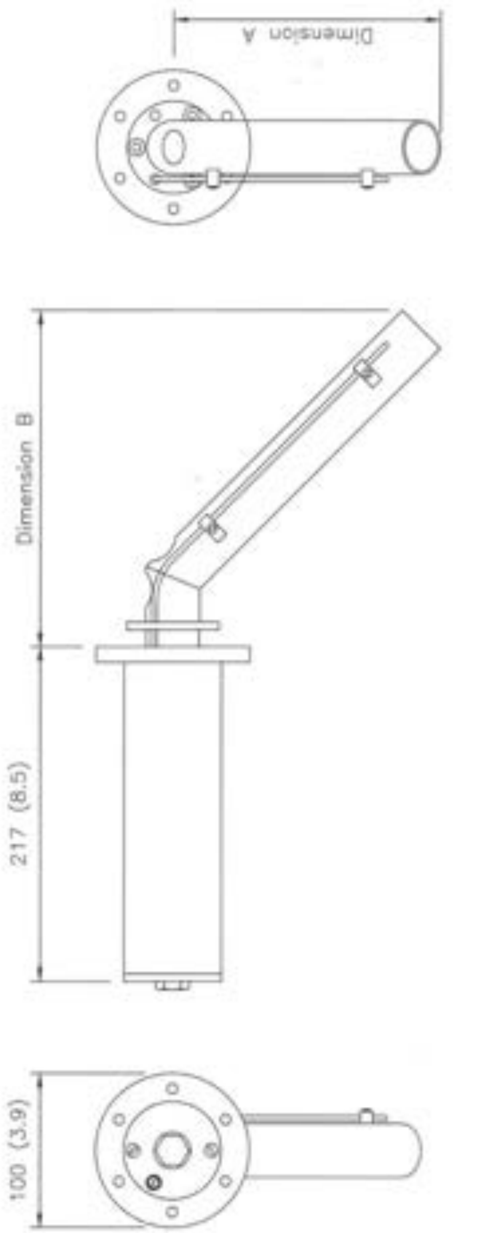
The oxygen probe is available in three different sizes, shown by the drawing on the following page.

NX6083-1 is suitable for flue/chimneys with diameter 0.3m to 0.86m.
NX6083-2 is suitable for flue/chimneys with diameter 0.5m to 1.6m.
NX6083-3 is suitable for flue/chimneys with diameter 1.0m to 3.75m.

The probe end cap is removed to expose the electrical connections and carries the 20 mm flexible conduit fitting, to enable the interconnection wiring to be easily detached without re-wiring.

There is a calibration port located in the back of the probe, which is sealed with a screw.
You must keep this port sealed during normal operation, for safe and accurate performance.

Oxygen Probe drawing:

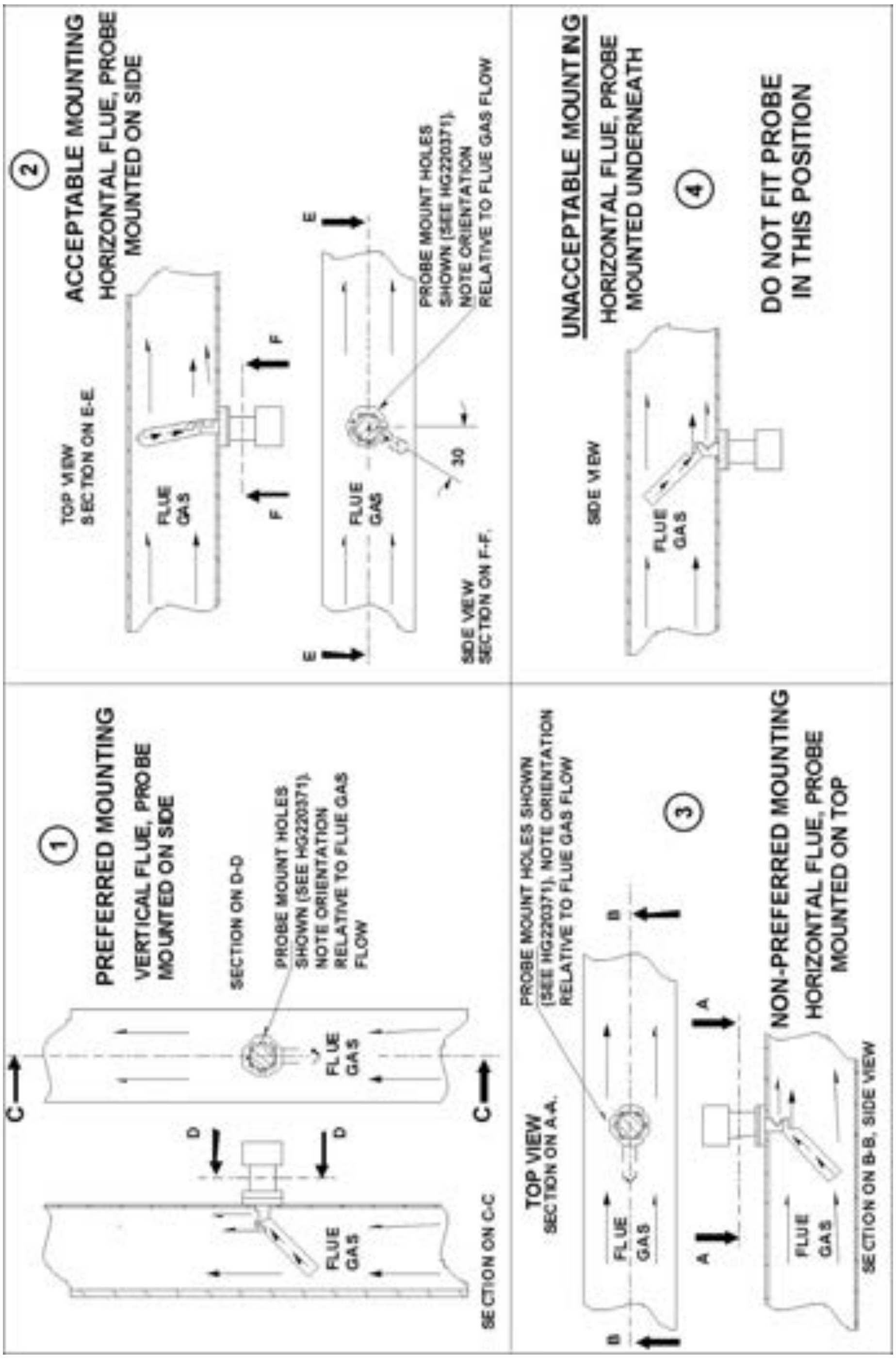


Model No.	Dimension A	Dimension B	Weight
6083/1	173mm (6.8")	215mm (8.5")	2.4kg (5.3lb)
6083/2	362mm (14.3")	406mm (16.0")	2.9kg (6.4lb)
6083/3	716mm (28.2")	757mm (31.4")	3.6kg (7.9lb)

2.3 Installing the Oxygen Probe

2.3.1 Mounting the Oxygen Probe onto the flue.

Mount the probe so that the flue gases pass into the gas tube at its open end and out of the tube at the flange end. Preferred mounting (1) is with the flange vertical, and the gas tube angled downwards, to make sure that particulates do not build up within the sample tube. Mounting the probe with the flange horizontal (2) is acceptable. Inverted probe mounting is **not** acceptable.



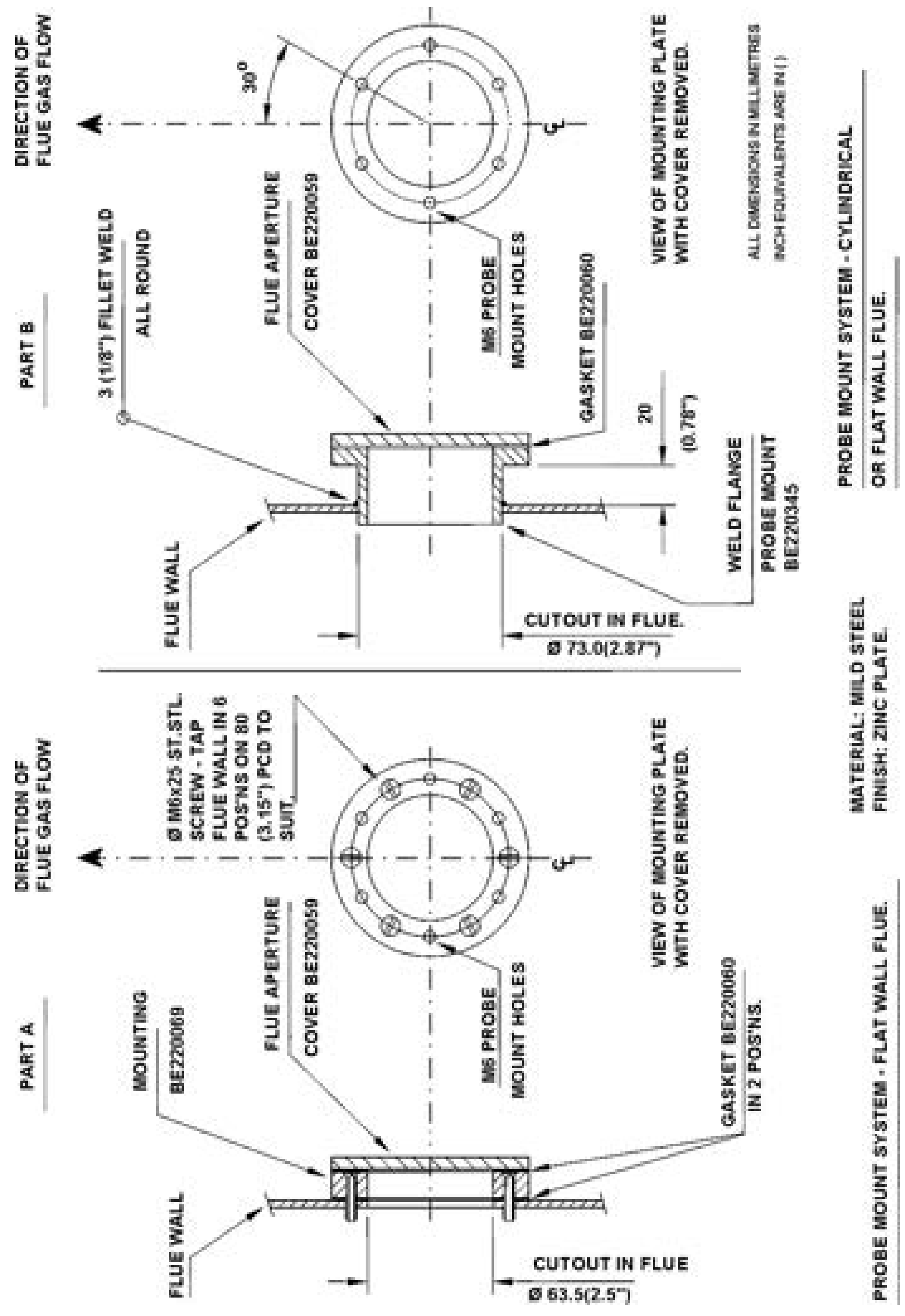
Mounting flanges

There are two types of flange available (see the drawing below). With either flange, the vertical center line of the flange shown on the drawing must correspond to the gas flow direction.

The flange kit includes 6 stainless steel M6 x 20 mm socket cap screws for attaching the probe.

The probe flange temperature must be maintained at the temperature of the flue wall by repacking or adding lagging that may have been removed to mount the probe. Sulphate condensation will occur if the flue wall of an oil-fired boiler falls below approximately 130 °C (266 °F). The sulphate problem does not occur in gas-fired installations, but vapor may cause problems due to condensation if the temperature of the flue gas falls below 100 °C. (212 °F)

The maximum flue gas temperature rating is 540 ºC. (1,004 °F)



2.3.2 Wiring

The NXO2TRIM Oxygen Probe Interface unit is designed to interface directly to the NX6083-X oxygen probe, which allows the NX6100 series controller to monitor the flue gas oxygen and temperature levels.

It can also provide closed loop oxygen trim control if required.

The cabling between the NXO2TRIM oxygen probe interface and the NX6083-X probe consists of the following:-

Cable function	Specification
Cell heater and O_2 measurement.	**Max Voltage in use 14V d.c.** • 6-core cable with each core 0.5 mm^2 (20 AWG) and with overall braded screen. Cable covered in PVC sheath. • Resistance per core 40 milliohms/meter. • Maximum working voltage 440V rms. • Maximum length between the probe and controller is 10m (33ft).
Cable Rating	**600 VAC**
Flue gas temperature measurement.	**Max Voltage in use 5V d.c.** • Type 'K' compensating cable. • 2-core PVC insulated cable with 0.25 mm^2 (24 AWG) conductors, covered in overall PVC sheath.

The Oxygen Probe connection detail is shown in Section 2.

2.4 Calibrating and servicing the Oxygen Probe

2.4.1 Probe Calibration

WARNING

- Before proceeding with probe calibration, make sure you have a compatible air and reference gas supply. You need both to complete the calibration procedure.
- If the probe calibration is to be checked while the burner is firing, make sure that oxygen limits have not been set (option 38.0), which may cause a burner lock-out to occur while the calibration is being performed.

You must execute the probe calibration in the correct sequence, or the calibration will be invalid. The calibration sequence is as follows:-

1. Enter the Option Set mode using the Commission passcode (see "Commissioning" in section 3.
2. Select option parameter 30.6 for the first oxygen probe, or 42.6 for the second oxygen probe. The display will show the status of calibration.
3. If the display shows 0, then the system is not in Calibrate mode.
4. Use the LEFT/RIGHT scroll keys and then the UP/DOWN keys to change option value to display 1, and then press Enter. The oxygen trim function will be disabled, and the system will be in Calibrate-Air mode.
5. Apply the calibration air supply to the oxygen probe calibration port at a rate of 350cc/min.
6. When the calibration air has been connected, scroll to view the probe offset, Option 30.1 (42.1). Wait for this value to settle (expect a value between 450 and 500).
7. When the value displayed for option 30.1 (42.1) has settled to a value within range, scroll back to Option 30.6 (42.6), change the display to zero and then press Enter.

8. Next, scroll to Option 30.2 and program a value which is 8 less than the value for option 30.1.

9. The new calibration value will now be used for the oxygen probe.

2.4.2 Testing the Oxygen Probe Filter

CAUTION

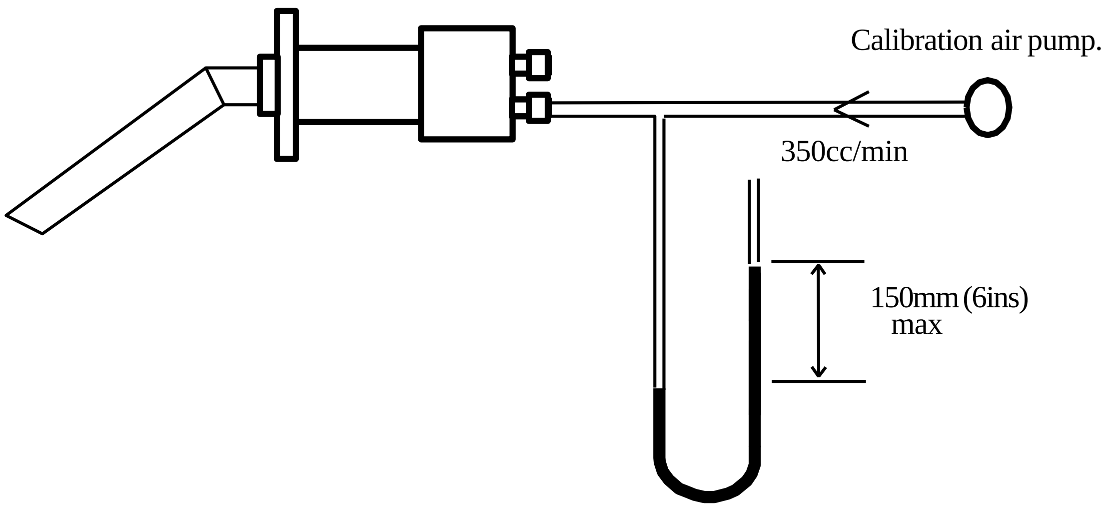
The filter can be tested without removing the probe from the flue.

- If the burner is firing before proceeding, disable the **oxygen trim** function using option parameter 30.5, and make sure that **oxygen limits** have **not** been set (option 38.0) which may cause a burner lock-out to occur while the calibration is being performed.

The filter can be tested without removing the probe from the flue. Before proceeding, use option parameter 30.5 to make sure the oxygen trim function is disabled.

To carry out the check, pass air at 350cc/min (22cu. ins/min) into the calibration gas connection on the rear of the probe adjacent to the flexible conduit fitting, and check the pressure drop.

The pressure drop can be found by connecting a manometer or similar in the flow line to the calibration gas connection, as shown below.



If the pressure is 150 mm (6 ins) water gauge or more, replace the filter.

2.4.3 Removing the oxygen probe from the flue

WARNING

- **Before attempting to** remove the probe, switch OFF the system and the boiler. It is essential to switch the burner OFF because dangerous levels of carbon monoxide may be present in the flue.
- Since the body of the probe will be hot, use heat resistant gloves to hold the probe.
- If you need to operate the boiler while the probe is removed, you **must** fit the blanking plate (supplied with the equipment) to the probe flange.

The NX6083-X Oxygen Probe is fixed in the flue by six, 6 mm stainless steel socket head cap screws.

- Loosen the 2 screws securing the probe end cap and remove the cap to expose the green 8-way terminal block.
- Remove the terminal block from the printed circuit board, allowing the cables to slide out of the probe body, complete with its plug.
- Remove the six retaining screws. Taking care not to damage the sealing gasket, you can now extract the probe from the flue.
- The only customer-replaceable items are the flue thermocouple and the oxygen filter.
- **Refitting** is the reverse of the removal procedure. Make sure that the screws are tightened sequentially and evenly.

2.4.4 Replacing the Filter

- Remove the oxygen probe from the flue as detailed in section 2.4.3 Removing the oxygen probe from the flue, and unscrew the insulating mounting blocks for the flue thermocouple, from the sample tube.
- Before removing the three fixing screws and spring washers which retain the sample tube, make sure you hold the body horizontal, or the sample tube downwards, to prevent soot or other deposits from falling into the probe body.
- When the screws and washers have been removed, pull the sample tube away from the body to allow the captive filter assembly to be removed.
- You can now insert the new filter assembly (Fireye number 19-117) into the sample tube, with the beveled side to the probe body.
- Refit the sample tube, ensuring that the filter locates into the probe body. Tighten the retaining washers and screws evenly, to seal the filter assembly to the flange.

2.4.5 Replacing the Probe-mounted Flue Thermocouple

- Remove the oxygen probe from the flue as detailed in section 2.4.3 Removing the oxygen probe from the flue.
- Disconnect the internal connections to the thermocouple.
- Unscrew the 2 thermocouple-mounting blocks from the probe sample tube, to allow the thermocouple to be straightened.
- Remove the hexagonal nut securing the thermocouple into the probe flange and withdraw the thermocouple through the probe body.
- Refitting is the reverse of the removal procedure but ensure that new packing material is used to seal the new thermocouple to the flange.
- The electrical connection and polarity of the thermocouple are shown in the picture below:

2.5 Oxygen Trim operation

With the oxygen trim system correctly commissioned and enabled, a multiple adaptive trim algorithm will compensate for changes in fuel and environmental conditions that affect combustion.

Using air or fuel flow information entered during the commissioning process, the trim drive motor(s) will be moved by an amount that will give the desired change in air or fuel flow, which then gives the desired flue oxygen reading. The trim system will continually monitor the flue oxygen level and attempt to maintain this as close to the programmed oxygen set point for the current point in the firing range.

The system will remember the amount of trim to apply for each firing position and the trim will be applied at each point immediately without having to wait for the oxygen value to change. The adaptive trim is reset on either a fuel profile (curve set) change or on a system power down.

Trim is not applied if the controller is in Commission mode.

2.6 Commissioning Oxygen Trim

WARNING

- **Before** commissioning the oxygen trim system, ensure that the modulation section of the combustion profiles (curve sets) have a minimum of 11 setpoints – P3 to P13. Ideally, the profile should have 15 points.
- If the trim commissioning process is manual, ensure that *all* combustion air drives are increased, and decreased, when characterizing the burner flow. This is important even if the trim drive set in 2.x will be only one device (for example VSD).

For the oxygen trim system to function correctly, the following information must be entered:

1. Option parameters
2. Flow values and O_2 set points.

A commissioning engineer can enter these values manually, or the system can automatically calculate the values and enter them itself ("Automatic Trim commissioning").

If the Automatic Trim commissioning is performed, the engineer **MUST** check that the values entered are valid and safe after completion. Also, check the oxygen probe calibration before and after the procedure, since the results are highly dependent on measurements taken using the probe.

2.6.1 Entering the Option Parameters

With the burner OFF, go into Commission mode (see section 3).

To get the trim operational, you need to set up the following option parameters:

1. Trim gain – to improve stability of the trim algorithm control (options 33.X, 34.X).
2. Trim limits – to impose limits on the amount of trim applied (options 32.X).
3. Trim enable – to turn trim ON (option 30.5).

Before you enter the oxygen set points for each profile, consider these points relating to the oxygen trim option:

- Make sure no trim is applied which would require a drive to move above its High Fire position or below its Low Fire position, unless a limited modulation range has been selected.
- The flow for each profile position must be programmed to ensure correct operation. The flow value can either be measured for each profile position or calculated as a percentage of the flow at High Fire.

2.6.2 Using the text display in Adjust Ratio mode to enter Oxygen Set Points and Flow Values manually.

CAUTION

- When using the Adjust Ratio mode, the controller cannot check drive positions at all times. It is therefore the responsibility of the engineer to check that motors and valves are responding correctly.

To adjust an oxygen set point or enter an air flow value in the firing range, use the following procedure. (The manual calculation of the values programmed here is covered in the following section 2.6.3.)

1. Go into Adjust Ratio mode. (With the burner ON, go into COM mode.)
2. Enable oxygen trim by setting option parameter 30.5 to 1.
3. Use the ▲ ▼scroll keys to select the desired set point (A4 for example). The system will modulate to the selected set point, and the number shown on the display will flash to indicate that the drives are modulating.
4. Wait for the number in the display to be illuminated steadily. This means that the drives have arrived at the selected set point.
5. The display will show an 'o2' value within the table for the profile set point. Press the **ADJ** key to move the highlight to the positions table then use ◄ ► keys to move the selection to the O2 field.
6. Use the ▲ ▼ keys to adjust the oxygen set point as necessary. If the new oxygen set point value is correct, then press the **ENTER** key. The value will be stored in memory.
7. If the new oxygen set point value is not wanted, or an adjustment is not required, press the **NEXT** key to return to the value stored in memory.
8. Use the ◄ ► scroll keys to select the ‘FLOW’ field on the display. The display shows the air flow value, represented as a percentage of the air flow when the drives are at the **High Fire** position.
9. Use the ▲ ▼ keys to adjust the Flow value as necessary. If the new Flow value is correct, then press the **ENTER** key. The value will be stored in memory.
10. If the new flow value is not wanted, or an adjustment is not required, press the **NEXT** key to return to the value stored in memory.
11. If you need to adjust another set point in the firing range, then press the **Axx** key and then repeat the procedure above from step 3.

2.6.3 Calculating and entering the Flow Values manually

If the flow values are to be calculated manually, then complete the procedure below, filling out the table in section 2.6.4 Flow Calculation table.

Go into Adjust Ratio mode with oxygen trim **disabled** as outlined above.

1. Select the High Fire position. The display will then show A(n), where n is the number of the High Fire profile point.

2. Wait until the oxygen reading has stabilized.

3. Record the **excess air** value at location x in the table. This value can be found using the e parameter EK48 (provided the hydrocarbon ratio has been entered into the appropriate option parameters (35.1 – 35.4) for the fuel being fired).

4. Select the profile position immediately below High Fire. The display will then show A(n-1).

5. Wait until the oxygen reading has stabilized and record the **excess air** value at location a_1 in the table.

6. Move the drive(s) that are to be trimmed {e.g., secondary air damper and variable speed or fuel drives} to their respective positions for the next profile position above the existing position. **Do <u>not</u> press Enter.**

7. Wait until the oxygen reading has stabilized, then record the **excess air** value at location b_1 in the table, relating to the current profile position.

8. Repeat the above for all other profile positions including Low Fire (profile position A3), recording each time the values at locations **a** and **b** in the table. When extra air is added at P3, measure the time taken before the flue oxygen reading starts to increase, and enter the value into Option 37.

9. After completing the table for all Excess Air values **a** and **b**, complete the Excess Air + 100 column, by adding 100; (i.e., y = x + 100, c = a + 100 and d = b + 100).

10. Complete the Ratio column by dividing c by d (i.e., e = c/d).

11. Complete the Airflow column by multiplying e by the previous value of f (i.e., $f_x = e_x f_{x-1}$).

12. If the system will be applying trim to the fuel, the fuel flow column must be completed. This is achieved by multiplying the airflow at each point by the ratio of excess air + 100 at High Fire divided by the excess air + 100 at the actual point (i.e., $g_x = f_x(y/c_x)$).

Here is an example of the table completed for A10 (High Fire) to A8. In practice, the table must be filled out down to A3 (Low Fire).

Profile position	Excess Air		Ex. Air + 100 y = x + 100 c = a + 100 d = b + 100		Ratio	Airflow	Fuel flow
High Fire = A**10**	x	**10**	y	**110**	------------	**99.9%**	**99.9%**
1 = A**9**	a_1	**8**	c_1	**108**	$e_1 = c_1/d_1$	$f_1 = e_1$ (99.9)	$g_1 = f_1\ (y/c_1)$
	b_1	**33**	d_1	**133**	**0.812**	**81.1%**	**82.6%**
2 = A**8**	a_2	**9**	c_2	**109**	$e_2 = c_2/d_2$	$f_2 = e_2\ (f_1)$	$g_2 = f_2\ (y/c_2)$
	b_2	**20**	d_2	**120**	**0.908**	**73.7%**	**74.4%**

2.6.4 Flow Calculation table

Profile position	Excess Air	Ex. Air + 100 y = x + 100 c = a + 100 d = b + 100	Ratio	Airflow	Fuel flow
High Fire = A	x	y			
1 = A	a_1 b_1	c_1 d_1	$e_1 = c_1/d_1$	$f_1 = e_1$ (99.9)	$g_1 = f_1 (y/c_1)$
2 = A	a_2 b_2	c_2 d_2	$e_2 = c_2/d_2$	$f_2 = e_2 (f_1)$	$g_2 = f_2 (y/c_2)$
3 = A	a_3 b_3	c_3 d_3	$e_3 = c_3/d_3$	$f_3 = e_3 (f_2)$	$g_3 = f_3 (y/c_3)$
4 = A	a_4 b_4	c_4 d_4	$e_4 = c_4/d_4$	$f_4 = e_4 (f_3)$	$g_4 = f_4 (y/c_4)$
5 = A	a_5 b_5	c_5 d_5	$e_5 = c_5/d_5$	$f_5 = e_5 (f_4)$	$g_5 = f_5 (y/c_5)$
6 = A	a_6 b_6	c_6 d_6	$e_6 = c_6/d_6$	$f_6 = e_6 (f_5)$	$g_6 = f_6 (y/c_6)$
7 = A	a_7 b_7	c_7 d_7	$e_7 = c_7/d_7$	$f_7 = e_7 (f_6)$	$g_7 = f_7 (y/c_7)$
8 = A	a_8 b_8	c_8 d_8	$e_8 = c_8/d_8$	$f_8 = e_8 (f_7)$	$g_8 = f_8 (y/c_8)$
9 = A	a_9 b_9	c_9 d_9	$e_9 = c_9/d_9$	$f_9 = e_9 (f_8)$	$g_9 = f_9 (y/c_9)$
10 = A	a_{10} b_{10}	c_{10} d_{10}	$e_{10} = c_{10}/d_{10}$	$f_{10} = e_{10} (f_9)$	$g_{10} = f_{10} (y/c_{10})$
11 = A	a_{11} b_{11}	c_{11} d_{11}	$e_{11} = c_{11}/d_{11}$	$f_{11} = e_{11} (f_{10})$	$g_{11} = f_{11} (y/c_{11})$
12 = A	a_{12} b_{12}	c_{12} d_{12}	$e_{12} = c_{12}/d_{12}$	$f_{12} = e_{12} (f_{11})$	$g_{12} = f_{12} (y/c_{12})$
13 = A	a_{13} b_{13}	c_{13} d_{13}	$e_{13} = c_{13}/d_{13}$	$f_{13} = e_{13} (f_{12})$	$g_{13} = f_{13} (y/c_{13})$

Profile position	Excess Air		Ex. Air + 100 y = x + 100 c = a + 100 d = b + 100		Ratio	Airflow	Fuel flow
14 = A	a_{14} b_{14}		c_{14} d_{14}		$e_{14} = c_{14}/d_{14}$	$f_{14} = e_{14}\ (f_{13})$	$g_{14} = f_{14}\ (y/c_{14})$
15 = A	a_{15} b_{15}		c_{15} d_{15}		$e_{15} = c_{15}/d_{15}$	$f_{15} = e_{15}$ $(f_{14})_{15}$	$g_{15} = f_{15}\ (y/c_{15})$
16 = A	a_{16} b_{16}		c_{16} d_{16}		$e_{16} = c_{16}/d_{16}$	$f_{16} = e_{16}\ (f_{15})$	$g_{16} = f_{16}\ (y/c_{16})$
17 = A	a_{17} b_{17}		c_{17} d_{17}		$e_{17} = c_{17}/d_{17}$	$f_{17} = e_{17}\ (f_{16})$	$g_{17} = f_{17}\ (y/c_{17})$

2.6.5 Automatic Trim commissioning

The controller can automate the above procedures, automatically calculating and entering flow values, oxygen trim set points, and boiler transport delay. The automatic commissioning procedure will only work if the following conditions are met:

- Option parameter 30.9 (Automatic Trim commissioning) is set to 1.
- An oxygen probe is fitted and fully operational.
- The controller is in Adjust Ratio mode with the burner firing.
- A hydrocarbon ratio has been entered for the current fuel profile.

The Automatic Trim commissioning procedure usually takes between 10 and 30 minutes (depending on number of set points), and is performed by the controller as follows:

1. Beginning with High Fire, the controller moves the drives to each point in the firing range. The 'PROFILE SET' display parameter toggles between '**A n**' and 'O2', where **n** is the current set point.

2. When the measured oxygen reading settles, the controller stores the measured oxygen reading as the new oxygen set point.

3. The controller moves the air drives up to one point above the current set point, leaving the fuel drive in the same position. The 'PROFILE SET' display parameter toggles between '**A n**' and '**Flo**', where **n** is the current set point.

4. When the new oxygen reading settles, the controller calculates and stores the new flow value. If the oxygen reading exceeds 15.0% during this stage, the controller shuts the burner down and shows fault code F77 (see "List of Fault Code Numbers" in section 5, "Fault Finding").

5. When the controller has completed the transition to Low Fire, the measured boiler transport delay (at Low Fire) is stored in Option 30.7. Also, Option parameter 30.5 (oxygen trim enable) is set to zero.

IMPORTANT: BEFORE ENABLING TRIM, USE ADJUST RATIO MODE TO MANUALLY CHECK THE CALCULATED FLOW VALUES, OXYGEN SET POINTS AND TRANSPORT DELAY.

The ratio of the flow numbers, being High Fire flow rate (99.9) to the Low Fire flow rate, should be similar to the expected turn-down ratio that you programmed into the controller. Refer to your prepared profile commissioning data for comparison.

To perform Automatic Trim commissioning, follow the procedure below:

1. Calibrate the oxygen probe (see 2.4 in this section, “Probe Calibration”).

2. Go into Adjust Ratio mode (see section 3, Commissioning).

3. Enable Automatic Trim commissioning by setting option parameter 30.9 to 1.

4. Wait for the procedure to finish.

5. Re-calibrate the oxygen probe.

6. Check that the O_2, flow and transport delay values are in the following ranges:

   - For O_2, we would expect it to be in the range 8% - 2%, normally reducing as the profile set point increases.
   - For Flow, we would expect the values to increase as the profile set point increases, ending with High Fire set point as a value of 99.9(%).
   - Typically, the transport delay will be 15 to 40s depending upon the size of the boiler.

3. The CO Trim option

3.1 Introduction.

The NX6100 system can be configured to modify the Oxygen trim algorithm based upon a Carbon Monoxide measurement made in the flue gases. For CO trim to be active the oxygen trim system must be commissioned and set ON.

The CO trim system will modify the O2 set points for the oxygen trim algorithm within limits set by option parameters. In addition, a high CO alarm can be configured to ensure that the burner operation is stopped in the event of the measurement of continuous high levels of CO.

3.2 CO Trim wiring.

The CO measurement must be provided as a 4-20mA signal from an external CO measuring device. The CO signal must be connected into the NXO2TRIM Oxygen Probe controller as follows:
PG6: CO signal +
PG5: CO signal –

If the application utilises a third party combined CO/O2 probe, then the 4-20mA for the Oxygen signal must be connected as follows:
PG7: Oxygen signal +
PG9: Oxygen signal –

3.3 CO Trim option parameters.

The option parameters associated with CO trim system are the same parameters assigned for a second oxygen probe, 42.0 to 42.6 but with alternative descriptions. Setting option 42.0 to the same value as set in option 30.0 automatically signals to the controller that the options are for CO trim.

The options are as follows:

Option	Description
42.0	Probe interface serial number.
42.1	CO sensor signal span value.
42.2	CO trim gain.
42.3	CO set point.
42.4	Maximum oxygen reduction.
42.5	Maximum oxygen increase.
42.6	High CO limit alarm.

Full option descriptions can be found in the Appendix section of this manual.

3.4 CO Trim EK's.

In a similar way to the option parameters, the EK's associated to the second oxygen probe change their meaning when CO trim is enabled as follows:

EK	Description
75	CO level (ppm)
76	Oxygen set point after CO trim.
78	CO trim modifier
79	Oxygen set point before CO trim.

4. Section 4 Update History

New version	Date		Changes in brief
V1pt4D	Dec 2022	GFS	Updated description of the oxygen measurement system.
V1pt4D	June 2024	RAL	Updated Fireye Version

——— End of Section 4 ———

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1. Faults and Fault Finding

1.1 The Fault Display

The NX6100 series controllers carry out a number of internal and external checks during operation. If a fault is found, a fault number (displayed with a text description) is used to identify the type of problem. (See 1.5 List of Fault Code Numbers.)

Many of the faults detected and displayed by the controller will cause a non-volatile lockout of the burner, i.e., removing the power to the controller will not cancel the fault. Some fault or limit messages will be displayed as a warning, but operation of the burner will not be affected.

Each fault number is prefixed on the display by a letter as follows:

F	This means that a fault has occurred and is still present. The fault may be internal or external to the controller.
C	This means that a fault did occur but has now cleared.
L	This means a programmed limit has been exceeded.

Many of the faults detected and displayed by the controller will cause a non-volatile lockout of the burner. Other faults will be displayed as a warning, but operation of the burner will not be affected. A complete list of faults can be found later in this chapter.

A fault history is available through the Engineer's Key Data, stored in the display unit memory, even if there is a power loss to the controller. For further information see 1.6.1 System Event History.

1.2 What to do when a Fault occurs

If faults or limits are present and the alarm or limit alarm is ON, then press the **MUTE RESET** key to mute the alarm (open the relay contacts).

Take note of the fault message and use the Fault Listing to identify why the fault occurred.

If the faults that cause a non-volatile lockout are still present when the alarm is muted, then the alarm will operate again when the fault clears, to indicate to the operator that the burner can be restarted.

After all faults have been diagnosed, rectified, and cleared, press the **MUTE RESET** key for about three seconds to remove the fault messages and re-start the burner.

The function of the **MUTE RESET** key may also be achieved via digital Communications or by using the FAULT MUTE input. See option parameter 1.2.

1.3 Non-Volatile Lockout

If power is removed from the controller while a fault is still present, the fault will be stored in non-volatile memory. When power is restored to the controller, the fault number will still be present, and you will need to clear the fault before restarting the burner.

1.4 Fault Subsets

As an aid to fault finding, most faults also have a ***fault subset*** that gives additional information about the type of fault, or what the burner was doing when the fault occurred.

The individual subsets have a code number in the sequence 1,2,4,8,16,32,64 and 128. However, there is only space on the display for 3 digits, so the displayed subset number represents the addition of individual subset codes.
For example, if a subset number is displayed as 3, this means that a combination of subset 1 AND subset 2 occurred: hence 1+2=3.
Subset no. 13=subsets 8+4+1.
Subset no. 57=subsets 32+16+8+1.
Subset no. 103=subsets 64+32+4+1.

Where applicable, the subsets are shown in this section in 1.5, “List of Fault Code Numbers”.

You can view the fault subsets on the system by looking at the Engineer's Key Data. For details, see 1.6.

1.5 List of Fault Code Numbers

These fault codes are shown on the two-line text display. See “The Fault Display” in 1.1.
The Touch screen display shows the following:

Fault No	Display text	Possible reason + Subset when fault occurred
F01	External Alarm Fault 1	One of the low voltage alarm / lockout inputs is causing an alarm.
F02	External Alarm Fault 2	The fault may be prefixed by either an ‘L’ or an ‘F’ and may or may not shutdown / lock out the burner.
F03	External Alarm Fault 3	See Option parameters 18.1 to 18.9.
F04	External Alarm Fault 4	*Subset = burner status number*
F05	External Alarm Fault 5	
F06	External Alarm Fault 6	
F07	External Alarm Fault 7	
F08	External Alarm Fault 8	
F09	External Alarm Fault 9	

Fault No	Display text	Possible reason + Subset when fault occurred
F10	Flame Failure	The flame detector did not register the presence of a flame when a flame should be present. • If there is a flame, check the wiring. *Subset = X + burner status number* *Where X=100 for Flame1, X=200 for Flame2*
F11	False Flame	The flame detector registered the presence of a flame when it should not be present or when the shutter (if selected) was closed. *Subset = X + burner status number* *Where X=100 for Flame1, X=200 for Flame2*
F12	External Alarm from Input 12	The high voltage alarm / lockout input number 12 is causing an alarm. The alarm number is prefixed by either an 'L' or an 'F' and may or may not shut down / lock out the burner. See Option parameter 16.3. *Subset = burner status number*
F13	External Alarm from Input 13	The high voltage alarm / lockout input number 13 is causing an alarm. The alarm number is prefixed by either an 'L' or an 'F' and may or may not shutdown / lock out the burner. See Option parameter 16.4. *Subset = burner status number*
F14	Main (secondary) combustion air pressure not detected	The main combustion air pressure switch failed to register air pressure when it should be present. *Subset = burner status number*
F15	Main (secondary) combustion air pressure detected when it should not be.	The main combustion air pressure switch registered air pressure when it should not be present (*subset: 1*), or the air pressure switch registered air pressure for more than 3 minutes after the burner was turned OFF (*subset: 2*). *This fault will also occur if Opt 6.x is not set correctly.*
F16	Optional second (primary) air pressure not detected	The primary air pressure switch failed to register air pressure when it should be present. *Subset = burner status number*
F17	Optional second (primary) air pressure detected when it should not be.	The primary air pressure switch registered air pressure when it should not be present (*subset: 1*), or the air pressure switch registered air pressure for more than 3 minutes after the burner was turned OFF (*subset: 2*).

Fault No	Display text	Possible reason + Subset when fault occurred
F18	Not enough set points entered	A fuel:air ratio profile has been selected which does not have at least four set points commissioned. Use Commission Ratio mode to enter more set points. *Subset = profile number*
F19	Circuit board voltage reference fault	The circuit board has an incorrect on-board reference level. • Check FS2 is the correct value and type. • Make sure ALL analog inputs (4-20 mA, 0 – 5 V) are in the range 0 to 5 Vdc. It is critical to the controller operation that none of the inputs is higher than 5 V. • If the problem persists even when all analog inputs are disconnected, check EK37 and contact supplier. *The subsets are binary coded and added up, hence Subset:* *1 = out of range,* *2 = zero check failed,* *3 = 1+2 = out of range AND zero check failed;* *4 = span check failed,* *5= 1+4 = out of range AND span check failed;* *6= 2+4= zero check failed AND span check failed,* *etc.*

Fault No	Display text	Possible reason + Subset when fault occurred
F20	Drive 0 position fault	A drive-positioning fault has occurred, which will cause a non-volatile lockout of the burner. This fault has occurred for one of the following reasons: 1. During ‘Close’ position prove, the measured position is in error, to the commissioned ‘Close’ position, by more than five degrees. 2. During Purge position prove, the measured position is in error, to the commissioned ‘Purge’ position, by more than five degrees. 3. During pre-purge, ignition, or post-purge, when a drive moves from its set point. 4. During modulation, when a drive is not at its correct set point as defined by the commissioned fuel: air ratio for the selected profile. A servo drive is defined as having moved from its set point if its positional error is more than 1° for 15s, or more than 5° for 1s. For positional errors between 1° and 5°, the detection time is variable between 15s and 1s. Inverter (VSD) drive error bands variable and set in option parameter 09.1. Note: Only the selected drives (i.e., used on the current fuel/ air profile) are checked. The other drives are ignored. *Subset = burner/CANbus/internal servo status number.* *000 to 016 = Burner status when the fault occurred.* *032 to 048 = CANbus communications error. Display shows ERR1 under the drive name.* *>64 = Internal servo fault. Display shows ERR2 – ERR7 under the drive name.*
F21	Drive 1 position fault	
F22	Drive 2 position fault	
F23	Drive 3 position fault	
F24	Drive 4 position fault	
F25	Drive 5 position fault	
F26	Drive 6 position fault	
F27	Drive 7 position fault	
F28	Drive 8 position fault	
F29	Drive 9 position fault	
F30	Gas Proof of Closure fault	The gas (main 2) valve proof of closure signal is not responding correctly. *Subset = burner status when the fault occurred.*
F31	Oil Proof of Closure fault	The oil valve proof of closure signal is not responding correctly. *Subset = burner status when the fault occurred.*
F32	Safety input fault	One or more of the fail-safe low voltage inputs is registering a fault. Check digital inputs 1 to 8 are wired to the correct commons. *Subset = 0 to 128. Work out the binary number of the number displayed, to see which digital inputs have failed.* • Check the panel wiring.

Fault No	Display text	Possible reason + Subset when fault occurred
F33	Burner input fault	One or more of the fail-safe high voltage inputs is registering a fault. *Subset = 0 – One, or more, of the Inputs is On in the wrong phase, possibly Line voltage pickup*. +1 = PE9 input faulty +2 = PE7 input faulty +4 = PE8 input faulty • Check the panel wiring.
F34	Primary relay fault	One or more of the internal relays is not responding correctly. *Subset when the fault occurred:* *1- 10 = Failed Relay number.* *100 = i/p13 (PE8) is not detecting the ignition o/p at the correct time when Option 8.0=1.* • Check the panel wiring.
F35	ADC fault	One of the internal checks on the Analog to digital converter has failed. *Subset = Failure mode when the fault occurred*. • Check the panel wiring.
F36	Reset fault	The controller is detecting Reset commands either by button pushes or an external event (5 in 15 mins), when there are no faults present. Power down or enter Commission mode to reset and clear this fault.
F37	RAM test fault	The main memory in the controller has malfunctioned. • Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. This could be due to high levels of electrical interference getting into the product. • Check that all cables are correctly screened, and the screens are terminated correctly. Make sure the mains supply is not excessively noisy. • If this fault persists, return the controller to the supplier. *Subset = Failed Page number in memory map when the fault occurred.*

<table>
<tr><th>Fault No</th><th>Display text</th><th>Possible reason + Subset when fault occurred</th></tr>
<tr><td>F38</td><td>Program memory CRC fault</td><td>The program memory in the controller has malfunctioned.
Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears.
This could be due to high levels of electrical interference getting into the product.
Check all cables are correctly screened, and screens are terminated correctly.
Make sure the mains supply is not excessively noisy.
If this fault persists, the controller must be returned to the supplier.
Subset = Failed Page number in memory map when the fault occurred.</td></tr>
<tr><td>F39</td><td>Profile table CRC fault</td><td>The profile table memory in the controller has been corrupted.
Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears.
Erase the system using option parameter 45.1 = 5 and re commission (or restore with option parameter 45.2).
This could be due to high levels of electrical interference getting into the product. Check all cables are correctly screened, and screens are terminated correctly. Make sure the mains supply is not excessively noisy.
If this fault persists, the controller must be returned to the supplier.
Subset = Failed Page number in memory map.</td></tr>
<tr><td>F40</td><td>Single fuel only fault</td><td>This fault will appear if an attempt is made to commission an oil profile on a gas only unit, or a gas profile on an oil only unit.
Check option parameters 6.1 to 6.4</td></tr>
<tr><td>F41</td><td>Boiler sensor fault or safety limit exceeded</td><td>The pressure/temperature sensor is not responding correctly, or the boiler’s measured value has exceeded the pressure/temperature safety limit.

Subset =
1 = sensor feedback < 1 V*,
2 = sensor feedback > 5 V*,
3 = sensor failed during test*,
4 = safety limit exceeded
255 = CAN Bus connection fault
* - Check the panel wiring.</td></tr>
<tr><td>F42</td><td>Valve prove (leak) test fault.</td><td>The measured gas pressure was not correct during the gas valve leak test.

Subset = Valve prove status number.
Check that Option 10.1 is set correctly</td></tr>
</table>

Fault No	Display text	Possible reason + Subset when fault occurred
F43	Gas pressure limit exceeded, or sensor fault.	The measured gas pressure is outside the operating limits. Subset = *1 = Pressure too Low* *2 = Pressure too High* *10 = The gas pressure sensor is not responding correctly.* *255+ CAN Bus connection fault* • Check the gas supply pressure
F45	Low cup speed.	The measured cup speed (PZ11) is below the limit set in option 9.7.
F46	EEPROM memory CRC fault	The EEPROM memory in the controller has been corrupted. This memory is used to store the option parameters. • Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. • Erase the system using option parameter 45.1 = 5 and re-commission (or restore with option parameter 45.2). This could be due to high levels of electrical interference getting into the product. • Check all cables are correctly screened, and screens are terminated correctly. • Make sure the mains supply is not excessively noisy. • If this fault persists, return the controller to the supplier. *Subset = Failed Page number in memory.*
F50	Oxygen probe heater fault	The probe heater has failed to heat to the correct temperature after 30 minutes of system power up. • Is the probe heater wiring, correct? • Is the probe cell thermocouple wiring, correct? After the fault is rectified, you need to interrupt the power to the oxygen probe interface, to attempt to heat the probe once more. *Subset: not applicable.*
L52	Oxygen low limit alarm	The oxygen level measured value is below the oxygen set point low alarm value for the current profile. *Subset = 0 = Limit violation, 1 = Probe Failed.*
L53	Oxygen high limit alarm	The oxygen level measured value has exceeded the oxygen set point high alarm value for the current profile. *Subset = 0 = Limit violation, 1 = Probe Failed.*

Fault No	Display text	Possible reason + Subset when fault occurred
F54	Oxygen probes mismatch fault	This fault occurs when two oxygen probes are used to give fail-safe oxygen monitoring. If this fault occurs, check and calibrate both oxygen probes. It may be necessary to increase option parameter 42.4 or 42.5 (within safe limits) if the oxygen probes are in different parts of the flue. The safe limits of the variation allowed between the Oxygen readings will most likely be determined either by 'local codes of practice', or as recommended by a competent combustion authority and agreed by the process owners. Subset = *1 = Oxygen values do not match,* *2 = Flue temperatures do not match* *3 = Both flue temperature and oxygen levels do not match* *255 = Second oxygen probe is faulty / not ready. See EK 76.*
F54	CO High limit.	Limit reached or exceeded see option 42.6
L55	Trim limit alarm	The trim drive has reached the allowed maximum deviation limit. • Change trim limit. • Re-commission fuel / air ratio. *Subset: Not applicable.*
F57	Auto trim commissioning fault	The measured oxygen level exceeded 15.0% during auto trim commissioning. The burner is shutdown. Subset = *Last auto trim commission set point (+32 if adding air).*
L58	Flue temperature low alarm value exceeded	The measured flue temperature is below the low alarm value for the current profile, or the flue thermocouple is faulty. *Subset: Not applicable.*
L59	Flue temperature high alarm value exceeded	The measured flue temperature has exceeded the high alarm value for the current profile. *Subset: Not applicable.*
F61	Air pressure level fault.	The measured air pressure has exceeded the limit set by option 42.9 for more than 6 seconds. *Subset = profile set point.*
F63	Option parameters uploaded	The option parameters have been uploaded via serial communications. Check all values are correct and match the application, then set option parameter 45.0 to 0. *Subset: Not applicable.*

Fault No	Display text	Possible reason + Subset when fault occurred
F64	Profile Invalid	This fault means that the controller can't execute the currently selected profile because the profile data does not match burner / site configuration. It could lead to a hazardous situation. There are three possible causes to this fault: 1. A drive has been commissioned in this profile but has now been deselected. E.g. - If a profile is commissioned with two air dampers but then the second air damper is de-selected with option parameter 4.0 to 4.9, then the profile is no longer valid. *Subset = Drive number (0 to 9)* 2. Servo / Drive changed. If the system is commissioned then later one of the servos is changed for a new one (i.e., different serial number), any profiles that use the original servo are now considered invalid. (This is to ensure that the maintenance engineer checks that the new servo is mechanically fixed the same way as the original one.) *Subset = Invalid profile + 100 (101 to 104).* 3. The selected profile has been uploaded from a PC but has not been verified on this burner. *Subset = Invalid profile + 100 (101 to 104).* In all cases the F64 can be cleared by switching to another (valid) profile, or by re-commissioning the profile in Commission Ratio mode, making sure all points up to and including High Fire are acknowledged using the 'NEXT' key (or 'ENTER' if the points are adjusted).
F65	Power-up Lockout	The controller has locked out on power-up. This will normally be because option parameter 1.0 is set to 1. *Subset =* *1 – See option parameter 1.0.* *254 – Serial EEPROM write failure.* *255 – NV Lockout verification failed.*

Fault No	Display text	Possible reason + Subset when fault occurred
F66	Flame Test	**For Option 13.0= 1 to 3:** The flame test (dark test) has failed. This could be a problem with the flame input circuit, failed UV tube, or a shutter problem. • Check JP6 is in the 'IN' position if a shuttered UV scanner is being used. *Subset =* *1 = Shutter not detected* *2 = Input circuit failure* *3 = Input stuck ON or terminals short circuit.* **For Option 12.0 or 13.0=5:** *Subset = +100 for Flame 1 and +200 for Flame 2* *+1 = CAN Bus time out (e.g., 101) – check wiring.* *+2, +3, +4 = Detector memory fault – Replace.* *+5, +6 = Detector internal fault – Replace.* *+7 = Shutter/dark check fault, or UV tube failed – check the operation off/out of burner.*
F67	Secondary relay fault	A secondary fault has occurred with the main 1, main 2, pilot, vent or non-volatile lockout relays. • Contact supplier *Subset = Failed relay number.*
F68	Secondary program memory checksum fault	A fault has occurred with the program memory in the controller. • Contact supplier *Subset: Not applicable.*
F69	Secondary watchdog fault	A fault has occurred with the CPU watchdog. • Contact supplier *Subset:* *1 = Late test failed.* *2 = Early test failed.*
F70 – F79	User Faults	These fault numbers are generated by the user-programmable section of the controller and will vary with the application.
L89	FGR input fault.	The 4-20mA input selected by Opt 44.0 is out of range – FGR will be held at P3 position

1.6 The Engineer's Key Data (EK)

By selecting the Engineer's Key Data, you can read the values of internal system variables, and external input and output states. You can also see the values of ***fault subsets***, which give more detailed information about a fault.

When using the Engineer's Key Data you cannot change any parameters, so you cannot affect the operation of the burner.

Viewing EK data on the NX6220 and NX6330 display

For the NX6220 display, press the Engineer's Key Data EK button :

- The top line of the display will show an EK (data register) number and the EK description.
- The bottom line of the display will show the value of the register.

For example:

```
EK025  Burner Status
= 02
```

- Use the UP or DOWN keys to change the EK number and view its corresponding data.
- Press the EK button to go back to the normal run display.

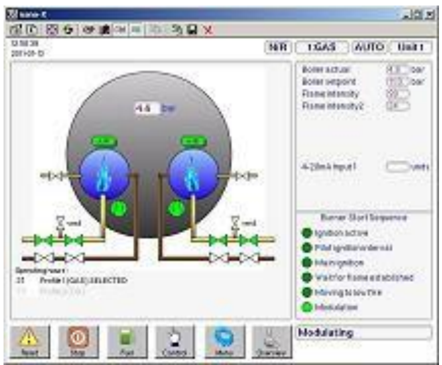
Timeout: The controller will revert automatically to the normal run display if a key has not been pressed for one minute.

Viewing EK data on the Touch screen

To view EK data using the Touch screen, tap these buttons:

Menu > Burner Settings > EngValues tab

Scroll through the EK values using scroll bar to the right of the panel.



1.6.1 System Event History

The NX6100 display modules store information on past events and faults. The memory in the 2-line text display unit will store the last 128 events/faults and the associated status data. However, the Touch screen display will store thousands of events. You can see the full set using the Fireye ComFire2 software interface to a Windows PC or laptop.

The Engineer's Key Data allows you to access the event history.

View the Event History Log on the NX6220 and NX6330 display.

To view the event history, press EK then LOG to see the fault list.

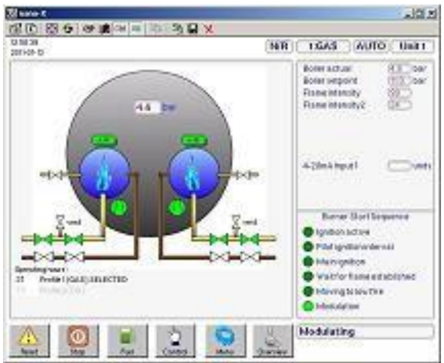
You can navigate the event history by using the UP/DOWN keys.

To review specific information regarding an event that is highlighted, press INFO.

Viewing Event History Log on the Touch screen

To view the Event History Log using the Touch screen, tap these buttons:

Menu > Fault/Event log button **> Show Event Log** button.
Scroll up and down the list to view all events.



Viewing Fault History (Touch screen)

To view the Fault History using the Touch screen, tap these buttons:

Menu > Fault/Event log button **> Show Fault History** button.
Scroll up and down the list to view all faults.

View the Event History Log using the NX610 display

To view the event history, scroll UP through the EK numbers to EK200, then scroll one step more. This displays the most recently occurring event, indicated by 00 in the top left corner of the display. For example:

Event History Log number (2 digits) — Date & Time — Subset number (3 digits)

```
00 24Jun13 09:03 001
Digital input12 (HV)
```

You can navigate the event history by using the UP/DOWN keys.

1.6.2 Engineer's Key Data (EK) Parameter List

EK No.	Name	Description
EK1	Low Voltage Digital Input 1 PB9 – PB10	Shows the state of each input. Where: 0 = OFF 1 = ON
EK2	Low Voltage Digital Input 2 PB9 – PB11	
EK3	Low Voltage Digital Input 3 PB9 – PB12	
EK4	Low Voltage Digital Input 4 PB9 – PB13	
EK5	Low Voltage Digital Input 5 PB14 – PB15	
EK6	Low Voltage Digital Input 6 PB14 – PB16	
EK7	Low Voltage Digital Input 7 PB14 – PB17	
EK8	Low Voltage Digital Input 8 / Profile 1 select. PB5 – PB6	
EK9	Low Voltage Digital Input 9 / Profile 3 select. PB5 – PB7	
EK10	Profile 2 select (Low voltage) PB8 – PB6	
EK11	Profile 4 select (Low voltage) PB8 – PB7	
EK12	High voltage digital input 12. PE7	
EK13	High voltage digital input 13. PE8	
EK14	Burner Select Input (High Voltage) PE9	
EK15	Airflow Input (Low Voltage) PB18– PB19	

EK No.	Name	Description
EK16	Low Fire Hold or Warming limit active.	0 = Burner free to modulate. 1 = Either Low Fire Hold is selected, or the measured value is below the warming limit. The burner is held at Low Fire if the controller is in Auto or Sequencing mode.
EK17	Flame Detected	0 = No flame detected. 1 = Flame detected. When both flame inputs are used together, this value will only show ‘1’ if both inputs are above their flame threshold.
EK18	Boiler status	0 = The Burner will not fire because the temperature / pressure measured value has exceeded the high controller value. 1 = The Burner will fire because the temperature / pressure measured value has fallen below the low controller value.
EK19	Confirm to adjust	0 = Either the Controller is not in Commission mode, or the controller is in Commission mode and the drives are moving to the set points. 1 = The Controller is in Commission mode, and you can adjust the drives using the UP/DOWN keys.
EK20	Drive moved	0 = Either the Controller is not in Commission mode, or the controller is in Commission mode and the drives have not been moved using the UP/DOWN keys. 1 = The Controller is in Commission mode and the drives have been moved using the UP/DOWN keys.
EK21	Positions proved	0 = The motor or servo position feedback have stopped changing, ready for the position prove test. 1 = Ready for the position prove test, but the drives are still moving.
EK22	Fault alarm	0 = No un-muted alarms (faults) present. +1 = Un-muted fault alarm present (prefix: F)
EK23	Oxygen Trim Enable	0 = Oxygen trim is OFF or not working. 1 = Oxygen trim is ON and working (EK46 = 0).

EK No.	Name	Description
EK24	Oil warming Active	The burner will not fire because the oil is not up to temperature and the oil warming function is active.
EK25	CAN_TX Failures	This is a count of the number of times the CANbus controller has failed to send a message since power-up. This should be zero unless there has been a problem.
EK26	Commission status	This shows the current Commission mode, where: 0 = Normal Run mode. 1 = Adjust Ratio mode. 2 = Commission ratio mode.
EK27	Commission set point	The current set point being commissioned. 0 = Closed set point. 1 = Purge set point. 2 = Ignition set point. 3 = Low Fire set point. 4 to 24 = profile set points
EK28	Commission Set Points entered	The number of set points that have been successfully entered during this commission ratio session.
EK29	Modulation rate (%)	The current modulation rate of the burner. 0 = Low Fire 100 = High Fire
EK30	Burner Status	The Status of the start-up sequence. See section 1, “Description of Operation”.
EK31	Fuel Profile Selected	The currently selected fuel profile.
EK32	Number of commission set points	The number of set points entered for the currently selected profile: 0 = No. of set points entered. 1 = Close set point only. 2 = Close and purge set points. 3 = Close, purge and ignition. 4 to 24 = profile set points.
EK33	Modulation mode	The current Modulation mode: 0 = Auto mode. +1 = Manual from keypad. +2 = LFH (Low Fire Hold) from keypad. +4 = Local 1. +8 = Local 2. +12 = Burner switched OFF from display command.
EK34	Photocell / IR sensor signal value	Infra-red Signal value received from the flame sensor input. For the photocell / IR input: 0 = Fully dark (no flame).

EK No.	Name	Description
EK35	UV sensor signal value	Ultra-violet Signal value received from the flame sensor input. For the UV/ionization probe input: 0 = Fully dark (no flame).
EK36	Nearest set point	The number of the profile set point that is nearest to the current modulation position.
EK37	Voltage reference error (V)	The error between the measured voltage reference and the calibrated value. Typically, this value will be <0.05 V. If it is above 0.12 V then fault F19 will occur. When the value is high, make sure that all ELV (low voltage) inputs are less than 5 Vdc.
EK38	RS485 Communications status	Toggles between 1 and 0 when the non-isolated RS485 (not Modbus) is active.
EK39	Fuel Swap Status	If this status is not zero, the controller is in the process of performing a fuel profile swap (without turning the burner OFF).
EK40	Shutdown set point	The nearest set point (EK36) when the burner last locked out.
EK41	Customer type no.	
EK42	Adjust ratio counter	The number of times Adjust Ratio mode has been used.
EK43	Commission ratio counter	The number of times Commission Ratio mode has been used.
EK44	Oxygen measured value	The current flue oxygen value as measured by the probe (if fitted).
EK45	Oxygen probe interface status	**For NX6083-x** +1 = Internal pcb comms fault. +2 = Internal pcb data fault. +4 = Probe heater fault. Causes F50. +8 = Temperature or O_2 inputs out of range. +16 = Cell millivolts out of range. +32 = CANbus error. +64 = Probe calibrating in reference gas. See option parameter 30.6. +128 = Probe calibrating in air. See option parameter 30.6.

EK No.	Name	Description
EK46	Oxygen trim status	0 = O_2 trim working, or +1 = no oxygen interface connected. +2 = no oxygen probe serial number entered, or option 30.5 is not 1, or option 30.8 is not 0 or no trim type is selected by option 31.x, or, trim is not selected via dig i/p, serial comms +4 = O_2 set points or flow values are incorrect +8 = Option 20.6 is not 0 +16 = Not modulating +32 = In Commission mode +64 = Probe faulty (see EK45).
EK47	Oxygen set point (%)	Current oxygen set point. This is only available if trim is enabled and working.
EK48	Excess air (%)	Excess combustion air at the current firing position.
EK49	Oxygen error (%)	Error between O_2 measured value and O_2 set point.
EK50	Trim deviation (% flow)	Deviation in airflow imposed by trim (-25 to +25%)
EK51	Gas pressure (display units)	Measured gas pressure from the gas pressure sensor (the sensor must be enabled, and gas must be selected).
EK52	VPS Valve close time t_{test} (s)	The Time for which each half of the valve leak prove test will be conducted. This time counts down to zero during stages 2 and 4 of the valve leak prove test.
EK53	Gas pressure change (display units)	Pressure drop/rise limit allowed during the valve leak prove test. This value is only valid during the valve leak test process EK54 = 1,2,3,4.
EK54	Valve prove status	Status of the valve leak test sequence.
EK55	Main PCB issue	The issue number of the main circuit board
EK56	Firmware issue.	The current revision of the main product firmware.
EK57	Spare	N/A
EK58	CPU serial number (low 4 digits)	The CPU board serial number.
EK59	Drives at set point	Represents which drives are currently at their set points, where: 0 = All drives are at their set points and are not moving. Non-zero = One or more drives are not at their set point.

EK No.	Name	Description
EK60	Digital (relay) outputs ON.	The combination of digital outputs currently set ON. **+1:** Digital Output 1 ON. Display, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage. **+2:** Digital Output 2 ON. Display, PR3(COM), PR5(NO), PR4(NC). Low voltage or line voltage. **+4:** Digital Output 3 ON. Display, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage. **+8:** Digital Output 4 ON. Main Unit, PD6(COM), PD7(NO), PD8(NC). Low voltage or line voltage. **+16:** Digital Output 5 ON. Main Unit, PD6(COM), PD4(NO), PD5(NC). Low voltage or line voltage. **+32:** Digital Output 6 ON. Main Unit, PD1(COM), PD2(NO), PD3(NC). Low voltage or line voltage. **+64:** Digital Output 7 ON. Daughter board, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY. **+128:** Digital Output 8 ON. Daughter board, PZ17 – PZ17. LOW VOLTAGE AND CURRENT ONLY.
EK61	Analog Input 1. Main Unit Terminal PA7.	The raw ADC counts from analog input 1. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK62	Analog Input 2. Main Unit Terminal PA8.	The raw ADC counts from analog input 2. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK63	Analog Input 3. Main Unit Terminal PA9.	The raw ADC counts from analog input 3. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK64	Analog Input 4. Main Unit Terminal PA12 (also gas pressure).	The raw ADC counts from analog input 4. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK65	Analog Input 5. Main Unit Terminal PA15 (also remote set point).	The raw ADC counts from analog input 5. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK66	Analog Input 6. Main Unit Terminal PA19 (also boiler measured value).	The raw ADC counts from analog input 6. 0 to 1023 for 0 to 5.00 volts. 4 mA = 180 counts 20 mA = 900 counts
EK67	Analog input 7. Daughter board terminal PZ12(-) PZ13(+). Also, VSD1.	The ADC counts from analog input 7. 0 to 999 for 4 to 20 mA.

EK No.	Name	Description
EK68	Analog input 8. Daughter board terminal PZ13(-) PZ14(+). Also VSD2.	The ADC counts from analog input 8. 0 to 999 for 4 to 20 mA.
EK69	Daughter board Frequency input 1 (PZ7). 0 to 12 volts.	Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.
EK70	Daughter board Frequency input 2 (PZ9). 0 to 12 volts.	Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.
EK71	Daughter board Frequency input 3 (PZ11). 0 to 12 volts.	Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.
EK72	Oxygen probe cell temperature.	For NXO2PK probe types the normal value is 650ºC for accurate operation. For NX6083 probe types the normal value is 820ºC for accurate operation.
EK73	Ambient air temperature.	The temperature measured by the inlet temperature sensor, if fitted. Units are ºC.
EK74	CPU utilization (%).	The percentage utilization of the CPU. This should be less than 95% at all times.
EK75	Second O_2 level (%)	The measured flue oxygen level as measured by the second oxygen probe interface (%).
EK76	Second probe status	The same as EK45, but for the second oxygen probe.
EK77	Program size.	This is the file size (in bytes) of the currently running manufacturer / user program. If a user program is selected, this should match the program size (in bytes) given by the 'Fireye Abacus' program.
EK78	Second cell temp (ºC)	The internal zirconia cell temperature of the second oxygen probe see EK72.
EK79	Second flue temp (ºC)	The flue temperature, as measured by the second oxygen probe, if fitted.
Alternative EK's for CO trim.		
EK75	CO level (ppm)	CO level as determined from the 4-20mA signal into the NXO2TRIM PG terminals.
EK76	Modified Oxygen set point	This is the value of the set point when modified by the CO trim function.

EK No.	Name	Description
EK78	CO trim modifier	This is the amount of CO trim where a value of ±500 = ±1% of Oxygen set point. Constantly changing if CO trim is active.
EK79	Oxygen set point before trim.	This is the original Oxygen set point before CO trim modification. CO trim = EK76-EK79
EK80 - 89	Drive Error values for drives 0 to 9.	The current error value for drives 0 to 9. These values will freeze when the controller performs a safety shutdown, so it may be possible to look at these values after a lockout to help determine the cause.
EK90	Burner cycles	The number of times the burner has attempted to start.
EK91	Burner Lockouts	The number of times the burner has locked out.
EK92	Commission data backup verification progress.	This value increases as the backup is verified when the burner is running. If a difference between the actual commissioning data and the backup is found, it will go to zero. A value of 999 indicates that the entire backup has been verified so all commissioning data are backed up in the display module's internal flash memory.
EK93	Flow Value	The instantaneous calculated air or fuel flow value, as used by the oxygen trim function. If flow values have been entered during commissioning for the current profile, this value will show the flow rate that corresponds to the current modulation rate. At High Fire, the value will be 99.9%. At Low Fire, it will be this value divided by the turn down ratio of the burner. If **fuel trim** is active, this value will track **air flow**. If **air trim** is active, this value will track **fuel flow**.
EK94	IR dc signal level	If option 12.0=2 then the flame signal is determined by the amount of flicker in the signal. EK 94 shows the average DC voltage level on the input, which corresponds to the resistance of the cell due to background IR radiation. Typical values are between 30 (cold) and 200 (hot). Range 0 = 0 volts = open circuit cell, 255 = 5 volts = short circuit cell.
EK95-Ek97	Spare, (not in use)	N/A
EK98	Combustion air pressure error.	The error between the measured pressure and the value stored during the curve commissioning process.

EK No.	Name	Description
EK100	Firmware type PT22xxxx	This shows the last four digits of the firmware part number for the controller firmware. It is used to identify the product variants.

CAUTION

- The product allows for customization of various non-safety-critical functions, including the modulation control.
- The **EK Engineers' Key codes shown below** relate to the default modulation control function programmed into the control at the factory. To verify that this has not been replaced by an application-specific function, check with the equipment supplier and / or check the option parameter.

No.	Name	Description
EK101	PID1 Active	If the value is 1, then Set point / PID set 1 is active.
EK102	PID2 Active	If the value is 1, then Set point / PID set 2 is active.
EK103	Control Limits Active	If the value is 1, the control limits are active and will turn the burner ON and OFF as the load dictates. The low and high limits are shown on EK153 and 154. If the control limits are holding the burner OFF, then EK18 will be zero.
EK104	User Modulation mode	This will normally be zero. A custom modulation program may change this value if it is modifying the modulation rate.
EK105	PID not required	If this value is 1, the internal modulation PID is not running. This may be because the burner is OFF, or in Commission / Manual mode, or for another reason.
EK106	Burner Firing	If this value is 1, either the burner is firing (fuel valves open), or it is in post-purge.
EK107	Warming Limit Active	If this value is 1, then the warming limit function (see option parameter 23.0) is holding the burner at Low Fire (status 15).
EK108	Remote Tracking Active	If this value is 1, then the remote tracking function is active. See option parameter 20.7. The AUTO modulation rate will come from analog input 5.
EK109	Remote Set point 1 Active	If this value is 1, then the remote set point 1 function is active. See option parameter 20.7. Set point 1 will come from analog input 5.
EK110	Control Limit Exceeded	1 = Limit exceeded.

No.	Name	Description
EK111 to EK119	Not used by the standard manufacturers program. They may be used by a custom program.	N/A
EK120	Lead selected	The controller has a command to be the lead boiler. (In a multi-boiler sequenced system, this is the master boiler that controls the sequence in which the boilers are started and shut down).
EK121	Running as lead	The controller has control of the (multi-boiler) sequence system.
EK122	1st Slave ON	1st Slave is required ON
EK123	2nd Slave ON	2nd Slave is required ON
EK124	3rd Slave ON	3rd Slave is required ON
EK125	New Lead asserted	A new lead boiler has been selected
EK126	Lead in Prop band	The lead boiler is modulating to the load in the proportional band
EK127	Burner available	1 = The Burner is available for sequencing
EK128	2 Slaves	1 = 2 slaves are available
EK129	3 Slaves	1 = 3 slaves are available
EK130	Don’t control SL1	1 = Slave 1 will not be used
EK131	Don’t control SL2	1 = Slave 2 will not be used
EK132	Don’t control SL3	1 = Slave 3 will not be used
EK133	Set point 2 selected remotely	1 = SP2 is selected remotely via serial communications, which could be as a Banking (standby) Lag in Boiler Sequencing or selected via Modbus.
EK134	Boiler Sequencing communications OK	1 = the controller is receiving set point selection requests via serial communications (including via Modbus and boiler sequencing). It usually indicates that the boiler sequencing is working.
EK135	Aux modulation i/p available	1 = option parameter 20.7 is non-zero
EK136		
EK137	Remote Lead selected	1 = A different boiler has been selected to be the lead boiler instead of this one
EK138	Set point 1 selected remotely	1 = SP1 is selected remotely via serial communications, which could be as a Lag in Boiler Sequencing, or via Modbus.
EK139 to EK150	Not used by the standard manufacturer's program. They may be used by a custom program.	N/A

No.	Name	Description
EK151	Set point 1 control value	The actual value of set point 1 now being applied.
EK152	Set point 2 control value	The actual value of set point 2 now being applied.
EK153	Low control limit	The actual value of the process low control limit (e.g., low steam pressure cut-in point) being applied.
EK154	High control limit	The actual value of the process high control limit (e.g., high steam pressure cut-out point) being applied.
EK155	Spare	N/A
EK156	Measured Value	The current boiler measured value (actual value) shown with increased precision.
EK157	AUTO modulation rate	The modulation rate that the boiler will fire to if in AUTO mode (provided option parameter 15.0 is not zero or 1).
EK158	Sequence status	0= Not available for sequence +1= Available for sequencing +2= New Lead selected +4= Running as Lead +8= Firing from set point 1 +16= Burner status < 8.
EK159		
EK160 to EK199	Not used by the standard manufacturers program. They may be used by a custom program.	N/A
EK200	Prog:	Currently running manufacturers / custom (user) modulation program name and revision number (if applicable).

1.7 Troubleshooting

1.7.1 Display / General Problems

Problem	Possible cause	Suggested action
Display shows its serial number but not data from controller	Display CANbus wired incorrectly. Main controller not running.	Check the wiring of CANbus (PT3 and PT4). Check main controller low voltage electronics fuse FS2. If blown, investigate all low voltage external wiring and replace fuse, if necessary, with a new one of the correct type and rating.
Display updates slowly or seems to freeze when scrolling a parameter number.	One of the CAN devices has the two CAN wires crossed over.	Check the wiring of the CANbus cable.
Display will not light at all.	24 VAC supply to display missing. Controller not running.	Check for 24 VAC on PT1 and PT2. Check the fuse FS1. If blown, investigate all high and low voltage external wiring and replace fuse, if necessary, with a new one of the correct type and rating.
Measured value incorrect.	Wrong sensor voltage. Wrong sensor input type. Incorrect sensor wiring. Wrong zero or span.	Check SENS SUPP link (see section 2, “How to Install and Wire the System”). Check SENS IN link (see section 2, “How to Install and Wire the System”). Check wiring to terminals PA18 to PA20. Check option parameters 15.0, 15.1, 15.2.
Hours run shows '---'.	No profile selected.	Select oil or gas profile.
Modulation rate is 0.	Burner not modulating.	Wait for burner to finish start-up sequence.
Burner status is flashing.	Controller in non-volatile lockout mode.	Burner status before shutdown displayed.
Gas pressure not shown.	Gas sensor not selected.	Select sensor using option parameter 10.0
Gas pressure incorrect.	Incorrect span value.	Check option parameter 10.1

1.7.2 Startup Problems

Problem	Possible cause	Suggested action
Burner will not start.	Controller in non-volatile lockout. High control limit exceeded. Control in Commission Ratio mode. Burner OFF via serial comms. Air pressure switch still made. No fuel selected. Burner not selected.	Hold FAULT MUTE key when faults clear. Check EK18 and wait for the press/temp to drop. Press NEXT to advance to the next set point. Turn the burner ON using the ComFire2 software (if fitted), or Profibus / Modbus interface. Use section 1 “Description of Operation” and burner status (EK30) to define why the controller is waiting. Also check EK31≠0, EK10=1, EK15=0.
Drive positioning fault occurs before drives move to purge.	Stored close positions do not match actual close positions.	Check feedback potentiometers and motor micro-switches. Reset close positions using Commission Ratio mode.
Drive positioning fault occurs when drives reach purge.	Stored purge positions cannot be reached.	Check feedback potentiometers and motor micro-switches. Reset purge positions using Commission Ratio mode.
Drives stuck at ignition and burner has not fired.	Drives cannot reach ignition position. ‘Ignition Wait’ input is holding controller at status 9.	Check motor micro-switches and linkages. Check digital input settings and connections
Pilot, main 1 and main 2 valves will not open.	No feed on BURNER SEL.	Check terminal PE9.
Drives stuck at ignition and burner has fired.	Ignition time has not elapsed.	Wait for ignition time to elapse. Reduce ignition time(s) (option parameters 7.6 and 7.7).

1.7.3 Commissioning Problems

Problem	Possible cause	Suggested action
Cannot get past P0.	See ‘burner will not start’ above.	See ‘burner will not start’ above.
'Px' or 'Ax' display flashes constantly and motor positions cannot be altered.	Drives are moving to position. Burner OFF in Adjust Ratio mode. Valve leak test in progress.	Wait for drives to position. Turn burner ON if you need to adjust points A3 onwards. Wait for the valve leak test to finish.
Option parameter not available.	Another option parameter must be set first.	Set option parameter (usually XX.0) to a non-zero value to enable other parameters. in group.

Problem	Possible cause	Suggested action
Option parameter not adjustable.	Wrong passcode entered or burner firing.	Enter the supplier passcode and/or turn the burner OFF before changing the value.
Not possible to enter Commission Ratio mode.	Supplier passcode incorrect. Burner firing (goes into Adjust Ratio mode).	Enter correct passcode. Turn burner OFF and try again.
Not possible to enter Adjust Ratio mode.	Supplier passcode incorrect.	Enter supplier passcode with the burner ON.

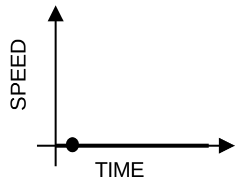
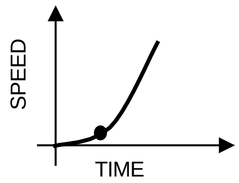
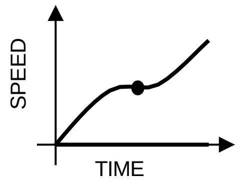
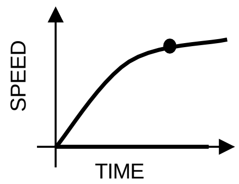
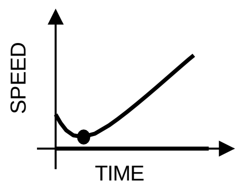
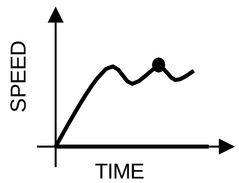
1.7.4 Gas Valve Leak Test Problems

Problem	Possible cause	Suggested action
Leak test sequence takes a long time.	Nominal gas pressure, test volume or leakage rate wrong.	Check option parameters 10.1 to 10.7. Expected time shown on EK52.
Main valve 2 does not open.	Vent valve option has been selected.	Check option parameter 10.7.
Vent valve does not open.	Vent valve not selected or wrong sense.	Check option parameter 10.7.
Main valve 1 and/or main valve 2 do not open.	Valve leak test not selected. No feed on BURNER SEL.	Check option parameter 10.0. Check for feed on terminal PE9.
Leak test fails at status4	Option 10.1 not set correctly when CAN Bus sensor is configured.	Set Opt 43.4 to zero/none, then set Opt 10.0=1 Check the value of Opt 10.1is correct.

1.7.5 Modulation Problems

Problem	Possible cause	Suggested action
Sensor or modulation rate inaccurate.	V/I input setting incorrect. 5/30 V supply setting incorrect.	Check option parameter. Check SENSOR IN and SUPPLY links.
Intermittent positioning faults.	Profile set point is too close to the P0 micro-switch position. Poor Earth or screening. Feedback potentiometer faulty. Poor communication to servomotor(s).	Move the increase the set point away from the P0 position. Check wiring. Move motor across range and check the feedback in Commission Ratio mode with the burner OFF. Check wiring.
Controller stuck at Low Fire.	Meas. value exceeds set point. Warming limit active Controller in MANUAL mode. External Low Fire hold, or missing AUTO input from burner controller. In Manual mode.	No fault. Wait for boiler to warm up. Check EK16. Press the AUTO key to change to auto mode. Remove feed from Aux inputs (if selected). Check EK 6. Increase the mod. rate using ‘UP’ key.
Controller stuck at a modulation rate.	Serial communications. Controller in Commission mode.	Disable or change modulation slider in Computer software. To enter Run mode, press RUN then ENTER.

1.7.6 Inverter (Variable Frequency Drive) Problems

Problem	Possible Cause	Solution
	• Inverter does not start because it does not receive a RUN signal.	• Make sure that the inverter receives a RUN signal from the daughter board fitted to the NX6100.
	• Inverter has a slow start. • Non-linear output from inverter or inverter's PID is enabled	• Make sure that the inverter's slow start feature is disabled. • Check that the inverter's output is selected to be linear, and that the inverter's own PID loop is **disabled**.
	• Current limit reached • Noise	• Slow down the inverter by increasing its acceleration / deceleration time settings. • Check cable screens.
	• Current limit reached. • Non-linear output from inverter or inverter's PID is enabled.	• Slow down the inverter by increasing its acceleration / deceleration time settings. • Check that the inverter's output is selected to be linear, and that the inverters own PID loop is **disabled**.
	• Fan failed to stop before restart.	• Increase the inverter stop time by increasing option parameter 09.3.
	• Control is unstable. •	• Adjust option parameters 9.0 and 9.2 to reduce accuracy & slow down control response. • Check Option parameter 9.4 matches the acceleration / deceleration time programmed into the VSD. • VSD is current limiting. Increase acceleration / deceleration time in VSD and option parameter 9.4.

In extreme cases, you may need to increase the inverter error tolerance to prevent non-volatile lockouts caused by positioning faults (set option 9.1 = 1). **This must only be changed if an inverter error of ±55 will not cause unsafe combustion.**

1.7.7 Oxygen Measurement and Trim Problems

Problem	Possible cause	Suggested action
Oxygen display not available.	The serial number of the oxygen probe interface unit has not been entered.	Enter the serial number into option parameter 30.0
No inlet temperature display	The serial number of the inlet temperature unit has not been entered.	Enter serial number into option parameter 35.0
Inlet or flue temperature display flashes 'Hi'	Inlet air temperature sensor / O_2 probe is not installed and wired correctly.	Check the wiring.
No efficiency display or efficiency incorrect.	No oxygen display. No inlet temperature display. No calorific value for the current fuel been entered into 35.X?	See 'No oxygen display' See 'No inlet temperature display' Enter the value for the fuel in use.
Oxygen display shows '--- '	Probe not to operating temperature - Off in sleep mode or other probe fault.	Check EK45 and EK72.
Oxygen trim will not work.	Trim is not operative. Boiler just fired up. Probe calibration values not entered correctly. Probe not heated up yet. Probe installed incorrectly. Set to monitor only. Probe in calibration. Trim being reset. Trim limits set to 0.0% of flow. Trim integral gain set to zero. Commissioning data missing.	Use EK45 and 46 to decide if trim is operative. Check that option 30.5 =1. Check option parameter 31.1 to 31.4. Wait for the boiler transport time (after ignition). Wait for modulation. Re-enter values (options 30.1,30.2) Check EK75 – must be above 810ºC to work. Check wiring. Check option parameter 30.5 set to 1. Check option parameter 30.6 set to 0. Check option parameter 30.8 set to 0. Check option parameters 32.X. Check option parameters 33.X are non-zero. Check oxygen and flow values been entered for all profile points in the firing range.

2. Section 5 Update History

New version	Date		Changes in brief
1pt4D	April 2022	GFS	Updates to F33 and F66 descriptions and EK45 description. Description for L89 added. Update to Oxygen system fault finding chart
1pt4D	June 2024	RAL	Update Fireye Version

——— End of Section 5 ———

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1. Technical Specifications

1.1 6000 Series Controller

1.1.1 General

Supply voltage	120/230 Vac +10%. -15%
Power consumption	Approx. 60 VA
Supply frequency	50/60 Hz ±5%
Ambient temperature range	0 to 60 °C (32 to 140 °F)
Controller protection category	IP20. The controller must be situated in a PD1 or PD2 environment according to EN6730-1. Indoor: Controller must be mounted in an IP40 enclosure Outdoor: Controller must be mounted in an IP54 enclosure
Mounting Attitude	Any
Cable Lengths	CANbus cable 100m,(330 ft) all others 10m (33ft) maximum
Unit dimensions	Controller 210 x 125 x 80 mm deep (8.3 x 4.9 x 3.1 in.)
Weight	Controller 2.13 kg (4 pd.11 oz.)
Display options	Either the Touch screen graphical display. or OLED display with 12 key membrane keypad.

1.2.1 Servo Motor control

Interface Type	CANbus
Maximum (total) number of servomotors	10 – limited to max 40 VA without additional power.
Maximum number of fuel profiles	4
Max. number of set points per profile	24 including close, purge and ignition
Positioning accuracy	+/-0.1°
Response time to positioning error	15s for ±1.0°, 1s for ±5.0°
Number of fuel motors	Not Limited within the total.
Number of air (non-fuel) motors	Not Limited within the total.

1.2.2 Digital (Relay) Outputs

Function:	
Ignition, Vent, Oil pump and Fan outputs *****	115/ 230 V ON-OFF relay. Feed from PE1.
Main Gas valves, pilot valve and Main Oil valve outputs *****	115/ 230 V ON-OFF relay. Feed from PE9.
Alarm and Relay outputs	Volt-free SPCO contacts, OFF in Alarm state.
Minimum current	200 mA rms
Maximum current (per output)	4 A rms (fused at 4 A maximum)
Maximum voltage	250 Vac rms

**** Maximum** total simultaneous current for these groups of outputs is **8 A rms** for each group.*

1.2.3 Digital Inputs

Low Voltage digital inputs 1 to 7.	Low voltage dynamic digital inputs. Common must be taken from the correct terminal as indicted in this manual.
Low Voltage Fuel / profile select inputs (8 & 9).	2.5 v OFF. Switching to 5 V or 0 v depending on switch direction. Four combinations in total.
Maximum current Maximum voltage	Less than 25 mA ±10 V absolute maximum
Burner select, High voltage inputs 12 & 13.	
Type	Digital, 0 V for OFF, 90-264 Vac for ON. Burner select also provides feed for pilot valve, Main Gas valves and Main Oil valves.
Burner Select input Maximum current	Supplying circuit must be able to carry sufficient current for all valves connected to the relay outputs and be fused at a maximum of 4 A, unless each output is fused at 4 A in which case the input fuse may be **8 A MAX**.

1.2.4 Pressure/Temperature Input

0-5 V	
Maximum current Maximum voltage Input accuracy (typical) Input accuracy (as specified by EN12067)	Less than 2 mA 0 to 5.0 volts maximum. ± 0.3% ± 0.4%
4-20 mA	
Maximum current Burden resistor Input accuracy (typical) Input accuracy (as specified by EN12067)	25 mA maximum 220 Ω nominal ± 1.1% ± 1.1%

103x boiler pressure sensor 104x boiler temperature sensor	See sensor specifications

1.2.5 Gas Pressure Analog Input

0-5 V Maximum current Maximum voltage Input accuracy (typical) Input accuracy (as specified by EN12067)	 Less than 2 mA ± 50 V absolute maximum ± 0.3% ± 0.4%
102x gas pressure sensor	See sensor specifications

1.2.6 Auxiliary Analog Inputs

0-5V Maximum current Input impedance Input accuracy (typical) Input accuracy (as specified by EN12067)	 25 mA maximum 220 Ω nominal ± 1.1% ± 1.1%

1.2.7 Flame-Sensing Inputs

Ionization Probe or Rectifying UV cell Minimum ionization current Maximum ionization current First safety time Response time to flame failure Continuous operation	The sensor and its installation must meet the requirements of EN298:2012. 6µA (display value 1%) 80 µA (display value 77%) Selectable 1 - 3 seconds, selectable Ionization or UV when used with a shutter device.

Photocell or I.R.	The sensor and its installation must meet the requirements of EN298:2012.
Minimum light resistance	11 kΩ
First safety time	Selectable
Response time to flame failure	1 - 3 seconds selectable
Continuous operation	Only if set for a.c. response.

1.2.8 Communications Interface

The communications interface cable is 2-wire RS485 plus ground, with a termination resistor selected using a link.

An isolated 3-wire RS485 interface with Modbus RTU protocol is available on optional Daughter boards. The NX6330 and NXTSD's support Modbus TCP and BACnet.

1.3 NXTSD104/NXTSD007 Touch screens

Electrical, environmental and mechanical details of the Touch-screen HMI units.

Interface Type	CANbus
Supply current	450 mA
Ambient temperature range	0 - 60 °C (32 to 140 °F)
Touch screen protection category	IP65 screen/bezel to panel IP20 electronics behind panel
Mounting attitude	Any
Number of relays	TSD104 – 4, TSD007 - 3
Relay Type	Volt-free single pole change-over.
Maximum relay current	6 A 250 V rms
Minimum relay current	100 mA
Unit dimensions: TSD104 TSD007	 250h x 314w x 66d (mm) (9.8 x 12.4 x 2.6 in.) 148h x 218w x 56d (mm) (5.83 x 8.58 x 2.2 in.)
Weight: TSD104 TSD007	 2.65kg (5 pd.13 oz) 1.3kg (2 pd 14 oz.)

1.4 NX6xx0 12 key display

Here are the electrical, environmental and mechanical details of the 12 key display unit.

Interface Type	CANbus
Supply current	100 mA
Ambient temperature range	0 - 60 °C (32 to 140 °F)
Touch screen protection category	IP65 screen/bezel to panel IP20 electronics behind panel
Mounting attitude	Any
Number of relays	3
Relay Type	Volt-free single pole change-over. 2 relays share a Common terminal.
Maximum relay current	6 A 250 V rms
Minimum relay current	100 mA
Unit dimensions	158h x 144w x 56d (mm) (6.22 x 5.67 x 2.2 in)
Weight	0.55 kg (1 pd. 3 oz.)

1.5 NX6087 Combustion Air Pressure sensor

Supply voltage	CANbus (24 Vac)
Electrical connection	M12 5-pin connector.
Pipe thread mounting dimensions	G 1/4" P (1/2NPT)
Working range (zero – span)	0 – 90 mbar (0 – 1.3 PSI)
Measurement type.	Guage or differential
Accuracy (as specified by EN1854:2010)	± 1.4% of value
Ambient temperature range	0 to 70 °C (32 to 158 °F)
Protection category	IP54
Dimensions	44 mm dia. x 85 mm long (1.73 x 3.25 in.) (excluding 12mm (0.472 in.) CANbus connector)
Weight	600 g (1 pd 5 oz.)

1.6 45UV5 Shuttered UVSC Flame-Detector

See bulletin SC-101	Do not use shielded wire with this scanner see bulletin for recommended wire.

1.7 NX6094 and 6095 self-checking flame detectors

Supply voltage:	CANbus - 24V AC
Electrical Connection:	M12 5-pin connector.
Ambient temperature range:	-20 to +60°C (-4 to 140 °F)
Protection category:	IP65 NEMA4.
Mounting system:	
NX6094	Clamp ring (provided) attached to the burner. Maximum insertion depth - 155mm. (6.1 in.) Maximum clamp screw torque – 0.3Nm
6095	1” BSPP threaded connection with integral air purge connection – $^{3}/_{8}$” BSPP.
Dimensions:	
NX6094	Overall length 249mm (9.8 in.) Sight tube 32 mm (1.26 in.) diameter x 197 mm (7.76 in.) Terminal and control box 79 x 74 x 52 mm (3.11 x 2.91 x 2.05 in.)
6095	Overall length 115mm Sight tube –Hex section 38 mm (1.5 in.) A/F x length 50 mm (2 in.) Terminal and control box 79 x 74 x 52 mm (3.11 x 2.91 x 2.05 in.)
Weight:	0.65 kg (1 pd 7 oz.)

1.8 NX6043 Gas Pressure Sensor

Supply voltage Electrical connection	CANbus (24 Vac) M12 5-pin connector.
Pipe thread mounting dimensions	G 1/4" (1/2 NPT process connection)
Working range (zero – span) Maximum working pressure Burst pressure Accuracy (as specified by EN1854:2010)	0 – 600 mbar (0 – 8.7 psi) 600 mbar for all applications (8.7 psi) >3 bar (44 psi) ± 0.6% of value
Ambient temperature range Protection category	-20 to 60 °C (-4 to 140 °F) IP54
Dimensions Weight	44 mm (1.73 in) dia. x 85 mm (3.25 in.) long (excluding 12mm (0.472 in.) CANbus connector) 600 g (1 pd 5 oz.)

1.9 NX6044 Pressure Sensor

Supply voltage Electrical connection	CANbus (24 Vac) M12 5-pin connector
Pipe thread mounting dimensions	G ¼" (1/2 NPT process connection)
Working range (zero – span) Maximum working pressure Burst pressure Accuracy (as specified by EN1854:2010)	0 – 4 bar (0 – 58 pd) 4 bar (58 pd) (3 bar for S class applications) >12 bar (174 pd) ± 0.6% of value
Ambient temperature range Protection category	-20 to 70 °C (-4 to 158 °F) IP54
Dimensions Weight	44 mm (1.73 in) dia. x 85 mm (3.25 in.) long (excluding 12mm (0.472 in.) CANbus connector) 600 g (1 pd 5 oz.)

1.10 NX6045 Boiler Steam Pressure Sensor

Supply voltage	CANbus (24 Vac)
Electrical connection	M12 5-pin connector
Pipe thread mounting dimensions	G ¼" (½ NPT process connection)
Working range (zero – span)	
Maximum working pressure	0 – 25 bar (0 – 363 psi)
Burst pressure	25 bar (20 bar S class)
Accuracy (as specified by EN1854:2010)	80 bar (1,160 psi)
	± 0.6% of value
Ambient temperature range	
Protection category	-20 to 70 °C (-4 to 158 °F)
	IP54
Dimensions	44 mm (1.73 in) dia. x 85 mm (3.25 in.) long (excluding 12mm (0.472 in.) CANbus connector)
Weight	
	600 g (1 pd 5 oz.)

1.11 NX1021 Gas Pressure Sensor

Supply voltage	24 - 30 Vdc ± 10%
Supply current	Approximately 10 mA
Working range (zero – span)	0 – 600 mbar (0 – 8.7 psi)
Ambient temperature range	0 to 70 °C (32 to 158 °F)
Protection category	IP54
Dimensions	44 mm (1.73 in) dia. x 85 mm (3.25 in.) long (excluding 12mm (0.472 in.) CANbus connector)
Pipe thread mounting dimensions	G 1/4" (1/2 NPT process connection)
Weight	600 g (1 pd 5 oz.)
Maximum working pressure	600 mbar for all applications (8.7 psi)
Burst pressure	1 bar (15 PSI)
Accuracy (typical)	± 0.1% of span
Accuracy (as specified by EN12067)	± 0.3% of span
	± 0.9% of value

1.12 NX1030 Steam Pressure Sensors

Supply voltage	24 - 30 Vdc ±10%
Supply current	Approximately 10 mA
Working range NX1030(zero – span)	0 – 25 bar (0 – 363 psi)
Ambient temperature range	0 to 70 °C (32 to 158 °F)
Protection category	IP54
Dimensions	44 mm (1.73 in) dia. x 85 mm (3.25 in.) long (excluding 12mm (0.472 in.) CANbus connector)
Pipe thread mounting dimensions	G ¼" (1/2 NPT)
Weight	600 g (1 pd 5 oz.)
Maximum working pressure	25 bar (363 psi) (20 bar S class)
Burst pressure	80 bar (1,160 psi)
Accuracy (typical)	± 0.1% of span
Accuracy (as specified by EN12067)	± 0.3% of span ± 0.9% of value

1.13 NX1034 Pressure Sensors

Supply voltage	24 - 30 Vdc ±10%
Supply current	Approximately 10 mA
Working range NX1034(zero – span)	0 – 4 bar (0 – 58 pd)
Ambient temperature range	0 to 70 °C (32 to 158 °F)
Protection category	IP54
Dimensions	44 mm dia. x 85 mm long (excluding connector)
Pipe thread mounting dimensions	G ¼" (1/2 NPT)
Weight	600 g (1 pd 5 oz.)
Maximum working pressure	4 bar (58 pd) (3 bar S class)
Burst pressure	12 bar (174 pd)
Accuracy (typical)	± 0.1% of span
Accuracy (as specified by EN12067)	± 0.3% of span ± 0.9% of value

1.14 NX1040 and NX1044 Boiler Temperature sensors

Supply voltage	24 - 30 Vdc ±10%
Supply current	Approximately 10 mA
Working range (zero – span):	
NX1040	0 to 150 °C (32 to 302 °F)
	0 to 400 °C (best accuracy 180 - 400 °C)
NX1044	32 to 752 °F (best accuracy 356 - 752 °F)
Ambient temperature range	0 to 60 °C (32 to 140 °F)
Protection category	IP65
Probe dimensions	6 mm (0.24 in) dia. x 200 mm (8 in) long (excl. body)
Body dimensions	65 mm (2.56 in) dia. x 75 mm (2.95 in) long)
Weight	200 g (7 oz)
Maximum temperature	450 °C (842 °F)
Accuracy (sensor element)	± 0.5% of span
Accuracy (typical)	± 0.1% of span
Accuracy (as specified by EN12067)	± 0.1% of span
	± 0.6% of value
	± 0.5% of span for the element (0.75 °C in 150 °C) (33.35 °F in 302 °F)

IMPORTANT: The Temperature sensor must be mounted in a 'pocket' to enable replacement without draining the boiler.

1.15 NXC40 Actuators

Type Interface to 6000 series.	AGROMATIC 24V asynchronous servo chassis: specific CANbus.
Speed Microswitches	30 seconds for 90 degrees. Open & close positions
Torque	NXC40 = 31 Nm (23 Ft/Lb) (driving), 41 Nm 29.0 FT/LB) (holding)
	NXC40 = 18 VA
VA rating	
	NXC40 = IP65
Protection Category	± 0.6°
Typical accuracy (as specified by EN12067)	

1.16 NXC04, NXC12 & NXC20 Actuators

Type Interface to 6000 series.	24V asynchronous servo chassis. specific CANbus.
Speed Microswitches Torque	30 seconds for 90 degrees. Open & close positions NXC04 = 4 Nm NXC12 = 10 Nm NXC20 = 20 Nm
VA Rating	NXC04 = 3 VA NXC12 = 5 VA NXC20 = 10 VA
Protection Category	NXC04 = IP40 NXC12 & NXC20 = IP54
Typical accuracy (as specified by EN12067)	± 0.5°

1.17 NXCBH CANbus PSU and Hub

Supply voltage Max Power consumption Supply frequency Ambient temperature range	120/230 Vac +10%. -15% 60 VA 50/60 Hz ±5% 0 to 60 °C (32 to 140 °F)
Controller protection category	IP20. The controller must be situated in a PD1 or PD2 environment according to EN6730-1. Indoor: Controller must be mounted in an IP40 enclosure Outdoor: Controller must be mounted in an IP54 enclosure
Mounting Attitude	Any.
Cable Lengths	Maximum CANbus cable 100m (Sum of all cable lengths).
Unit dimensions	Controller 176 x 114 x 95 mm deep. (6.93 x 4.49 x 3.74 in deep)
Weight	1.3 kg (2 pd 14 oz)

1.18 NXO2TRIM Oxygen Probe Interface

Supply voltage (CANbus)	26 Vac ± 15%
Power consumption	Approximately 8 VA
Supply frequency	50/60 Hz ± 5%
Ambient temperature range	0 to 60 °C (32 to 140 °F)
Protection category	IP65 / NEMA4.
Unit dimensions	160 x 110 x 75 mm deep (6.3 x 4.3 x 3 in deep)
Weight	0.6 kg (1.4 pd)
Interface to oxygen probe.	Proprietary
Oxygen sensor heater supply.	14 Vac nominal
Oxygen sensor temperature set point.	820 °C ±3 °C (1,508 °F ±3 °F)
Oxygen measurement accuracy	±1% of value.
Auxiliary Inputs:	
Type	4– 20mA.
Input impedance	220Ω
Pre-assignment	O2, CO
Flue gas temperature input:	
Type	Type-K thermocouple.
Measurement range	0-540 °C (1000 °F).
Flue temperature accuracy	± 2 °C (± 2 °F)

1.19 NX6083-x Flue Gas Oxygen probe

Type Ambient temperature range Protection category Maximum flue temperature	proprietary 0 to 70 °C (32 to 158 °F) IP20. 600 °C (1,112 °F)
Unit Weight	2.5 – 4.5 kg (model dependent) (5 pd 8 oz – 9 pd 15 oz)
Oxygen Measurement	Zirconia oxide cell, Range 1 – 21% Oxygen. Response 5s Time constant 15s for 63% change.
Flue Gas Temperature Measurement	Type K thermocouple, 0-540 °C. (32 – 1,004 °F)
Calibration: Reference gas concentration Reference and Calibration gas flow rate	 Ambient air at 20.9% O_2 300 cc/min
Filter and flame arrestor Filter pressure drop Filter replacement pressure	4 – 7 micron sintered stainless steel. 50 – 100 mm water gauge. 150 mm water gauge.

1.20 NXIATS Ambient Air Temperature Sensor

Type Ambient temperature range Protection category	CAN Bus 0 to 60 °C (32 to 140 °F) IP65.
Unit dimensions	63 x 58 x 36 mm deep (2.48 x 2.28 x 1.42 in deep)
Weight	0.2 kg
Temperature measurement accuracy	E± 2 °C (2 °F)

1.21 NXDBVSD and NXDBMB Daughter Boards

Ambient temperature range Protection category	0 to 60 °C (32 to 140 °F) Not applicable (fits inside main controller).
Encoder Inputs (NXDBMB) Accuracy Accuracy (as specified by EN12067)	 ±0.1% ±0.2%
Analog inputs (4 – 20 mA) (if fitted) Input impedance Accuracy Accuracy (as specified by EN12067)	2 max (non-isolated) (if fitted) 120 ohms ±0.4% ±0.5%
Analog outputs (4 – 20 mA) (if fitted) Maximum loop resistance Isolation voltage	3 max (isolated) (if fitted) 400 ohms 50 Vdc
Isolated RS485 communications. Protocol Communications speed Isolation Voltage	Terminals PC1,2,3. Modbus RTU. 8-bit, no parity, 1 stop bit Selectable - 4800, 9600, 19200 baud 50 Vdc
Auxiliary relays Type Maximum current Maximum voltage	2 ON-OFF relay, de-energize for OFF. 100 mA 50 Vdc

1.22 Approvals

Classification in accordance with EN298:

Tested in accordance with the Gas Appliances Regulation (EU) 2016/426 - GAR, encompassing the following standards:

- EN14459:2007, Safety and control equipment for burners and fuel appliances for gaseous or liquid fuels - Control and regulation functions in electronic systems - Methods for classification and evaluation.
- EN298:2012, Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
- EN60730-1, Automatic electrical controls for household and similar use
- EN12067-2, Gas/air ratio controls for gas burners as gas burning appliances
- EN1643:2014, Valve leak test systems
- EN1854 2010, Pressure sensing devices for gas burners and gas burning appliances
- ANSIUL 462, Heat r
- UL 60730-2-5 3rd Ed., Issue Date 2014-01-30, Revision Date: 2019-09-20

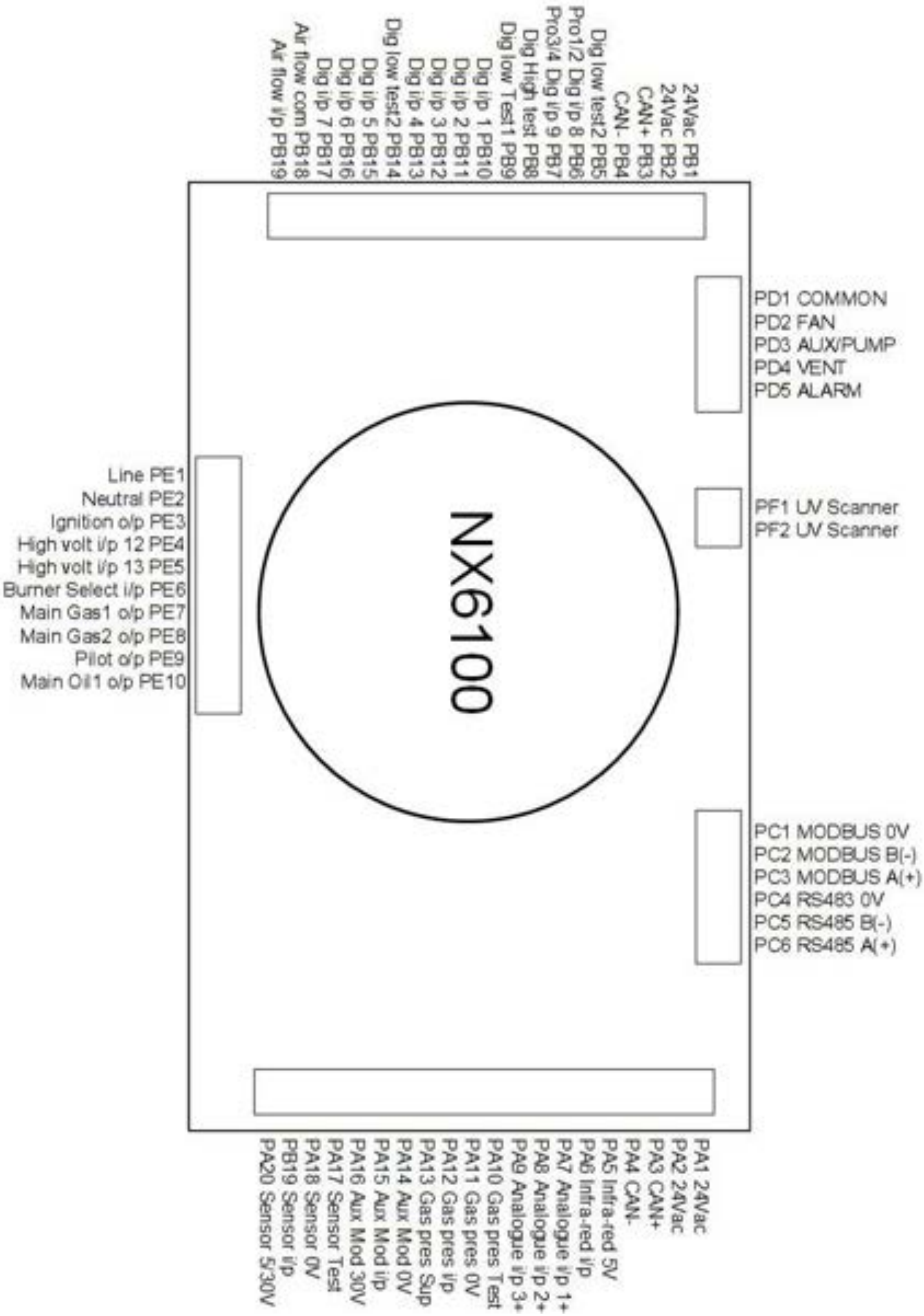
Functional safety certification - EN61508 (2010). Suitable for inclusion in a S.I.L. 3 loop.

TRD 411:02.97 – Compliance (TÜV Rheinland)
TRD 412:06.98 – Compliance (TÜV Rheinland)

Australian Gas Association certified product.
Relevant standards: EN298:2012, AS 4625-2008, AS 4630-2005.

2. 6000 Series Terminal Connections

These are the wiring terminal connections for the 6000 controller, inside the box.



Connections on the NXDBVSD Daughter board (option)

Daughter board connections:

- PZ1 Channel 1 (4-20 mA) –ve
- PZ2 Channel 1 (4-20 mA) +ve
- PZ3 Channel 2 [4-20 mA] –ve
- PZ4 Channel 2 [4-20 mA] +ve
- PZ5 Channel 3 [4-20 mA] –ve
- PZ6 Channel 3 [4-20 mA] +ve
- PZ7 Encoder Feedback 1
- PZ8 Encoder [+12v] Supply
- PZ9 Encoder Feedback 2
- PZ10 Encoder [+12v] Supply
- PZ11 Encoder Feedback 3
- PZ12 [4-20 mA] Feedback –ve
- PZ13 [4-20 mA] Feedback Ch1 +ve
- PZ14 [4-20 mA] Feedback Ch2 +ve
- PZ15 Relay Output 2
- PZ16 Relay Output 2
- PZ17 Relay Output 1
- PZ18 Relay Output 1

3. Section 6 Update History

New version	Date		Changes in brief
PE1	Jan 2019	GFS	General update for V1.4 Firmware.
V1PT4C	July 2024	RAL	North American Version

——— End of Section 6 ———

Section 7: Appendix

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1. Option Parameters in detail

WARNING

- Be **extremely careful** when entering or changing option parameters. Incorrect data entry could cause a hazardous situation to occur.
- **Parameter Adjustment Security:** For reasons related to application safety, option parameters may not be adjustable under some circumstances. The security level for each option parameter is shown in the brackets **[ ]** next to each option title and classified as follows:

  Level 0 – Adjustment can be performed at any time using the site passcode.
  Level 1 – Adjustment can be made at any time but only after access using the Commission passcode.
  Level 2 – Adjustment may only be made when the burner is OFF and after access using the Commission passcode.

ALL PARAMETERS DEFAULT TO ZERO UNLESS OTHERWISE SPECIFIED.

Option 00.1 - Site passcode (0 - 999) [1]

This is a three-digit passcode that will allow the site engineer or end-user to go into the **Option Set mode**, where you can adjust a limited range of option parameters (those not marked with '*' in this section). This passcode can be zero, in which case you only need to press the **COM / ENTER** key twice to enter **Option Set mode** with limited access.

Option 00.2 - Serial communications controller address (0 - 15) [2]

If the controller is to be connected to other equipment via the serial communications interface, it must be given a unique address using this option parameter. Additionally, if more than one controller is connected on the CANbus (for example to share a display), the controllers must all have unique addresses BEFORE THEY ARE CONNECTED TO THE SAME CANBUS.

Option 00.3 - Reset hours run (0 - 1) [1]

This option parameter allows the HOURS RUN display for all fuels to be reset to zero. To perform a reset, set this option parameter to **1** and leave Option Set mode. When the burner begins to modulate, the HOURS RUN display will be reset and the option parameter automatically returns to **0**. Additionally, the counters of burner cycles and burner lockouts will be cleared (see Engineer's Key Data numbers 90 and 91).

Option 00.4 – User program select (0 / 1) [2]

This parameter may not be available. Where it is available, it allows you to de-select the manufacturer's standard modulation program and select a **User program**. The User program can be modified using PC software to change the controller's behavior for non-standard applications.

The programmable system only allows access to non-safety related functions such as modulation, enabling / disabling burner start-up and other similar functions. Only the User program can be modified, and the default manufacturer's program can be re-selected at any time by changing this parameter back to zero.

Option 00.4 value	Meaning
0	Run standard manufacturer modulation program. Controls PID, control limits, and some Input / Output settings (see option parameters 20.0 to 29.9)
1	Run user program, if available.

Option 00.5 – Language select (0 / 1) [2]

This parameter may not be available. Where it is available, it allows you to change the language used for the display. Depending on customer requirements, this option may only change the text displayed to users in RUN mode, and not in COMMISSION mode – or all text can be changed to a second language.

This parameter can optionally be used to switch in different 'manufacturers' modulation programs. This operation is beyond the scope of this document.

Option 00.5 value	Meaning
0	Operate with standard language (usually ENGLISH).
1	Operate with alternate language, in RUN mode – but possibly in other modes depending on specification of the controller.

Option 00.7 – Modbus device address (0 – 99) [2]

DEFAULT: 0
This option sets the Modbus device address for the controller.

Option 00.8 – Modbus communications speed (0 – 3) [2]

DEFAULT: 0
This option sets the Modbus communications speed as follows:

Option 00.8 value	Speed bits/s
0	9600
1	4800
2	9600
3	19200

Option 01.0 – Power Up Option (0 - 30) [2]

This option can be used to modify the behaviour of the controller at power-up.

Option 01.0 value	Meaning
0	Normal power-up. If no faults and fuel / burner selected, the burner will start.
1	Lockout. The burner will always lock out after a power-up. An F75 will be generated which will require manual intervention to clear.
2 – 30	The controller will power-up as normal but wait for 2 to 30 seconds before checking the digital inputs for fault conditions. This may be useful to prevent nuisance lockouts at power-up due to water levels and plant interlocks. The controller will remain in safety shutdown (but not locked out) for this time.

Option 01.1 – Keyboard Auto/Manual enable (0 - 1) [1]

DEFAULT: 1
You can enable/disable the auto/man facility from the keyboard. Selecting a 0 will disable the operation of the ‘auto/man’ function from the keyboard. Selecting a 1 will enable the operation of the ‘auto/man’ function from the keyboard.

Option 01.2 – Fault Mute Input enable (0 - 13) [2]

The Fault Mute function is available via serial communications, and from the keyboard. It can also be selected to be from a digital input. Selecting a non-zero value will enable the operation of the ‘Fault Mute’ function from the corresponding digital input. Make sure that the digital input selected is not used for any other function (option parameters 1.x, 16.x and 18.x, 20.x). Note: Inputs 10 and 11 do not physically exist as separate input pins, so they cannot be used.

Note: any key/button that provides a Fault Mute function must be mounted near the burner.

Number entered in parameter 01.2	Fault mute from:
0	Keyboard / comms only.
1	Input 1, PB9 to PB10 Low Voltage
2	Input 2, PB9 to PB11 Low Voltage
3	Input 3, PB9 to PB12 Low Voltage
4	Input 4, PB9 to PB13 Low Voltage
5	Input 5, PB14 to PB15 Low Voltage
6	Input 6, PB14 to PB16 Low Voltage
7	Input 7, PB14 to PB17 Low Voltage
8	Input 8, PB5 to PB6 Low Voltage
9	Input 9, PB5 to PB7 Low Voltage
10	No physical terminal DO NOT USE

Number entered in parameter 01.2	Fault mute from:
11	No physical terminal DO NOT USE
12	i/p 12, PE7 to live High Voltage
13	i/p 13, PE8 to live High Voltage

Option 01.3 – External profile select enable (0 - 2) [2]

This option parameter specifies whether the fuel profile select inputs (PB6 & PB7) are used for profile selection, or whether they are available as general-purpose inputs.

Number entered in parameter 01.3	PB6 Function	PB7 Function
0	General purpose input 8. Use with PB5.	General purpose input 9. Use with PB5.
1	Connect to PB5 to select profile 1. Connect to PB8 to select profile 2.	General purpose input 9. Use with PB5.
2	Connect to PB5 to select profile 1. Connect to PB8 to select profile 2.	Connect to PB5 to select profile 3. Connect to PB8 to select profile 4.

When a profile is selected externally, this will override any fuel profile selection made from the display keyboard. If no profile is selected externally (i.e., the inputs are open or not selected here), the fuel profile selection can be chosen from the display keyboard. If this option is used, it must be ensured that the digital input is not used for any other function (option parameters 1.x, 16.x and 18.x).

When a fuel profile selection is removed (by opening the input switch), the controller will continue to run on the previously selected fuel profile – THE CONTROLLER WILL NOT TURN THE BURNER OFF.

Option 01.4 – Gas Valve Proof of Closure (POC) select (1 - 13) [2]

This option parameter is used to enable proof of closure switches to be monitored for the gas shut-off valves. When enabled, POC for GAS uses digital input as specified by the number entered (1 – 13), please note digital inputs 1-9 are low voltage and 12 & 13 are high voltage. If any digital input is used for this function, make sure the same input is not selected for any other function (option parameters 1.x, 16.x and 18.x). Note: Inputs 10 and 11 do not have physical input pins, so they cannot be used.

Number entered in parameter 01.4	Gas valve monitored	Digital Input used
0	NONE	NONE.
1	YES	Input 1, PB9 to PB10 Low Voltage
2	YES	Input 2, PB9 to PB11 Low Voltage
3	YES	Input 3, PB9 to PB12 Low Voltage
4	YES	Input 4, PB9 to PB13 Low Voltage

Number entered in parameter 01.4	Gas valve monitored	Digital Input used
5	YES	Input 5, PB14 to PB15 Low Voltage
6	YES	Input 6, PB14 to PB16 Low Voltage
7	YES	Input 7, PB14 to PB17 Low Voltage
8	YES	Input 8, PB5 to PB6 Low Voltage
9	YES	Input 9, PB5 to PB7 Low Voltage
10	N/A	No physical terminal DO NOT USE
11	N/A	No physical terminal DO NOT USE
12	YES	Input 12, PE7 to live. High Voltage
13	YES	Input 13, PE8 to live. High Voltage

Option 01.5 – Oil Valve Proof of Closure (POC) select (0 - 13) [2]

This option parameter is used to enable proof of closure switches to be monitored for the oil shut-off valves. When enabled, POC for OIL uses digital input as specified by the number entered (1 – 13), please note digital inputs 1-9 are low voltage and 12 & 13 are high voltage. If any digital input is used for this function, make sure the same input is not selected for any other function (option parameters 1.x, 16.x and 18.x). Note: Inputs 10 and 11 do not physically exist as separate input pins, so they cannot be used.

Number entered in parameter 01.5	Oil valves monitored	Digital Input used
0	NONE	NONE.
1	YES	Input 1, PB9 to PB10 Low Voltage
2	YES	Input 2, PB9 to PB11 Low Voltage
3	YES	Input 3, PB9 to PB12 Low Voltage
4	YES	Input 4, PB9 to PB13 Low Voltage
5	YES	Input 5, PB14 to PB15 Low Voltage
6	YES	Input 6, PB14 to PB16 Low Voltage
7	YES	Input 7, PB14 to PB17 Low Voltage
8	YES	Input 8, PB5 to PB6 Low Voltage
9	YES	Input 9, PB5 to PB7 Low Voltage
10	N/A	No physical terminal. DO NOT USE
11	N/A	No physical terminal. DO NOT USE
12	YES	Input 12, PE7 to live. High Voltage
13	YES	Input 13, PE8 to live. High Voltage

Option 01.6 – Second Airflow switch (Primary Air) enable (0 - 3) [2]

THIS PARAMETER ALLOWS THE SELECTION OF A SECOND AIRFLOW-MONITORING SWITCH. THIS MIGHT BE USED FOR A FLAME-SHAPING (SOMETIMES CALLED PRIMARY AIR) FUNCTION. SELECTING A NON-ZERO VALUE WILL ENABLE THE OPERATION OF THE 'PRIMARY AIRFLOW' FUNCTION FROM DIGITAL INPUT 6 (LOW VOLTAGE). IF DIGITAL INPUT 6 IS USED FOR THIS FUNCTION, MAKE SURE IT IS NOT SELECTED FOR ANY OTHER FUNCTION (OPTION PARAMETERS 1.X, AND 18.6).

Number entered in parameter 01.6	Primary Airflow Function	Digital inputs used
0	No primary airflow monitoring	NONE
1	Gas profiles only	i/p 6, PB14 to PB16 LV
2	Oil profiles only	i/p 6, PB14 to PB16 LV
3	All profiles	i/p 6, PB14 to PB16 LV

Option 01.7 – Safety time configuration set (0 - 5) [2]

DEFAULT: 1

This parameter allows the selection of a set of values to be forced for the burner start-up safety times. Specifically, option parameters 7.4, 7.5, 7.6 and 14.6 will be forced.

If this option parameter is set to zero, the above option parameters become independently adjustable. The controller is shipped with set 1 selected.

Number entered in parameter 01.7	Option 7.4 (T4 Pilot ignition) forced to:	Option 7.5 (T5 Pilot hold) forced to:	Option 7.6 (T6 Main ignition) forced to:	Option 14.6 (spark termination) forced to:
0	Adjustable	Adjustable	Adjustable	Adjustable
1	10	5	10	1
2	10	5	10	2
3	5	5	10	0
4	2	8	2	1
5	5	8	5	1

Safety Time Configuration Table

Fireye EP and YP Series Programmer Equivalents	Air Proving Time (t1)	Pre-Purge Time (t2)	Pre-Ignition Time (t3)	Pilot Ignition Time (t4)	Pilot Hold Time (t5)	Main Ignition Time (t6)	Ignition Spark Output Check	Flame Failure Response Time (t9)
Option Parameter	Opt. 07.1	Opt. 07.2	Opt. 07.3	Opt. 07.4	Opt. 07.5	Opt. 07.6	Opt. 08.0	Opt. . 08.1
NX6300 Default	**30**	**30**	**0**	**10**	**5**	**10**	NA	**1**
EP113 Cfg1	8	36	4	2	8	2	NA	**1**
EP113 Cfg3	8	66	4	2	8	2	NA	**1**
EP160	**30**	**30**	**0**	**10**	**10**	**10/15**	NA	3
EP161	**30**	**30**	**0**	**10**	**5**	10/301	NA	3
EP163	NA	40	**0**	5	5	5	NA	3
EP165	NA	**30**	**0**	**10**	**10**	10	NA	2
EP166	NA	**30**	**0**	**10**	**5**	15	NA	2
EP170	NA	**30**		5	10	10	Required	3
YP100	NA	**30**	**0**	**10**	**5**	15	NA	4
YP102	NA	**30**	**0**	**10**	**5**	15	NA	2
YP138	NA	**30**	**0**	**10**	**5**	15	NA	4
YP113	NA	**30**	**0**	5	**5**	5	NA	1

Option 01.8 – Force mode i/p (0-13) [2]

This option parameter is used to assign a digital input to force the operating mode of the controller to LOC1. When enabled, a digital input as specified by the number entered (1 – 13), will set the burner 'ON' in LOC1 mode. When the input is disabled, the controller will stay 'ON' and change to Normal mode.
Note. When a digital input is used for this function, make sure the same input is not selected for any other function (option parameters 1.x, 16.x and 18.x). Digital inputs 1-9 are low voltage, 12 & 13 are high voltage and inputs 10 and 11 do not have input pins, so they cannot be used.

Number entered in parameter 01.8	Digital Input used for mode change.
0	NONE.
1	Input 1, PB9 to PB10 Low Voltage
2	Input 2, PB9 to PB11 Low Voltage
3	Input 3, PB9 to PB12 Low Voltage
4	Input 4, PB9 to PB13 Low Voltage
5	Input 5, PB14 to PB15 Low Voltage
6	Input 6, PB14 to PB16 Low Voltage
7	Input 7, PB14 to PB17 Low Voltage
8	Input 8, PB5 to PB6 Low Voltage
9	Input 9, PB5 to PB7 Low Voltage
10	N/A
11	N/A
12	Input 12, PE7 to live. High Voltage
13	Input 13, PE8 to live. High Voltage
16	Permanently ON

Option 02.x – Drive Name [2]

CAUTION

- The total electrical load for all connected servomotors **must not** exceed 40 VA.

The maximum of drives which can be connected is 10 (0 - 9). The names are set by option parameter 02.0 to 02.9.

Each Drive device connected to the system can be given a name which will show above the position on the display. The drives are displayed with the drive number first, then a three-character label, such as ‘1GAS’, ‘2AIR’, ‘3AIR’ etc.

The permitted drive names are:

Value entered in parameter 02.0 to 02.9	Drive Name	Considered as:	Trim in Modulation	Meaning
0	N/A	Not used	N/A	This drive will not be used.
1	FUE	Fuel drive	YES	Generic fuel drive
2	GAS	Fuel drive	YES	A gas drive
3	OIL	Fuel drive	YES	An oil drive
4	CUP	Fuel drive	YES	Cup speed for rotary cup burners
5	FGR	Fuel drive	NO	Flue Gas Recirculation damper
6	PUM	Fuel drive	YES	VSD controlled oil pump. Can be used for oil warming – see option parameter 9.8
7	WAS	Fuel drive	YES	Waste fuel (combined fuel firing)
8	PRI	Fuel drive	YES	Primary (flame shaping) air or atomising medium
9	FUE	Fuel drive	NO	Generic fuel, but not trimmed.
10	AIR	Air drive	YES	Main combustion air damper
11	FAN	Air drive	YES	Main combustion air fan
12	SEC	Air drive	YES	Secondary air (same as 10 apart from name)
13	AIR	Air drive	NO	Generic Air, but not trimmed.
14	SLE	Air drive	YES	Burner Sleeve

Primary air is considered a fuel drive since it is used for flame shaping and should normally track the fuel valve. Two (or more) drives can be given the same name.

The number entered also tells the controller information about the drive. If the number entered here is less than 10, the drive is considered a fuel. If the number is greater than or equal to 10, it is considered an air drive. This is important when oxygen trim is enabled for a particular drive, because it determines the trim direction. Selection of fuel trim or air trim is made with option parameters 31.1 to 31.4.

Option 03.x – Drive Serial Number [2]

CAUTION

- The total electrical load for all connected servomotors **must not** exceed 40 VA.

Each servomotor connected to controller has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to identify each drive uniquely.

When the system is in Commission mode, the serial number of all the connected drives is read by the controller and displayed as a 'list' to allow the selection of the relevant servomotor for each drive (0 – 9) to be made.

Scrolling the list in an upward direction will scroll through all drive options available until '0, No Drive' is displayed. Enter this value to disconnect the specified drive from any hardware.

Scrolling the list in a downward direction will stop when the currently selected item is displayed, and the value will stop flashing.

The display will show type information for each drive present (such as the torque rating of a servo). Before setting these parameters, the commissioning engineer should be aware of each servo type and serial number that is connected to the burner.

Inverter (Variable speed) Drives - If the optional NXDBVSD daughter board is fitted, four additional devices are shown in the drive list:

Displayed Option	Meaning
-a,VSD1:mA	VSD channel 1 is used with a 4-20 mA feedback
-b,VSD1:Hz	VSD channel 1 is used with an encoder pulse (frequency) feedback
-c,VSD2:mA	VSD channel 2 is used with a 4-20 mA feedback.
-d,VSD2:Hz.	VSD channel 2 is used with an encoder pulse (frequency) feedback.

WARNING

- If a drive serial number is changed, then any profiles using that drive will require re-commissioning.
  A 'profile invalid' fault (see FAULT 64) will lock the burner out if there is an attempt to fire a profile that has had a previously commissioned drive removed. The profile can be re-commissioned by using the NEXT / ENTER keys in Commission Ratio mode to verify all points on the combustion curve.

Option 04.x – Drive Usage Information [2]

The system will allow a maximum of four fuel / air profiles to be entered. Each drive (servo or VSD) can be selected to operate for any, all or none of these profiles - for example the 'gas' servo can be selected on a gas profile – but not an oil profile.
When the controller has been set to use a profile that doesn't use a specific drive, this drive can be disconnected, and the controller will continue to operate on the selected profile without interruption. Therefore, if the gas servo is broken, the burner can be run on oil, for example.

Number entered in parameter 4.X	Drive X used for profile(s)
0	NONE
1	1
2	2
3	2+1
4	3
5	3+1
6	3+2
7	3+2+1
8	4
9	4+1
10	4+2
11	4+2+1
12	4+3
13	4+3+1
14	4+3+2
15	4+3+2+1 (ALL)

Example of use:

Option parameter 4.2 = 1 means that drive 2 is used for profile 1 only.
Option parameter 4.0 = 4 means that drive 0 is used for profile 3 only.
Option parameter 4.3 = 15 means that drive 3 is used for all profiles.
Option parameter 4.4 = 5 means that drive 4 is used for profile 3 and profile 1 only.

WARNING

- **If these parameters are changed after the burner has been commissioned, then any profiles affected will need to be re-commissioned. A 'profile invalid' fault (see FAULT 64) will 'Lock out' the controller on an attempt to fire a profile that has had a previously commissioned drive removed.**
- **If a drive has been added or removed from a profile, then it is recommended that the specified profile is erased (using option parameter 45.X) before an attempt is made to re-commission it.**

Option 05.x – Drive Options [2]

This parameter is used to specify direction for each servo drive. This parameter has no effect for variable speed drives (VSD). If this parameter is changed, then the effected profiles must be re-commissioned by a qualified engineer. A 'profile invalid' fault (see FAULT 64) will lock the burner out until this is done.

Number entered in parameter 5.X	Drive Options
0	Drive moves anticlockwise
1	Drive moves clockwise.

Option 06.x – Fuel Options [2]

Option parameters 6.1 to 6.4 select the fuel solenoid valves requirements for each profile, 1 to 4.

Normally available options:

Number entered in parameter 6.X	Fuel solenoid valves opened
0	NONE
1	GAS1 + GAS2
2	OIL1 + OIL2
3*	GAS1 + GAS2 + OIL1 + OIL2

*Selection 3 allows combined gas and oil firing. This selection may not be available on certain versions of this product.

NOTE: When a dual fuel profile is selected, the pilot is Gas only. Oil valves come on at the Main Ignition phase.

Option 07.0 – Fan ON Early, time (0 to 120 seconds) [2]

DEFAULT: 0
During the burner start-up, it is possible to start the fan before starting to open the main damper. This reduces the load on the F.D. fan motor. The value entered will be the time in seconds from powering the 'FAN' relay output to starting to move the selected 'drives' to their relevant pre-purge positions. If zero is entered, the FAN relay will be energized at the same time as the drives start to open.

Option 07.1 – Air Proving Time (t1) (5 to 60 seconds) [2]

DEFAULT: 15
Here, "proving" is confirming that an air pressure switch has changed state, indicating that there is air pressure in the burner.
You can set the time for air pressure to be 'proved' by the air pressure switch, using this option parameter. It is the time in seconds allowed for the air pressure switch to change state starting from when the FAN relay is closed and the air damper starts to open.
If the air pressure switch doesn't register air pressure after this time, the burner will perform a safety shutdown.
If the air pressure is proved during this time, and the drives have moved successfully to their pre-purge (P1) positions, then the pre-purge time will start.

Air pressure must be present when the air proving time t1 has elapsed until the end of any selected post-purge. All selected 'drives' must be in their correct positions, or a safety shutdown will occur. See section 1, "Description of Operation", for the status diagram.

Option 07.2 – Pre-Purge Time (t2) (5 to 120 seconds) [2]

DEFAULT: 30
The pre-purge time is set using this option parameter. This is the time in seconds that the burner will remain at the pre-purge position, air pressure must be present throughout the pre-purge time, or a safety shutdown will occur, the value entered should allow sufficient time for any un-burnt 'fuel' to be cleared from the boiler.
If in any doubt about the time being used, please consult with the burner or boiler supplier, as incorrect setting could result in a hazardous condition.
The pre-purge time will not start until the air pressure switch has 'closed', and the selected drives have reached their relevant pre-purge positions.

Option 07.3 – Pre-Ignition Time (t3) (0 to 10 seconds) [2]

DEFAULT: 3
The pre-ignition time can be set using this option parameter. **If in any doubt about the time being used, please consult with the burner or boiler supplier, because incorrect setting could result in a hazardous condition**.

t3 is the time in seconds that the ignition transformer will be 'ON' with the selected 'drives' at their relevant ignition positions before the pilot valve(s) are opened.

The pre-ignition time will not start until the pre-purge time has elapsed, the selected drives have reached their relevant ignition positions and the valve leak test has completed (if selected).

A flame **must not** be detected during the pre-ignition time **t3**, otherwise a controller lockout will occur. If there is a risk that the flame scanner will detect a flame during this period, then set option 08.0 = 1 to allow monitoring of the ignition relay output terminals (an additional wire is also required, see section 2, "How to Install and Wire the System", which will ignore a flame detected during this pre-ignition time.

Option 07.4 Pilot Ignition Time (t4) (1 to 10 seconds) [2]

DEFAULT: 5 and may only be changed if option 01.7=0.

The Pilot Ignition Time is set using this option parameter, the time should be set to allow sufficient time for the Pilot flame to stabilize before the flame must be detected. **If in any doubt about the time being used, please consult with the burner or boiler supplier, as incorrect setting could result in a hazardous condition**.

This is the time, in seconds, that the Pilot Valve will be open with the ignition transformer 'ON', with the selected drives at their relevant ignition positions, before a flame is required to be detected. Depending on the setting of other option parameters, the 'Pilot' or 'Pilot and First Main Gas Valve' or the 'Pilot and Main Oil Valve' may be open during this time. The Pilot Ignition Time will not start until the pre-ignition time has elapsed.
The controller does not monitor if a flame is present during the pilot ignition time **t4**.

Also see option 10.9.

Option 07.5 – Pilot Hold Time (t5) (1 to 10 seconds) [2]

DEFAULT: 8, and may only be changed if option 01.7=0

You can set the Pilot Hold Time using this option parameter. Set the time to allow sufficient time for the pilot flame to stabilize. This is the time in seconds that the Pilot Valve will be open with the selected 'drives' at their relevant ignition positions and a flame detected, before the main valve is opened. The ignition transformer output may be ON or OFF, depending on option parameter 14.6.

The Pilot Hold Time will not start until the pilot ignition time has elapsed and a flame must be detected throughout the interval. Dependent on the setting of other option parameters, the 'Pilot' or 'Pilot and First Main Gas Valve' or the 'Pilot and Main Oil Valve' may be open during this time.

Early spark termination will cause the ignition transformer to be OFF during the pilot hold time **t5**.

Option 07.6 – Main Ignition Time (t6) (1 to 10 seconds) [2]

DEFAULT: 5 and may only be changed if option 01.7=0.

The Main Ignition Time is be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize before removing the pilot flame. **If in any doubt about the time being used, please consult with the equipment supplier**.

The Main Ignition Time is the time in seconds that the pilot valve and the main fuel valve(s) are open together, with the selected 'drives' at their relevant ignition positions and a flame detected. The Main Ignition Time will not start until the pilot hold time has elapsed. At the end of the Main Ignition Time, the pilot valve will be de-energized, unless permanent pilot has been selected.

Extended Oil Pilot time (see option parameter 14.8) will cause an extension of the Main Ignition Time.

Late or returning spark termination will cause the ignition transformer to be ON during the main ignition time **t6**. See option parameter 14.6.

Option 07.7 – Ignition Hold Time t7 (1 to 30 seconds) [2]

DEFAULT: 1
The ignition position hold time can be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize after removing the Pilot flame and before allowing the burner to modulate, **if in any doubt about the time being used, please consult with the burner or boiler supplier**.

This is the time in seconds that the burner will remain at the ignition position, with only the Main Fuel Valve(s) open (unless permanent pilot has been selected) with the selected drives at their relevant ignition positions and a flame detected. At the end of the ignition hold time, the burner will move to Low Fire. The ignition hold time will not start until the main ignition time has elapsed. A flame must be detected, or a safety shutdown will occur.

Option 07.8 – Low Fire Hold Time t8 (0 to 999 seconds) [2]

DEFAULT: 0
The Low Fire Hold Time can be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize after moving away from the ignition positions before allowing the burner to modulate as required, **if in any doubt about the time being used please consult with the equipment supplier**.

The Low Fire Hold Time is the time in seconds that the burner will remain at the Low Fire position after a start-up before modulating as required with the selected 'drives' at their relevant Low Fire positions and a flame detected. At the end of the Low Fire hold time the burner will modulate as required. The Low Fire hold time will not start until the ignition hold time has elapsed. A flame must be detected, or a safety shutdown will occur.

Option 07.9 – Post Purge Time (t9) (-999 to 999 seconds) [2]

DEFAULT: 0
The Post Purge Time can be set using this option parameter if a post purge is required by the application. The time should be set to allow sufficient time for any un-burnt fuel to be removed from the boiler or sufficient cooling to occur (as required).
A ***negative*** number will execute the post-purge at the ***pre-purge*** position.
A ***positive*** number will execute the post-purge at the ***Low Fire*** position.
All selected drives will move to their relevant post-purge positions before the post purge time starts, **if in any doubt about the time being used, please consult with the equipment supplier**.

The Post Purge Time is the time in seconds that the selected 'drives' will remain at their relative post-purge positions following a burner shut-down or lock-out (product dependent). The presence of a flame is not checked in post purge. After the post purge time is complete the burner will move all drives to their relative closed positions ready for another start-up, unless the post-purge followed a 'Lockout', in which case the controller will remain in 'Lockout' with the drives at the positions at the time of 'Lockout'.

Option 08.0 – Ignition Spark Output Check (0 - 1) [2]

CAUTION

- If the **Ignition Spark Output Check** function is selected (because the spark can be seen as a flame), we recommend you use early or returning spark termination (option parameter 14.6). Early spark termination will allow the pilot flame to be validated.
- Make sure setting of this option does not allow an unsafe condition to occur and is acceptable for the application being controlled.

If the ignition spark is visible as a flame, then it is necessary to ensure that the controller monitors the ignition transformer output. Digital input 13 is used for this function. If this check is not made and the ignition spark is seen as a flame, a hazardous condition could occur.
Set this option parameter to a value of '1' to enable the check and wire a connection between the ignition output terminal PE3 and PE8 (input 13). Make sure that input 13 is not selected for any other function in options 01.x, and 16.x.

Number entered in parameter 08.0	Ignition Output Monitored	Digital inputs used
0	no	NONE
1	yes	i/p 13, PE8

Option 08.1 –Flame Failure Response Time (t9) (0 to3) [2]

DEFAULT: 0
The FFRT can be set between 0 and 3 second as required by the application. The value entered will be the time in seconds after the loss of flame (when a flame should be present) for a 'Lockout' to occur (all safety valves closed etc).

In most applications this option will be set at zero. For this setting the PF1/2 input response time is 1s as required by EN298:2012, and the PA5/6 input response time is 250ms.

The response of both inputs may be extended by increasing the option value up to 3s.

You can connect an external flame amplifier to the PA5/6 input if required. The flame amplifier must have a volt-free relay output when connected to the PA5/6 input and the UV input must not be selected in option 13.0. For this configuration, this option parameter ***must*** be set to zero, which will result in a flame failure response time of approximately 250 ms. This ensures that an excessive safety time is not applied.

Option 08.2 – False Flame Response Time (t9) [2]

The False Flame Response Time should be set to the shortest time possible to minimize the risk of a hazard, but, in any case, within the maximum time allowable for the particular application being controlled. The value entered will be 0 or 1, corresponding to 3 or 30 seconds after the detection of a flame (when a flame should not be present) for a 'Lockout' to occur (all fuel valves closed etc).

Number entered in parameter 08.2	False flame lockout time (seconds)
0	3 seconds
1	30 seconds

WARNING

- If in any doubt about the time being used in options 08.1 and 08.2, please consult with the burner or boiler supplier, as an excessive time will increase the possibility of a hazardous condition.
- Make sure the time set is acceptable for the application to which the product is being applied.

Option 08.3 – Recycling on Pilot flame failure (0 – 2) [2]

Set this option to allow a re-cycle of the burner start sequence and re-try of pilot ignition if the pilot flame does not ignite during status 11 and 12.
The number entered is the number of re-tries (maximum of 2), before a flame failure will 'Lockout' the burner.

CAUTION

- Make sure that the setting of this option does not allow an unsafe condition to occur and is acceptable for the application being controlled.

Option 09.0 - Inverter control accuracy (0 / 1) [2]

This parameter affects the inverter control algorithm within the controller.

Option parameter 09.0 value	Meaning
0	Low accuracy (normal setting). Control will be performed to within approximately 9 display units, ±0.45 Hz for a 0-50 Hz system.
1	High accuracy. Control will be performed to within approximately 3 display units, ±0.15 Hz for a 0-50 Hz system.

Note: When using the high accuracy setting, the controller may have difficulty controlling the speed of the inverter. If this occurs, use the low accuracy setting for reliable operation.

Option 09.1 - Inverter error tolerance (0 / 1) [2]

This parameter affects the inverter control algorithm within the controller.

Option parameter 09.1 value	Meaning
0	Small tolerance (normal setting). The controller will perform a non-volatile lockout if the inverter positioning error exceeds ±30 for 15 seconds or ±55 for 3 second (units conform to those seen on the display).
1	Large tolerance. The controller will perform a non-volatile lockout if the inverter positioning error exceeds ±55 for 3 seconds (units conform to those seen on the display).

Note: Only use the large tolerance setting if an inverter error of up to ±55 will not cause an unsafe combustion condition to occur at any firing position.

Option 09.2 - Inverter closed loop gain (15 – 125%) [2]

DEFAULT: 100
This option parameter affects all inverters connected to the controller.

For normal operation, use 100%. If the inverter control is unstable, reducing this value has the effect of damping the inverter's speed change as it approaches its set point.

Option 09.3 - Inverter stop time (0 – 100 seconds) [2]

Determines the minimum time between a burner shutdown and subsequent start-up. Set this parameter to give the inverter sufficient time to stop before the burner restarts. This parameter will increase the time the burner is held in status 5.

Option 09.4 - Inverter acceleration time (25 – 60 seconds recommended) [2]

DEFAULT 30
The value entered for this parameter must be set to the time in seconds that the inverter takes to move from zero to maximum speed.

The inverter should also be able to move from maximum to zero speed in the same time. If this is not the case, adjust the time settings in the inverter to ensure the times to accelerate and decelerate are the same.

If this option parameter does not match the true inverter acceleration / deceleration times, drive positioning will be compromised, and position faults will be likely.

Note: This parameter can be set to values higher than 60 (up to 100), but this should only be used as a last resort and is not recommended.

Note: If a very slow inverter is used, take extra care during commissioning to make sure that the UP / DOWN keys are not pressed for more than a few seconds at a time. This is essential, to make sure that the controller does not get out of step with the inverter and cause a position fault during the commission process. This controller is not designed to work with inverters that take more than 60 seconds to drive from zero to maximum speed.

Option 09.5 – VSD1 Speed Encoder Scaler (255 - 999) [2]

When using encoder feedback for VSD1, program this option to make sure that the feedback signal gives between 950 and 995 when the motor is at maximum speed (drive signal at 20 mA). The value for the parameter can be calculated using the following formula:

$$\frac{\text{Motor Max RPM} \times \text{No of teeth on encoder}}{60} = \text{Scaler}$$

The value may need adjustment after the device has been tested. Specifically, it must be ensured that the feedback received never exceeds this value. In practice, this may mean adding 2% to 5% to this value. See **Section 4** for more details.

Option 09.6 – VSD2 Speed Encoder Scaler (255 - 999) [2]

When using encoder feedback for VSD2, program this option to make sure that the feedback signal gives between 950 and 995 when the motor is at maximum speed (drive signal at 20 mA). The value for the parameter can be calculated using the following formula:

$$\frac{\text{Motor Max RPM} \times \text{No of teeth on encoder}}{60} = \text{Scaler}$$

The value may need adjustment after the device has been tested. Specifically, it must be ensured that the feedback received never exceeds this value. In practice, this may mean adding 2% to 5% to this value. See **Section 4** for more details.

Option 09.7 – Low Cup Speed Limit Hz (0 - 999) [2]

This option allows a speed check to be made on the cup of a rotary cup oil burner.
If the value is set to zero no check is made. If a non-zero value is set, a lockout will be performed if the burner is firing and the speed fails below the value entered.

The speed is measured via an input, PZ11, on the daughter board. A check is also made that the cup stops when the burner is OFF, although this will not happen whilst an oil-warming cycle is on-going (see option parameter 09.8).

Option 09.8 – Oil Warming Speed (0 – 99.9%) [2]

Set this parameter if the controller is required to control the speed of a VSD driven oil pump and there is a requirement to keep the oil circulating when the burner is OFF, in order to maintain the correct oil temperature in preparation for a call for heat.

If a non-zero value is entered into this parameter, digital input 5 (PB15) will be monitored as a temperature switch input when the burner is OFF. If this input is ‘OFF’, then the Oil pump output (PE6) will be turned ON and a 4-20 mA signal, proportional to the value set, will be sent to the VSDs of any drives that are specified as ‘PUMP (OIL)’ - a value of 6 in option parameter 2.0 to 2.9.

Option 10.0 - Gas pressure select (0 - 4) [2]

If an Fireye gas pressure sensor is connected to the system, its type and units must be entered here. Be sure to set these options before setting the value of Opt 43.4.

Option parameter 10.0 value	Meaning
0	Gas pressure input not used.
1	NX1021 or NX6043 gas pressure sensor fitted (low pressure range, **mbar**). The controller monitors the gas pressure (including the gas pressure limits) when a gas profile is selected and performs gas valve leak test if parameter 10.8 is non-zero. The span of the gas pressure sensor is less than 1000 **mbar**. **Note: The test volume and leakage rates will be entered in litres and litres per hour.**
2	NX1034 or NX6044 gas pressure sensor fitted (high pressure range, **bar**). The controller monitors the gas pressure (including the gas pressure limits) when a gas profile is selected and performs gas valve leak test if parameter 10.8 is non-zero. The span of the gas pressure sensor is in the range 1 to 9.99 **bar**. **Note: The test volume and leakage rates will be entered in litres and litres per hour.**
3	NX1021 or NX6043 gas pressure sensor fitted (low pressure range, **inches of water column**). The controller monitors the gas pressure (including the gas pressure limits) when a gas profile is selected and performs gas valve leak test if parameter 10.8 is non-zero. The span of the gas pressure sensor is less than 1000 **inches of water**. **Note: The test volume and leakage rates will be entered in cubic inches and cubic inches per hour.**
4	NX1034 or NX6044 gas pressure sensor fitted (high pressure range, **PSI**). The controller monitors the gas pressure (including the gas pressure limits) when a gas profile is selected and performs gas valve leak test if parameter 10.8 is non-zero. The span of the gas pressure sensor is in the range 1 to 99.9 **PSI**. **Note: The test volume and leakage rates will be entered in cubic inches and cubic inches per hour.**
5	NX6043/6044 CAN Bus device selected by option 43.4.

Option 10.1 - Gas pressure sensor span (mbar, bar, inches of water, PSI) [2]

This is the gas pressure (above atmospheric) measured by the sensor at its maximum output. The units and number of decimal places depend on option parameter 10.0.

Option 10.2 - Gas pressure nominal (mbar, bar, inches of water, PSI) [2]

This is the nominal, governed line pressure of the gas supply delivered to the burner. The units and number of decimal places depend on option parameter 10.0.

Option 10.3 - Gas pressure low limit (mbar, bar, inches of water, PSI) [2]

This is the minimum gas pressure (above atmospheric) permitted by the controller before a gas pressure limit fault is given. The units and number of decimal places depend on option parameter 10.0.

Option 10.4 - Gas pressure high limit (mbar, bar, inches of water, PSI) [2]

This is the maximum gas pressure (above atmospheric) permitted by the controller before a gas pressure limit fault is given. Make sure the value set is within the capability of the sensor. The units and number of decimal places depend on option parameter 10.0.

Option 10.5 - Test volume (0.0 - 99.9 litres or 0 to 999 cubic inches) [2]

This must be set to the volume of the test pipe section between the two safety valves, including the volume in each valve on the test section side. The units and number of decimal places depend on option parameter 10.0.

Option 10.6 - Maximum permissible leakage rate (0 - 99.9 litres/hr or 0 - 999 inch^3/hr) [2]

This is the maximum permissible leakage rate allowed during the valve leak test. This value must be set according to the installation and local regulations. The units and number of decimal places depend on option parameter 10.0.

Option 10.7 - Vent valve select (0 - 2) [2]

This option parameter is used to select if a (gas) vent valve is fitted.

Option parameter 10.7 value	Meaning
0	No vent valve fitted. Use main valve 2 to vent into the boiler.
1	Vent valve fitted, output energized to open valve.
2	Vent valve fitted, output energized to close valve.

Option 10.8 – Valve leak test selection (0 - 360) [2]

Option parameter 10.8 value	Meaning
0	No valve leak test is performed.
1	When firing on Gas, the gas valve prove (leak) test will be performed each time the burner starts up, mostly during pre-purge.
2 to 360	When firing on Gas the gas valve prove (leak) test will be performed after the burner is turned OFF. However no pre-purge or valve leak test (at restart) will be performed if the burner restarts within the time entered (in minutes). If the burner does not restart within the time limit, normal valve leak test and pre-purge will happen on the next start-up.

Option 10.9 – VPS valve energize time (0 – 6 seconds) [2]

During the valve leakage tests for the valve prove (leak) test system (VPS), Gas Valve output 1 or Gas Valve output 2 is energized for just under three seconds, depending upon the phase of the test. It is an approvals and safety requirement that the valve never opens (lets gas pass) for more than three seconds, during this test.

Some gas valves require power for a few seconds to open enough to allow gas to pass through – this is often the case for hydraulically actuated valves. When three seconds of energizing is not enough time to allow gas to flow, then this parameter can be set to increase the valve energize time for up to six seconds. This parameter must be set to the minimum value that allows the VPS system to function correctly. In addition, for this function to operate correctly, option 7.4 must be set equal to, or greater than, the value set for this option.

WARNING

- **This option parameter must only be adjusted above three seconds if a valve energize time of three seconds is not sufficient to allow the valve to open and allow gas to pass.**
- **Under no circumstances must it be used to allow gas through a valve for more than three seconds.**

Option parameter 10.9 value	Meaning
0, 1, 2 or 3	The gas valves will be energized for just under 3 seconds.
4	The gas valves will be energized for just under 4 seconds.
5	The gas valves will be energized for just under 5 seconds.
6	The gas valves will be energized for just under 6 seconds.

Option 12.0 – Flame1 detection device - (0 – 2) [2]

This option parameter sets the flame sensor as a Photocell or I.R. device, or alternatively as a dual active scanner using dual sensors.

Option parameter 12.0 value	Meaning
0	The Photocell / IR input is not used. The flame monitoring must be done via the UV input.
1	The Photocell / IR input is used for light level monitoring. This setting is typically used for a photocell device where the flame signal level is determined by the amount of light falling on the sensor. This type may not be permitted for continuous operation (>24 hours) depending on the appliance standards.
2	The Photocell / IR input used for flame flicker monitoring. This setting is typically used for an infrared (IR) flame scanner. The flame signal level is determined by the amount of 'flicker' seen by the sensor. This type of flame monitoring is suitable for continuous operation (>24 hours) when a suitable flame-sensing device is used.
3	The Dual active flame scanner option may be unavailable. This type of flame monitoring is suitable for continuous operation (>24 hours) when a suitable dual active flame scanner is used.
4	NX6094/NX6095 CAN Bus device selected by option 12.4.

If in any doubt about the compatibility of the sensor being connected, contact the equipment supplier.

Option 12.1 – Flame1 Pilot Flame Threshold Photocell or I.R. (1 -100%) [1]

DEFAULT: 20
If option parameter 12.0 has been set to a value greater than zero, then this option parameter may be adjusted to a value for the flame threshold to validate the pilot flame. After a value is set, the flame signal detected during pilot ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.

Option 12.2 – Flame1 Main Flame Threshold Photocell or I.R.(0 – 100%) [1]

DEFAULT: 20
In a similar manner to option 12.1 when option parameter 12.0 has been set to value greater than zero, then this option parameter may be adjusted to a value for the flame threshold to validate the main flame. After a value is set, the flame signal detected during main ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set, please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 12.3 – Flame1 per profile (0 to 2) [2]

DEFAULT: 0
You may choose to validate particular flame types with the Flame1 detector by setting the value of this option as follows.

Option parameter 12.3 value	Meaning
0	The Flame1 Photocell / IR input is monitored for all profiles. .
1	The Flame1 Photocell / IR input is monitored for Gas profiles only.
2	The Flame1 Photocell / IR input is monitored for Oil profiles only.

Option 12.4 – Flame1 CAN detector serial number. [2]

DEFAULT: 0
Where a CANbus flame detector is used for Flame1 select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x.
Note: Setting a value in 12.4 will automatically set 12.0 to a value of 4.

Procedure to change an NX6094/6095 flame detector.

1. Set option 12.4 = None/zero
2. Remove the original device and connect a new device.
3. Set Option 12.4 to select the serial number for the new device.

Note: Flame monitoring may be performed simultaneously by both the Flame 1 and Flame 2 channels. When this is required, the controller **must not** see a flame at either device when the flame should be OFF. When the flame should be ON, a flame **must** be detected by BOTH devices.
Alternatively, when both flame inputs are active, you can set a pilot or zero threshold for either device to ignore the flame, provided that a flame is detected on the other device.

Option 13.0 – Flame2 detection type - U.V. / Ionisation or Shuttered U.V. (0 – 3) [2]

This option parameter sets the selection of the high voltage flame sensor device.

Option parameter 13.0 value	Meaning
0	UV / Ionization input not used. The flame monitoring must be done via the photocell / IR input.
1	Ionization probe or UV flame monitoring provided using a non-shuttered device. *Ionization probe (flame rod) fitted:* The controller will energize an ionization probe. The fail-safe circuits within the controller allow an ionization probe for continuous operation (subject to appliance standards). Set hardware jumper JP6 to the 'OUT' position. *Non-shuttered UV cell fitted:* The controller will energize a non-shuttered UV cell. Due to the possibility of a faulty UV cell and giving a false flame signal, this type of flame detector may not be used for continuous operation (>24 hours) depending on the appliance standards. Set hardware jumper JP6 to the 'IN' position.
2	Shuttered UV detector. UV flame monitoring provided using a slow shuttered device. The flame signal should be interrupted for at least 90 ms every 6 minutes or more often (approximate timings). If these conditions do not prevail, the controller will perform a Lockout. This type of flame monitoring is suitable for continuous operation (>24 hours) when a 45UV5 flame detector is used. Set hardware jumper JP6 to the '**OUT**' position. Note: As an alternative, a relay can be configured to drive / enable the shutter only when the control requires the flame detection to be tested. This provides maximum flame detection sensitivity because the shutter is only operated occasionally and very briefly. See option parameters 17.1 to 17.9, setting value 42.
3	UV flame monitoring provided using a fast shuttered device. The flame signal should be interrupted for at least 90 ms every 5 seconds or more often (approximate timings). If these conditions do not prevail, the controller will perform a Lockout. This type of flame monitoring is suitable for continuous operation (>24 hours) when a suitable flame-sensing device is used. Set hardware jumper JP6 to the 'IN' position.
4	NX6094/NX6095 CAN Bus device selected by option 13.4.

Option 13.1 – Flame2 Pilot Flame Threshold. (0 – 100%) [2]

DEFAULT: 20
If option parameter 13.0 has been set to a value greater than zero, then this option parameter must be adjusted to a value for the flame threshold to validate the pilot flame. After a value is set, the flame signal detected during pilot ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 13.2 – Flame2 Main Flame Threshold. (0 – 100%) [2]

DEFAULT: 20
If option parameter 13.0 has been set to a value greater than zero, then this option parameter must be adjusted to a value for the flame threshold to validate the main flame. After a value is set, the flame signal detected during main ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 13.3 – Flame1 per profile (0 to 2) [2]

DEFAULT: 0
You may choose to validate particular flames types with the Flame2 detector by setting the value of this option as follows

Option parameter 12.3 value	Meaning
0	The Flame2 Photocell / IR input is monitored for all profiles. .
1	The Flame2 Photocell / IR input is monitored for Gas profiles only.
2	The Flame2 Photocell / IR input is monitored for Oil profiles only.

Option 13.4 – Flame2 CAN detector serial number. [2]

DEFAULT: 0
Where a CANbus flame detector is used for Flame2 select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x.

Note: Setting a value in 13.4 will automatically set 13.0 to a value of 4.

Procedure to change an NX6094/NX6095 flame detector.

1. Set option 13.4 = None/zero
2. Remove the original device and connect a new device.
3. Set Option 13.4 to select the serial number for the new device.

Note: Flame monitoring may be performed simultaneously by both the Flame 1 and Flame 2 channels. When this is required, the controller **must not** see a flame at either device when the flame should be OFF. When the flame should be ON, a flame **must** be detected by BOTH devices.

Alternatively, when both flame inputs are active, you can set a pilot or zero threshold for either device to ignore the flame, provided that a flame is detected on the other device.

Option 14.0 – Primary Fault Relay (0 - 8) [2]

This option parameter assigns the primary faults to a specific relay. Relays 2 & 3 share a common connection, and relays 4 & 5 share a common connection.

Option parameter 14.0 value	Meaning	Connection Details
0	Primary faults not assigned to any relay.	N/A
1	Primary faults assigned to relay 1	**Display**, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Primary faults assigned to relay 2	**Display**, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Primary faults assigned to relay 3	**Display**, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Primary faults assigned to relay 4	**Main Controller**, PD6(COM), PD7(NO), PD8(NC). Low voltage or line voltage.
5	Primary faults assigned to relay 5	**Main Controller**, PD6(COM), PD4(NO), PD5(NC). Low voltage or line voltage.
6	Primary faults assigned to relay 6	**Main Controller**, PD1(COM), PD2(NO), PD3(NC). Low voltage or line voltage.
7	Primary faults assigned to relay 7	**Daughter board**, PZ17 – PZ18. LOW VOLTAGE AND CURRENT ONLY.
8	Primary faults assigned to relay 8	**Daughter board**, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.

These relays MUST NOT be used to provide a safety function.

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2, which means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so you need to wire an alarm bell in series with the normally closed contacts.

Option 14.1 – Limit Relay (0 - 8) [2]

This option parameter assigns the limits to a specific relay. Relays 2 & 3 share a common connection, relays 4 & 5 share a common connection.

Option parameter 14.1 value	Meaning	Connection Details
0	Limits not assigned to any relay.	N/A
1	Limits assigned to relay 1	**Display**, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Limits assigned to relay 2	**Display**, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Limits assigned to relay 3	**Display**, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Limits assigned to relay 4	**Main Controller**, PD6(COM), PD7(NO), PD8(NC). Low voltage or line voltage.
5	Limits assigned to relay 5	**Main Controller**, PD6(COM), PD4(NO), PD5(NC). Low voltage or line voltage.
6	Limits assigned to relay 6	**Main Controller**, PD1(COM), PD2(NO), PD3(NC). Low voltage or line voltage.
7	Limits assigned to relay 7	**Daughter board**, PZ17 – PZ18. LOW VOLTAGE AND CURRENT ONLY.
8	Limits assigned to relay 8	**Daughter board**, PZ15 – PZ19. LOW VOLTAGE AND CURRENT ONLY.

These relays MUST NOT be used to provide a safety function.

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2, which means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so you need to wire an alarm bell in series with the normally closed contacts.

Option 14.2 – Oxygen and Flue Temperature Limit Relay (0 - 8) [2]

This option parameter assigns the limits to a specific relay. Relays 2 & 3 share a common connection, relays 4 & 5 share a common connection.

Option parameter 14.2 value	Meaning	Connection Details
0	Flue Limits not assigned to any relay.	N/A
1	Flue Limits assigned to relay 1	**Display**, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Flue Limits assigned to relay 2	**Display**, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Flue Limits assigned to relay 3	**Display**, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Flue Limits assigned to relay 4	**Main Controller**, PD6(COM), PD7(NO), PD8(NC). Low voltage or line voltage.
5	Flue Limits assigned to relay 5	**Main Controller**, PD6(COM), PD4(NO), PD5(NC). Low voltage or line voltage.
6	Flue Limits assigned to relay 6	**Main Controller**, PD1(COM), PD2(NO), PD3(NC). Low voltage or line voltage.
7	Flue Limits assigned to relay 7	**Daughter board**, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.
8	Flue Limits assigned to relay 8	**Daughter board**, PZ17 – PZ18. LOW VOLTAGE AND CURRENT ONLY.

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2, which means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so you need to wire an alarm bell in series with the normally closed contacts.

Option 14.3 – Permanent gas pilot select (0 - 1) [2]

Set this option to select of permanent pilot operation when the burner is firing on gas. When firing on oil only this option parameter is ignored, but it is used if both gas and oil are firing simultaneously.

Option parameter 14.3 value	Meaning
0	Non-permanent pilot
1	Permanent pilot operation, when firing on gas.

Option 14.4 – Pilot with/without main valve select (0 – 1) [2]

This option parameter sets the selection of pilot operation with or without the main gas valve when the burner is firing on gas. When firing on oil only, this option parameter is ignored, and the pilot valve always operates without the main gas valve. This parameter is used if both gas and oil are firing simultaneously.

Option parameter 14.4 value	Meaning
0	Bring pilot valve on without main gas valve 1. Pilot operates without main gas valve, when firing on gas
1	Bring main gas valve 1 on when pilot comes on. Pilot operates with main gas valve, when firing on gas.

Option 14.5 – Direct Ignition on Oil (0 - 1) [2]

This option parameter sets the selection of direct ignition when firing Oil. This allows the main oil valve(s) to open at the same time as the pilot valve opens. If the profile fires gas only, this parameter is ignored.

Option parameter 14.5 value	Meaning
0	Ignition on pilot only.
1	Ignition on pilot and main oil valve together.
2	As selection 1 (Oil main opens at ignition), but pilot does not energize for Oil only profiles

Direct ignition on Gas burners.

The use of direct ignition on gas burners is restricted by the burner and fuel handling application standards, for example EN746. Typically, the restriction refers to the burner size and the maximum ignition flame heat rate, as a percentage of the Maximum heat output for the burner
It is the responsibility of the burner equipment supplier to sate these constraints, and of the commissioning technician to implement the function within the stated constraints.

The procedure to implement direct ignition for gas profiles is as follows:

Install an electrical link between terminals PE11 (MV2 output) and PE12 (Pilot output).
Set option 14.4 to a value of 1, which ensures that MV1 is energized at the same time as the Pilot.
Set option 14.5 to a value of 2.

Option 14.6 – Spark Termination (0-3) [2]

DEFAULT = 1 and can only be changed if option 01.7=0.

> ***CAUTION***
>
> - If the late spark termination function is selected, it is **not** recommended to use a flame scanner that detects the ignition spark as a flame (option 08.0).
> - Make sure setting of this option does not allow an unsafe condition to occur.

This option parameter allows the operation of the ignition transformer to be changed from the default behaviour.

Normally, the ignition transformer will switch OFF at the same time that the main fuel valve(s) open. If required, the ignition spark can be terminated early, so it is OFF during the pilot hold time **t5**, OR, to hold it on right through the main ignition time **t6**.

Option parameter 14.6 value	Meaning
0	Early spark termination. The spark turns OFF at the end of **t4**, leaving the pilot to stabilize without a spark present.
1	Normal spark termination. Spark turns OFF at the end of **t5**, when the main valve opens.
2	Late spark termination. The spark stays ON through main ignition, turning OFF at the end of **t6**.
3	Returning Spark. The spark turns OFF at the end of **t4**, as for selection 0, but it comes back ON when the main valve opens, for **t6**.

This parameter affects all profiles whether they fire gas or oil.

Option 14.7 – Aux / Oil Pump Relay Function. (0 - 6) [2]

Setting this parameter as shown in the table below configures the function of output PE6.

Option parameter 14.7 value	Meaning
0	The oil pump relay is not used for one of the functions listed below.
1	This is an Auxiliary relay output used to control the oil pump for oil profiles. This output is valid for burner status between 10 and 16.
2	This is an Auxiliary relay output used to control a steam atomizing valve for oil profiles. This output is valid for burner status between 6 and 16.
3	This is an Auxiliary relay output used to control a steam purge valve for oil profiles. This output is valid for burner status 17 or 18.
4	This is an auxiliary relay used to switch power to a cup motor, an oil pump or primary air motor, which comes ON at status 6 and remains ON during a post purge when firing oil only.
5	Flame ON – The relay comes ON when a flame is detected.
6	Gas Booster – On when firing GAS between burner status 6 and 16.

Note: Oil warming (if selected) may turn the Oil Pump output ON when it would otherwise be OFF. See option parameter 9.8, if applicable.

Option 14.8 – Extended Oil Pilot (0-20 seconds) [2]

This option parameter can be set to extend **t6** for profiles that fire oil. The main ignition time **t6** used will be the larger of option parameters 7.6 and 14.8. If a profile fires gas, this setting is ignored.

Option 14.9 – Fan Run-on Time (0 to 999 minutes) [2]

DEFAULT: 0
Using this option parameter, you can set a fan run–on time in minutes up to approximately 16 hours (998 minutes). If you need continuous fan operation, set it to 999.

While fan run-on is active, all drives will be positioned to their Low Fire positions rather than their closed positions. This is the case if the burner is switched OFF or locked out. This will allow air to flow through the burner.

The fan output relay on plug PE5 behaves as normal, but a second relay can be used to drive the actual fan, if required. This will be an auxiliary relay, selected by setting option parameter **17.x** to 27.

At power-up, this output will be OFF even if continuous run is selected, until the first burner start-up is initiated.

To ensure safe operation of the burner and compliance with safety standards, it is essential that the control is able to verify correct operation of the air pressure/flow switch. In normal operation (without fan run-on), this is achieved by verifying that it detects no pressure/flow when the burner F.D. fan is OFF (in burner status 1 – 5 inclusive).

However, if the fan run-on option is being used, the fan may be operating continuously and therefore the control would not be able to verify the correct operation of the air pressure/flow switch. To overcome this issue, it is necessary to fit a solenoid valve in the 'air connection' between the burner and the air pressure/flow switch. This additional solenoid is then powered by the normal FAN output. Under no circumstances must the FAN output be used to open the electrical connection between the air pressure/flow switch and the control, since this would not verify the correct operation of the air pressure/flow switch.

Option 15.0 - Modulation sensor input type (0 - 4) [2]

You can configure the modulation sensor input in several modes as detailed below.

Option parameter 15.0 value	Meaning
0	0 - 5 V Tracking operation. Set the JP1 link to 'OUT', and the JP4 link to 5 V. The burner modulation will track the voltage applied, where High Fire is for a 5 V input. There is no 'measured value', just a tracking set point. Option parameters 15.0 to 15.5 are unavailable.
1	4 - 20 mA Tacking operation. Set the JP1 link to 'IN', and the JP4 link to '30 V'. The burner modulation will track the current applied, going to High Fire for 20 mA and Low Fire for 4 mA. If the current measured is out of range, then the burner will go to Low Fire. There is no 'measured value', just a tracking set point. Option parameters 15.0 to 15.5 are unavailable.
2	4 - 20 mA Sensor operation. Set the JP1 link to 'IN' and the JP4 link to '30 V' for a loop powered sensor. This configures the input for to a 4-20 mA measured value input device such as a pressure or temperature sensor. The internal PID will be available, if required.
3	NX104x "fail safe" boiler temperature sensor. Set the JP1 link to 'OUT', and the JP4 link to '30 V'.
4	NX103x "fail safe" boiler pressure sensors. Set the JP1 link to 'OUT', and the JP4 link to '30 V'.
5	NX6044/NX6045 CAN Bus device selected by option 43.3.

When using an NX6044/NX6045 sensor, the controller can monitor the boiler high safety limit and perform a non-volatile lockout if it is exceeded. If a 4 – 20 mA sensor is used, a safety limit can be set, but an external limit device **must** be fitted to protect the boiler. Make sure that the correct links are set.

Option 15.1 – Modulation input decimal places (0 to 2) [2]

This parameter specifies the number of decimal places to which the measured value and set point are displayed. It also affects the scaling of the zero, span and safety limit – so it is vital that this parameter is set before parameters 15.2, 15.3 and 15.5.

Option parameter 15.1 value	Meaning
0	Measure value and set point displayed with no decimal places. Range of values is from 000 to 999.
1	Measure value and set point displayed with one decimal place. Range of values is from 00.0 to 99.9.
2	Measure value and set point displayed with two decimal places. Range of values is from 0.00 to 9.99.

Option 15.2 – Modulation input zero value (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) [2]

This value will normally be left at zero. It is the measured value to be displayed when the sensor connected is at its minimum value. For NX1030 and NX1034 fail-safe sensors, this value must be left at zero.

If a 4-20 mA sensor is used, this parameter must be set to the 4 mA value (usually zero).

Option 15.3 – Modulation input span value (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) [2]

This value is the measured value to be displayed when the sensor connected is at its maximum value. For NX1030 and NX1034 fail-safe sensors, this value must be set to the specified range of the sensor.

If a 4-20 mA sensor is used, this parameter must be set to the 20 mA value.

Option 15.4 – Set point display units (0 – 3) [2]

This option selects the displayed units for measured value and set point, detailed in option(s) 21.x.

Option parameter 15.4 value	Meaning
0	Show measured value as **PSI**.
1	Show measured value as **bar**.
2	Show measured value as **°F**.
3	Show measured value as **°C**.
4	Show measured value as **%**.
5	Show measured value as blank – i.e., no units.

Option 15.5 - Boiler high safety limit (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) [2]

If a “fail safe” boiler sensor model NX1030 or NX1034 is used, the controller can monitor the boiler high safety limit and perform a shutdown and lockout if the limit is exceeded. ***If a high safety limit is not required and a fail-safe sensor is still to be used, set this option parameter to 999.***

If a 4-20 mA sensor is used, you can configure this parameter to give a lockout when a high limit is reached. In this case, enter a value other than zero. ***Note: When a 4-20 mA sensor is used, external limits must be in place to protect the boiler in case of sensor failure.***

Option 15.6 – Modulation Time (0 – 120 seconds) [1]

This parameter sets the minimum time for the burner to modulate from low to High Fire and in reverse. Note - The modulation speed in AUTO mode is set. The burner may modulate slower than this setting if the drive speeds dictate this at any point in the range.

Option 15.7 – Bumpless Transfer (0 or 1) [1]

Bumpless transfer allows the controller to switch from Manual to Automatic mode or vice versa, without the control output suddenly 'bumping' to a different value.

This parameter only affects the burner operation while in Manual mode.

Option parameter 15.7 value	Meaning
0	When the burner comes back ON after going OFF, it will remain at Low Fire.
1	When the burner comes back ON after going OFF, it will go to the last modulation rate that was set in Manual mode and stay there.

Option 15.8 – Low before Off (0 or 1) [1]

When set to 1, this parameter will change the way a normal controlled shutdown works.

Option parameter 15.7 value	Meaning
0	The burner will turn OFF immediately when it is expected / required to.
1	The burner will modulate down for up to 30 seconds (or until Low Fire is reached) and then turn OFF.

Note: This function works for shutdowns caused by control limits for the currently selected set point and for shutdowns caused by option parameter 20.1 (aux shutdown) only. Lockouts / shutdowns caused by the alarm inputs in parameters 18.X will always work immediately.

Option 16.1 – Go back to pilot (0 to 15) [2]

This option sets a digital input to be configured to force the controller to modulate down to Low Fire (if not already there), then move to the ignition position and close the main fuel valves. The burner will continue to run with only the pilot ON (in status 12) until the digital input is OFF. The ignition transformer will not come ON during the time that the 'go back to pilot' input is ON, however it may come ON briefly when the input is removed as part of the normal start-up procedure, as determined by option parameter 14.6.

You can use this function to prevent the burner from having to go OFF when the demand is low, meaning that it is ready to respond immediately to a sudden increase in demand; no pre-purge is required.

Option 16.2 – Allow On-line profile swap (0 to 16) [2]

This option configures a digital input to allow a profile swap without turning the burner OFF.

Number entered in parameter. 16.1 and 16.2	Digital input used:
0	None.
1	Input 1, PB9 to PB10 Low Voltage
2	Input 2, PB9 to PB11 Low Voltage
3	Input 3, PB9 to PB12 Low Voltage
4	Input 4, PB9 to PB13 Low Voltage
5	Input 5, PB14 to PB15 Low Voltage
6	Input 6, PB14 to PB16 Low Voltage
7	Input 7, PB14 to PB17 Low Voltage
8	Input 8, PB5 to PB6 Low Voltage
9	Input 9, PB5 to PB7 Low Voltage
10	Reserved input. DO NOT USE
11	Reserved input. DO NOT USE
12	i/p 12, PE7 to live High Voltage
13	i/p 13, PE8 to live High Voltage
14	Not a real input. Used for custom applications
15	Not a real input. Used for custom applications
16	Permanently allow profile swap.

If this input is ON and a different fuel profile is selected, the controller will go to Low Fire then back to pilot ignition (P2) on the original profile. It will then close the main fuel valves and run with just the pilot ON (and the ignition transformer ON if option parameter 14.6 is set to 1 or 2). The controller will then move all drives to the P2 position of the new profile and open the appropriate main fuel valves, at which time the ignition transformer may switch ON for a time if option 14.6=3.

The digital input number to use for this function is entered as the option parameter value.

Option 16.3 – High voltage Input 12 Alarm / Lockout Function (0 - 360) [2]

This option parameter works identically to option parameters 18.1 to 18.9, except that it relates to the high voltage input 12, PE7.

Option 16.4 – High voltage Input 13 Alarm / Lockout Function (0 - 360) [2]

This option parameter works identically to option parameters 18.1 to 18.9, except that it relates to the high voltage input 13, PE8.

Option 16.5 – High voltage Input 12 Fail-safe Alarm / Lockout Display Messages (0 - 999) [2]

This option parameter works identically to option parameters 19.1 to 19.9, except that it relates to the high voltage input 12, PE7.

Option 16.6 – High voltage Input 13 Fail-safe Alarm / Lockout Display Messages (0 - 999) [2]

This option parameter works identically to option parameters 19.1 to 19.9, except that it relates to the high voltage input 13, PE8.

Option 16.7 – Oil Gun Blow-out time (0 - 30 s) [1]

This option defines the length of time that the PE6 terminal is ON when Option 14.7 = 3 - Steam purge valve for Oil gun.

Option 17.x - Relay outputs [1]

These are the relay outputs from the Touch screen device, and their corresponding Option Parameters:

Option Parameter	Relay Output	Connection Detail
17.1	1	Touch screen - PR1(COM), PR2(NC), PR3(NO). Low or Line voltage
17.2	2	Touch screen – PR4(COM), PR5(NC), PR6(NO). Low or Line voltage.
17.3	3	Touch screen - PR7(COM), PR8(NC), PR9(NO). Low or Line voltage.
17.4	4	Controller, PD6(COM), PD7(NO), PD8(NC). Low or Line voltage
17.5	5	Controller, PD4(NO), PD5(NC), PD6(COM). Low or Line voltage.
17.6	6	Controller, PD1(COM), PD2(NO), PD3(NC). Low or Line voltage.
17.7	7	Daughter board PZ17, PZ18
17.8	8	Daughter board PZ15, PZ16
17.9	9	10” Touch screen, PR10(COM), PR11(NC), PR12(NO). Low or Line Voltage

Option 17.1 to 17.9 – Relay Output Functions (1 – 26) [1]

This option parameter assigns ‘events’ to the relay outputs. Set option parameter 17.1 to select the function for relay output 1, option 17.2 to select the function for relay 2 etc.

Option parameter 17.x value	Meaning
0	No function set from this option parameter
1	Digital Input 1 (PB9 – PB10)
2	Digital Input 2 (PB9 – PB11)
3	Digital Input 3 (PB9 – PB12)
4	Digital Input 4 (PB9 – PB13)
5	Digital Input 5 (PB14 – PB15)
6	Digital Input 6 (PB14 – PB16)
7	Digital Input 7 (PB14 – PB17)
8	Digital Input 8 (PB5 – PB6)
9	Digital Input 9 (PB5 – PB7)
10	Profile 2 select (PB8 – PB6)
11	Profile 4 select (PB8 – PB7)
12	Digital input 12 (PE7)
13	Digital input 13 (PE8)
14	Burner Select Input (PE9)

Option parameter 17.x value	Meaning
15	Airflow Input (PB18– PB19)
16	Warming limit exceeded
17	Flame Detected
18	Boiler Below Control Limit
19	Gas Profile Selected
20	Oil Profile Selected
21	Controller in Lockout
22	Burner is Shutdown from a Limit or Input event
23	Burner in Loc1/Loc2/OFF from the keypad
24	Profile uses second fuel train
25	Burner modulating
26	Profile with Variable Speed Drive (VSD) selected and Fan output is ON
27	Copy Fan relay output
28	Gas Booster o/p for gas profiles, status 6-16
29	Burner OFF from Shutdown or Lockout
30	Burner is status 15 through to 18
31	Profile 1 selected
32	Profile 2 selected
33	Profile 3 selected
34	Profile 4 selected
35	No function
36	No function
37	No function
38	The burner is available. The relay is ON if there are no faults causing the burner to switch OFF, and the burner is not turned OFF from the keypad or the burner select input.
39	Purge in progress. The relay is ON if the burner status is 8.
40	Purge completed. The relay is ON if the burner status is 9.
41	The relay is ON if the burner is not turned OFF from the keypad.
42	Shutter drive for UV check. Used when option parameter 13.0 is set to 2. Relay comes ON when shutter operation is required.
43	ON if controller is in ‘Normal/Remote’ mode, OFF when in ‘Local’ or ‘Off’ mode. OFF when controller loses power.
44	The Relay is ON if the controller is powered up.
45	Draft/Ventilation control – ON if controller status value is 3 through to 18.

Option parameter 17.x value	Meaning
46	Burner available to fire – ON if controller status value is 3 through to 16.
47	At Low Fire position.
48	At High Fire position.
49 – 100	No function
101 – 199	Fault numbers 1 – 99 control the relay
200	No functions
201 – 250	Engineer's Key Data numbers 101 – 150 mirrored (On/Off)

When used to indicate a fault or limit, the N/O contacts will be closed when no alarm is present, to ensure the alarm indication is fail-safe; therefore, wire the alarm devices in series with the normally closed contacts.

The following table shows details of the output relay connections for the text display:

Option Parameter	Relay Output	Connection Detail
17.1	1	Display - PR1(NO), PR2(NC), PR3(COM). Low or Line voltage
17.2	2	Display - PR5(NO), PR6(NC), PR7(COM). Low or Line voltage.
17.3	3	Display - PR7(COM), PR8(NC), PR9(NO). Low or Line voltage.

Option 18.1 to 18.9 – Fail-safe Digital Inputs (0 – 360) - also 16.3 & 16.4 [2]

The fail-safe digital inputs can be used to lock out or shutdown the burner, by the opening of a contact across the input terminals. This event will generate a fault or limit number that relates directly to the input that caused the event (changing to open circuit). As an example, F1 comes from input 1, F8 comes from input 8 and F13 comes from input 13. Inputs 10 and 11 cannot be used for alarm functions. Faults F10 and F11 are flame failure / false flame faults.

The shutdown or lockout functions are activated by setting a number into option parameters 18.1 to 18.9 for inputs 1 to 9, and option parameters 16.3 & 16.4 for inputs 12 & 13. The number is a one-, two- or three-digit number defined as follows - zero gives no function.

HUNDREDS (fault type)	TENS (fuel type)	UNITS (burner status type)
0 – This alarm will lock out the burner and shows on the display as 'FXX'. Manual intervention (Mute/Reset) is required to restart the burner after the fault condition has cleared. The burner will lock out within **one** second.	**0 or 1** – Fault will be active for any fuel selection (including no fuel selected at all).	**0 or 1** – Fault will be active regardless of the current burner status (i.e., all the time).
1 – This alarm will shut down the burner and show on the display as 'Lxx'. When the event condition clears, this code will change to 'CXX' and the burner will restart without manual intervention. The burner will shut down within **three** seconds.	**2** – Fault will be active only when the currently selected profile fires GAS.	**2** – Fault will be active after the fan has started, the air pressure switch has made and the drives have made their purge positions (i.e. after pre-purge starts). Not active during post purge.
2 – This alarm is for indication only. It will appear on the display as 'LXX' but will not stop the burner operating. The limit will operate within **three** seconds.	**3** – Fault will be active only when the currently selected profile fires OIL.	**3** – Fault will be active after pre-purge has finished (i.e. drives moving to the ignition position). Not active during post purge.
3 – This operates the same as selection 1 in this column, but the fault will be generated when the input closes. **This mode of operation must not be used for any safety function because if the wire breaks, it cannot be detected.**	**4** – Fault will be active only when there is a fuel profile currently selected (either firing GAS or OIL).	**4** – Fault will be active after pilot ignition has started (status 11 onwards). Not active during post purge.

HUNDREDS (fault type)	TENS (fuel type)	UNITS (burner status type)
4 This alarm will lock out the burner and shows on the display as 'FXX'. Manual intervention (Mute/Reset) is required to restart the burner after the fault condition has cleared. The burner will lock out within **three** seconds.	**5** - Input will be considered when Profile 1 is active.	**5** – Fault will be active after main ignition has started (status 13 onwards). Not active during post purge.

HUNDREDS (fault type)	TENS (fuel type)	UNITS (burner status type)
5 to 9 are spare and cannot be selected.	**6** - Input will be considered when Profile 2 is active.	**6** – Fault will be active after the drives have reached their Low Fire positions and the burner is ready to modulate (status 16). Not active during post purge.
5 to 9 are spare and cannot be selected.	**7** - Input will be considered when Profile 3 is active.	**7** – Fault will be active at IGNITION only (burner status 10 to 14 inclusive)
5 to 9 are spare and cannot be selected.	**8** - Input will be considered when Profile 4 is active.	**8** – Fault will be active at pre-purge only.
5 to 9 are spare and cannot be selected.	All other values will work like selection 1 (including zero). 5 to 9 are spare so that new functions can be added later.	**All other values will work like selection 1 (including zero). 7 to 9 are spare so new functions can be added later.**

Option parameter no.	Digital Input Number / Terminals	Fault number
18.1	Input 1 PB9 to PB10, LOW VOLTAGE	F1 or L1
18.2	Input 2 - PB9 to PB11, LOW VOLTAGE	F2 or L2
18.3	Input 3 - PB9 to PB12, LOW VOLTAGE	F3 or L3
18.4	Input 4 - PB9 to PB13, LOW VOLTAGE	F4 or L4
18.5	Input 5 - PB14 to PB15, LOW VOLTAGE	F5 or L5
18.6	Input 6 - PB14 to PB16, LOW VOLTAGE	F6 or L6
18.7	Input 7 - PB14 to PB17, LOW VOLTAGE	F7 or L7
18.8	Input 8 – PB6 to PB5, LOW VOLTAGE	F8 or L8
18.9	Input 9 – PB7 to PB5, LOW VOLTAGE	F9 or L9
16.3	Input 12 - PE7 to live, HIGH VOLTAGE	F8 or L8
16.4	Input 13 - PE8 to live, HIGH VOLTAGE	F9 or L9

Examples:
To set input 5 to give a 'high gas pressure lockout' you might enter 25 (025) into option parameter 18.5. This will give a lockout if gas is selected and the main valve is open.
To set input 1 to give an 'extra low water' lockout you would enter 11 (or 1) into option parameter 18.1.
To set input 2 to give a 'high water alarm' you would set 211 (or 200 or 210 or 201) in option parameter 18.2.

Option 19.1 to 19.9 –Alarm / Lockout Display Messages* also options 16.5 & 16.6 [2]

These option parameters assign messages to the shutdown or lockout functions defined in options 18.1 to 18.9. The messages are chosen from a list of 32 possible items using option parameters 19.1 to 19.9 (for inputs 1 to 9) and option parameters 16.5 & 16.6 for the high voltage inputs (12 & 13). The list below details the preset messages.

19.x (or 16.5 / 16.6) value	Message
0	Alarm Input Open
1	Low Water
2	Extra Low Water
3	High Water
4	High Gas Pressure
5	Low Gas Pressure
6	High Oil Pressure
7	Low Oil Pressure
8	High Oil Temp.
9	Low Oil Temp.
0	Low Atom. Media
11	High Temperature
12	Low Temperature
13	High Pressure
14	Low Pressure
15	Panel Switch Open
16	High Stack Temp.
17	Fan Interlock
18	End Switch Open
19	Oil Interlock
20	Gas Interlock
21	Forced Lockout
22	Extra High Water
23	Oil Gun Interlock
24	Low Draft

19.x (or 16.5 / 16.6) value	Message
25	Burner Door Switch
26	Emergency Stop
27	Exit Damper Closed
28	Low Water Flow
29	Low System Press
30	Excess Temp
31	PM5 Shutdown
32	Feed Tank Low
33	Phase Failure
34	Soft Start Fault
35	Feed Pump1 O/L
36	Feed Pump2 O/L
37	Blower Motor O/L
38	Dunk Failed Sink
39	Dunk Failed Rise
40	W/D Timer Fault
41	Low Pilot Press
42	High Pilot Press
43	Fan VSD Tripped
44	Pmp1 VSD Tripped
45	Pmp2 VSD Tripped
46	High BioGas Press
47	Low BioGas Press
48	BioGas Bster Tripped

CAUTION

- The NX6100 series of controllers allows for customization of various non-safety-critical functions, including the modulation control.
- Option parameters 20.0 to 29.9, which follow, relate to the default 'supplier control function' programmed in the control at the factory.
- To verify this has not been replaced by an application specific function, check with the equipment supplier and / or check option parameter 00.4, if available.

Option 20.0 – Set point Select input (0 – 16 and 21 to 36) [1]

This option parameter allows for a digital input to be used to select between modulation set point sets 1 and 2 (see option parameters 21.0 and 22.0 onwards). Select 0 to always give set point 1. A value of 16 will permanently select set point 2.
Values 21 to 36 invert the function.

Digital Input Numbers	Digital input used:
0	None. Always reads OFF.
1	Input 1, PB9 to PB10 Low Voltage
2	Input 2, PB9 to PB11 Low Voltage
3	Input 3, PB9 to PB12 Low Voltage
4	Input 4, PB9 to PB13 Low Voltage
5	Input 5, PB14 to PB15 Low Voltage
6	Input 6, PB14 to PB16 Low Voltage
7	Input 7, PB14 to PB17 Low Voltage
8	Input 8, PB5 to PB6 Low Voltage
9	Input 9, PB5 to PB7 Low Voltage
10	Not a real input. DO NOT USE
11	Not a real input. DO NOT USE
12	i/p 12, PE7 to live High Voltage
13	i/p 13, PE8 to live High Voltage
14	Not a real input. Used for custom applications
15	Not a real input. Used for custom applications
16	Always reads ON.

Option 20.1 – Boiler Shutdown input (0 – 16 and 21 to 36) [1]

A closed contact or high level on the input specified here will cause the boiler to go OFF and stay OFF until it is removed. No fault / alarm is generated. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 36 invert the function.

Option 20.2 – Low Fire Hold input (0 – 16 and 21 to 36) [1]

A closed contact or high level on the input specified here will cause the boiler to go to Low Fire and stay there until it is removed. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 36 invert the function.

Option 20.3 – Oxygen Trim Disable input (0 – 16 and 21 to 36) [1]

A closed contact or high level on the input specified here will cause the oxygen trim function to switch OFF (if it is selected) until it is removed. The input numbers are as specified in option parameter 20.0 above. See option parameter 30.5.
Values 21 to 36 invert the function.

Option 20.4 – Ignition Wait input (0 – 16 and 21 to 36) [1]

A closed contact or high level on the input specified here will prevent the burner from igniting. The drives stay at their ignition positions, but the light up sequence will not start until this input is removed. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 36 invert the function.

Option 20.5 – Purge Hold input (0 – 16 and 21 to 36) [1]

A closed contact or high level on the input specified here will prevent the burner moving on past pre-purge. The drives stay at their purge positions, until this input is removed. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 36 invert the function.

Option 20.6 – Purge Time Start input (0 – 16 and 21 to 36) [1]

A high level on the input specified here will prevent the pre-purge time from starting. The drives stay at their purge positions, until this input is removed and the specified pre-purge time has elapsed. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 36 invert the function.

Option 20.7 – Analog Input 5 function (0 - 2) [1]

This parameter configures the function of Analog input 5 (PA14 and 15) when the controller is set to 'Normal' mode.

Option parameter 20.7 Value	Digital input used:
0	This input does nothing.
1	**Remote tracking input.** If the controller is operating in AUTO modulation and a 4-20 mA signal is applied to the input terminals, then the controller will set the modulation rate proportionally to the input current where 4 mA = Low Fire, 20 mA = High Fire. If the signal goes below 3.5 mA or above 21 mA, this mode will be cancelled and normal PID modulation will resume.
2	**Remote Set point 1 Input.** If the controller is operating in AUTO modulation and a 4-20 mA signal is applied to the input terminals, then the controller will set the modulation rate against a new set point proportional to the input current, where the 4-20 mA levels are set in option parameters 21.8 and 21.9. If deviation limits are set (see option parameter 21.5), then the high and low control limits will also move with the set point. If the signal goes below 3.5 mA or above 21 mA, this mode will be cancelled, and normal set point 1 value will be applied.

Option 20.8 – Lead Boiler Select (0 – 16 and 21 to 36) [0]

This option parameter allows for a digital input to be assigned to select the controller as the *Lead Boiler* in the NX6100 series sequencing system (see option parameters 24.x for further details). The input numbers are as specified in option parameter 20.0 previously.
Values 21 to 36 invert the function.

Option 21.0 – Set point 1 enable (0 - 1) [1]

Use this option parameter to select set point 1.

Option 21.1 – Set point 1 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the control value used in the PID control loop for set point 1. When the controller is in AUTO mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as set by this parameter.

Option 21.2 – Set point 1 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the span of the proportional band that the PID control loop uses for set point 1. If the set point was 100 PSI, and this term was set to 10 PSI, then the proportional band would be from 90 to 100 PSI. A measured value of 90 PSI would give High Fire, and 100 PSI would give Low Fire, assuming no integral or derivative terms were entered.

A value of 0 means no proportional band – the burner would stay at High Fire until the set point is reached, then drop to Low Fire. Proportional control is therefore needed to prevent the measured value from overshooting the set point.

Option 21.3 – Set point 1 integral time (0 – 999 seconds) [0]

This is the integral time used in the PID control loop for set point 1. It can be set to any value from 0 to 999, seconds. If a time value of 0 is entered, the integral function is disabled. If >0 then the time entered is the number of seconds the PID system will take to give an additional modulation change equal to that currently given by the proportional term. Integral control is required for the burner to accurately reach its set point. The lower the number (apart from zero), the more affect the integral function has. A large number will cause the integral term to act very slowly.

Option 21.4 – Set point 1 derivative time (0 – 999 seconds) [0]

This is the derivative time used in the PID control loop for set point 1. It can be set to any value from 0 to 999. A value of zero will disable the derivative function. A non-zero value will have the effect of 'advancing' the modulation rate change caused by a constantly changing measured value by the number of seconds given. A low value will have little effect; a large value will cause a large effect.

Derivative control is seldom needed for fire-tube boilers, but can improve the response of the modulation system to sudden load changes, characteristic of water-tube boilers.

Option 21.5 - Set point 1 control limit type (0 - 2) [1]

This option parameter defines the control limit type for set point 1. The control limits are used to automatically turn the burner OFF when it is not needed and bring it back ON when it is needed.

Option parameter 21.5 value	Meaning
0	**No limits.** The burner will run until another method is used to switch it OFF.
1	**Absolute limit.** The values entered in option parameters 21.6 and 21.7 are the fixed limit values.
2	**Deviation limit.** The values entered in option parameters 21.6 and 21.7 represent a deviation (i.e., offset) from the set point 1 control value. This means that if the set point control value is changed, the limits are automatically changed correspondingly.

Option 21.6 - Set point 1 low limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

If the boiler is OFF due to a controlled shutdown, this parameter defines the measured value at which the boiler will be turned ON again.

Option 21.7 - Set point 1 high limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

If the boiler is ON and firing, this parameter defines the measured value at which the boiler will be turned OFF via a controlled shutdown.

Option 21.8 – Remote Set point 1 zero (4 mA) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

This is the zero value for the remote set point function specified by option parameter 20.7.

Option 21.9 – Remote Set point 1 span (20 mA) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

This is the span value for the remote set point function specified by option parameter 20.7.

Option 22.0 – Set point 2 enable (0 - 1) [1]

Use this option parameter to select set point 2.

Option 22.1 – Set point 2 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the control value used in the PID control loop for set point 2. When the controller is in AUTO mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as set by this parameter.

Option 22.2 – Set point 2 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the span of the proportional band that the PID control loop uses for set point 1. If the set point was 100 PSI, and this term was set to 10 PSI, then the proportional band would be from 90 to 100 PSI. A measured value of 90 PSI would give High Fire, and 100 PSI would give Low Fire, assuming no integral or derivative terms were entered.
A value of 0 means no proportional band.

Option 22.3 – Set point 2 integral time (0 – 999 seconds) [0]

This is the integral time used in the PID control loop for set point 2. It can be set to any value from 0 to 999, seconds. If a time value of 0 is entered, the integral function is disabled; otherwise, the time entered is the number of seconds the PID system will take to give an additional modulation change equal to that currently given by the proportional term. Integral control is required for the burner to accurately reach its set point. The lower the number (apart from zero), the more affect the integral function has. A large number will cause the integral term to act very slowly.

Option 22.4 – Set point 2 derivative time (0 – 999 seconds) [0]

This is the derivative time used in the PID control loop for set point 2. It can be set to any value from 0 to 999. A time value of zero will disable the derivative function. A non-zero value will have the effect of ‘advancing’ the modulation rate change caused by a constantly changing measured value by the number of seconds given. A low value will have little effect; a large value will cause a large effect.

Option 22.5 - Set point 2 control limit type (0 - 2) [1]

This option parameter defines the control limit type for set point 2. The control limits are used to automatically turn the burner OFF when it is not needed and bring it back ON when it is needed.

Option parameter 22.5 value	Meaning
0	**No limits.** The burner will run until another method is used to switch it OFF.
1	**Absolute limit.** The values entered in option parameters 22.6 and 22.7 are the actual limit values.
2	**Deviation limit.** The values entered in option parameters 22.6 and 22.7 represent a deviation (i.e., offset) from the set point 1 control value. This means that if the set point control value is changed, the limits are automatically changed correspondingly.

Option 22.6 - Set point 2 low limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

If the boiler is OFF due to a controlled shutdown, then this parameter defines the measured value at which the boiler will be turned ON again.

Option 22.7 - Set point 2 high limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

If the boiler is ON and firing, this parameter defines the measured value at which the boiler will be turned OFF by means of a controlled shutdown.

Option 23.0 – Warming Enable (0 or 1) [1]

This parameter allows a warming function to be applied to the boiler and enables option parameters 23.1 and 23.2. If the value is zero then no warming limit is applied.

Option 23.1 – Warming Limit (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

During the start-up phase for the burner, if the measured boiler pressure or temperature value is lower than that specified in this option, the controller will hold the burner at Low Fire until the value specified is reached. The controller will hold the burner at Low Fire (in status 15) indefinitely unless a non-zero time has been entered in option parameter 23.2.

Note: If during normal modulation, the measured value falls below this limit after having been above it, the warming function will not be re-applied. The warming function is only applied when there is a burner start-up.

Option 23.2 – Warming Time (0 to 999 minutes) [1]

This parameter specifies a maximum time to hold the burner at Low Fire, before ignoring the warming limit and allowing normal modulation.

Note: If the burner goes OFF (for any reason other than power interruption), and the measured value falls below the warming limit, the warming function will not be activated again until this time has passed.

Option 24.0 - Number of sequence *Lags* (0 - 3) [1]

This option defines the number of *Lags* available to this controller if it were a *Lead*.
If this option is set to 0 then the controller will not be available as *Lead* or *Lag* in a sequence.

Option 24.1 - 1st *Lag* communications address (0 – 15) [1]

This defines the address of the first *Lag* to be selected if this controller is the *Lead*.

Option 24.2 - 2nd *Lag* communications address (0 – 15) [1]

This defines the address of the second *Lag* to be selected if this controller is the *Lead*.

Option 24.3 - 3rd *Lag* communications address (0 – 15) [1]

This defines the address of the third *Lag* to be selected if this controller is the *Lead*.

Option 24.5 - *Lead* type (0 – 3) [1]

Defines how the Lead status is determined.
0 = No *Lead* select available
1 = *Lead* selected from Keypad
2 = *Lead* selected from Digital input
3 = *Lead* selected from Digital communications

Option 24.6 - *Lag* ON mod rate (51 – 100%) [1]

Defines the modulation rate at which to command the next *Lag* boiler to be *on-line*.

Option 24.7 - *Lag* ON delay (minutes) [1]

This delay time is the time for which the modulation rate must exceed the value in Option 24.6 before the next lag is commanded *on-line*.

Option 24.8 - *Lag* OFF mod rate (0 – 49%) [1]

Defines the modulation rate at which to *Bank* the last *Lag* boiler, i.e., it sets the standby modulation level.

Option 24.9 - *Lag* OFF delay (minutes) [1]

This delay time is the time for which the modulation rate must be below the value set in Opt 24.8 before the next lag is commanded to *Bank*.

Option 28.0 – Analog input 1 (PA7 to PA11, 4-20 mA) display value decimal point (0 – 2) [1]

Set this option to a value that determines the position of the decimal place for the input value display.

Option parameter 28.0, 28.3 & 28.6 values	Description
0	Measured value displayed with no decimal places. Range of values is from 000 to 999.
1	Measure value displayed with one decimal place. Range of values is from 00.0 to 99.9.
2	Measure value displayed with two decimal places. Range of values is from 0.00 to 9.99.

Option 28.1 – Analog input 1 zero value (4 mA input) [1]

Set this option to the value that a 4mA input current will represent. Often this will be zero, but non-zero values may be used. For example, a value of 100 may be better suited for a minimum Gas Flow to ensure best resolution.

Option 28.2 – Analog input 1 span value (20 mA input) [1]

Set this option to the value that a 20mA input current will represent.

Option 28.3 – Analog input 2 (PA8 to PA11, 4-20 mA) display value decimal point (0 – 2) [1]

Set this option to a value that determines the position of the decimal place for the input value display. See 28.0 above.

Option 28.4 – Analog input 2 zero value (4 mA input) [1]

Set this option to the value that a 4mA input current will represent. Often this will be zero, but non-zero values may be used.

Option 28.5 – Analog input 2 span value (20 mA input) [1]

Set this option to the value that a 20mA input current will represent.

Option 28.6 – Analog input 3 (PA9 to PA11, 4-20 mA) display value decimal point (0 – 2) [1]

Set this option to a value that determines the position of the decimal place for the input value display. See 28.0 above.

Option 28.7 – Analog input 3 zero value (4 mA input) [1]

Set this option to the value that a 4mA input current will represent. Often this will be zero, but non-zero values may be used.

Option 28.8 – Analog input 3 span value (20 mA input) [1]

Set this option to the value that a 20mA input current will represent.

Option 29.0 – 4-20mA Output 1 function if not VSD [1]

Set this option to a value from the table below to enable an Analog output to re-transmit system variables as a 4-20 mA signal.

For example, if this output is to represent Flue Gas Temperature, then set a value of 22.

If this output has been assigned for VSD (Variable Speed Drive) control in option 3.x, then this setting will be ignored.

Option 29.0, 29.3 and 29.6 function list:					
Value	Function		Value	Function
0	Drive 0 Position		20	Spare
1	Drive 1 Position		21	Boiler operating Set point
2	Drive 2 Position		22	Flue gas temperature
3	Drive 3 Position		23	Spare
4	Drive 4 Position		24	Spare
5	Drive 5 Position		25	Spare
6	Drive 6 Position		26	Spare
7	Drive 7 Position		27	Spare
8	Drive 8 Position		28	Spare
9	Drive 9 Position		29	Spare
10	Spare		30	Burner modulation rate
11	Spare		31	Analog i/p 1
12	Measured Value		32	Analog i/p 2
13	Boiler Efficiency		33	Spare
14	Inlet air temperature		34	Spare
15	Flue gas oxygen level		35	Gas pressure
16	Calculated flue gas CO_2 level		36	Spare
17	Flue gas CO level		37	Flame1 level (PA5/6 i/p)
18	Spare		38	Flame2 level (PF1/2 i/p)
19	Spare		39	Combustion air pressure
			40	Analog i/p 3

Option 29.1 – Output 1 zero value (4 mA output) [1]

Set this option to the value that a 4mA output represents. Often this will be zero, but non-zero values may be used. For example, a value of 100 may be better suited for a minimum Flue Gas Temperature to ensure best resolution.
If this output has been assigned for VSD control in option 3.x, then this setting will be ignored.

Option 29.2 – Output 1 span value (20 mA output) [1]

Set this option to the value that a 20mA output will represent. For example, value of 200 may be better suited for a maximum Flue Gas Temperature to ensure best resolution.

If this output has been assigned for VSD control in option 3.x, then this setting will be ignored.

Option 29.3 – 4-20 mA Output 2 function if not VSD [1]

Set this option to a value from the table in 29.0 to enable an Analog output to re-transmit system variables as a 4-20 mA signal.
If this output has been assigned for VSD (Variable Speed Drive) control in option 3.x, then this setting will be ignored.

Option 29.4 – Output 2 zero value (4 mA output) [1]

Set this option to the value that a 4mA output will represent. Often this will be zero, but non-zero values can be used.
If this output has been assigned for VSD control in option 3.x, then this setting will be ignored.

Option 29.5 – Output 2 span value (20 mA output) [1]

Set this option to the value that a 20mA output will represent.
If this output has been assigned for VSD control in option 3.x, then this setting will be ignored.

Option 29.6 – 4-20 mA Output 3 function if not VSD [1]

Set this option to a value from the table in 29.0 to enable an Analog output to re-transmit system variables as a 4-20 mA signal.

Option 29.7 – Output 3 zero value (4 mA output) [1]

Set this option to the value that a 4mA output will represent. Often this will be zero, but non-zero values can be used.

Option 29.8 – span value (20 mA output) [1]

Set this option to the value that a 20mA output will represent.

Option 30.0 – Oxygen probe interface serial number [2]

Each CANbus device connected to the system has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to uniquely identify each device.

When the system is in Commission mode the serial numbers of all CANbus devices that are connected are collated by the controller and displayed as a 'list' to allow the selection of the relevant serial number against a specific function.
Scrolling the list in an upward direction will scroll through all oxygen probe interface options available until '0, nothing' is displayed. Enter this value to disconnect the specified device from any hardware. Scrolling the list downwards will stop when the currently selected item is displayed, and the value will stop flashing.

The display will show type information for each device present (such as 'O2 probe'), but the commissioning engineer should be aware of which serial number device is being used for which function.

Option 30.1 - Oxygen probe calibration offset value (0 – 999) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be set to the calibration offset value that is specified with the probe supplied.

Option 30.2 - Oxygen probe calibration gain value (0 – 999) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be set to the calibration gain value that is specified with the probe supplied.

Option 30.3 - Oxygen probe calibration gas concentration (0.00 – 9.99%) [1]

This option parameter is only available if option 30.0 is non-zero.
This option parameter must be set to the percentage oxygen concentration of the calibration gas used if the probe is to be calibrated using a reference gas (see option parameter 30.6).
The range of this parameter is 0.00 - 9.99%.

Option 30.4 – Flue and inlet sensor temperature units (0 – 1) [1]

This option parameter is only available if option 30.0 is not zero.
Set this option parameter to select the units for display of both temperatures on either °C or °F.

Option parameter 30.4 value	Meaning
0	**°C.** The temperature value will be displayed in °C.
1	**°F.** The temperature value will be displayed in °F.

Please note that temperature limits MUST be set in the correct units.

Option 30.5 - Oxygen input function (0/1) [1]

This option parameter can only be set above 1 if option 30.0 is not zero.

Use this option parameter to configure the oxygen input for a monitoring function or trim function. The two functions are explained below:

Option parameter 30.5 value	Meaning
0	**Monitor only.** The oxygen value is only used to display the measured oxygen level.
1	**Closed loop trim.** The oxygen value provides both a display of the measured oxygen level and a feedback signal for closed loop trim control function of the NX6100 series controller.
2	**Closed loop trim with feed forward.** This option may not be available. **This is an advanced mode of operation and is beyond the scope of this manual.**

Option 30.6 - Oxygen probe calibrate enable (0 – 2) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be used when calibrating the NX6083x/NXPK22445x oxygen probe. There are three possible values:

Option parameter 30.6 value	Meaning
0	**No calibrate.** This is the normal operating condition, where the probe measures the oxygen concentration in the flue.
1	**Calibrate in air.** The probe 'offset' will be calibrated at the normal atmospheric oxygen concentration.
2	**Calibrate in reference gas.** The probe 'gain' will be calibrated in a reference gas with a nominal oxygen concentration (typically 3.0%), the level specified in option parameter 30.3.

After this calibration has been successfully completed, the values in 30.1 and 30.2 will be updated automatically.

Option 30.7 - Boiler transport delay (5 – 60 seconds) [1]

The Boiler transport delay is the time taken for 'gas' to travel from the burner to the oxygen probe. This delay varies with burner fire rate.

In order for the oxygen trim control loop to be stable, this parameter must be set accurately to the transport delay of the boiler **when at Low Fire**. This option can be set between **5** and **60** seconds inclusive.

- To measure the transport delay, ignite the burner and enter Adjust Ratio mode. Select the Low Fire set point and allow time for the flue oxygen reading to settle. After the oxygen reading is steady, make a step change to the fuel: air ratio and start a timer. As soon as the measured oxygen reading **begins** to change, stop the timer. Set the option parameter to the recorded timer value in seconds.

- Automatic Trim commissioning (option 30.9) will attempt to set this automatically. However, the engineer must check the value.

Option 30.8 - Reset oxygen trim profile (0/1) [1]

This option parameter allows the learned trim profile to be reset. If the option is set to 1, any learned profile currently held in memory will be reset, and the trim drives will return to their commissioned positions for the corresponding modulation position. After the profile has been reset, this option parameter will automatically reset to 0.

Option 30.9 – Automatic Trim commissioning (0 / 1) [1]

Option parameter 30.9 value	Meaning
0	**Not selected.**
1	**Perform automatic trim characterization.** The controller will attempt to characterize the burner profile by calculating flow values and selecting oxygen set points to match the currently commissioned points. Automatic Trim commissioning will be performed under the following conditions: • An oxygen probe is fitted and fully operational. • The controller is in Adjust Ratio mode. • A hydrocarbon ratio has been entered for the current fuel profile (see option parameters 35.1 – 35.4).

Option 31.0 - Limit Modulation Range (0 to 1) [2]

By default, the controller modulates the burner between the set points P_3 (Low Fire) and P_h (High Fire), where P_h is the last set point entered in Commission Ratio mode. If oxygen trim is fitted, it is not possible for any drive position to be trimmed lower than point P_3 (Low Fire) or higher than point P_h (High Fire). This means that, you cannot take fuel or air OFF at Low Fire, and you cannot add fuel or air at High Fire.

Setting this option parameter to a value of 1 will limit the modulation range of the burner such that the modulate range will be between points P_4 (one set point above Low Fire) and P_{h-1} (one set point below High Fire). Since oxygen trim is not affected by this limitation, each drive can be trimmed between the points P_3 and P_h. This means that it is not possible to over-fire or under-fire the burner, but a degree of trim may still be achieved at high and Low Fire. Note that this option may reduce the turn down ratio of the boiler.

Option parameter 31.0 value	Meaning
0	Modulation not limited. Burner modulates from P_3 to P_h. Oxygen trim works over full range from P_3 to P_h, but may not be able to apply trim at High Fire, or Low Fire – depending on trim direction. The burner always modulates to the desired modulation rate, which may limit the system's ability to maintain the desired oxygen value.

1	Normal modulation range limited to P_4 to P_{h-1} always. Oxygen trim works over full range from P_3 to P_h, and can apply extra trim at low and High Fire – limited by P_3 and P_h.

Options 31.1 to 31.4 - Trim Type for profiles 1 to 4 (0 to 2) [2]

These option parameters determine the type of oxygen trim applied to profiles 1 to 4. These parameters are used together with the parameters entered in option parameters 2.0 to 2.9 to determine which drives are trimmed, and in which direction.

Parameter	Meaning
31.1	Trim Type for profile 1.
31.2	Trim Type for profile 2.
31.3	Trim Type for profile 3.
31.4	Trim Type for profile 4.

Parameter value in 31.X	Meaning
0	No Trim. Do not apply oxygen trim when running on this profile.
1	Air Trim. Trim 'Air' drives when running on this profile (see option parameters 2.0 to 2.9.)
2	Fuel Trim. Trim 'Fuel' drives when running on this profile (see option parameters 2.0 to 2.9.)

Option 32.0 - Trim limit default (0/1) [1]
Options 32.1 to 32.4 - Trim limits (0.0 – 25.0) [1]

Option 32.0 is only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

It is possible for the system to apply trim to the air or fuel drives up to a maximum deviation of ±25.0% of the air or fuel flow, for the chosen trim drives, at each profile set point.

If option 32.0 is set to 0, the default trim limit will be ±5.0% for all profile selections. Option parameters 32.1 to 32.4 will not be available.

If option 32.0 is set to 1, you can individually adjust the trim limit for each profile selection using option parameters 32.1 to 32.4. The trim limit can be adjusted from 0.0% (no trim) up to a maximum of ±25.0% (maximum allowable trim).

It is the responsibility of the commissioning engineer to make sure the trim limit set will not allow a hazardous combustion condition to occur in the event of an oxygen probe failure. Where oxygen is to be considered safety critical, use option parameters 42.X to set up a second oxygen monitor. When a second oxygen monitoring system is used, the oxygen can be considered fail-safe, and the trim limits can be set up to 50% instead of 25%, provided the maximum time between probe calibrations does not exceed six months.

Options 33.1 to 33.4 - Trim integral term (0.0 – 99.9%) [1]

Options 33.1 to 33.4 are only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

In order for the oxygen trim control loop to be stable, the integral gain must be set correctly. Options 33.1 to 33.4 allow the integral term to be set individually for each profile combination to any value between 0.0 and 99.9%. As a general recommendation, the integral term should be initially set to 15.0%.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the integral term for any profile selection.

Option 34.0 - Trim proportional gain default (0/1) [1]
Options 34.1 to 34.4 - Trim proportional gain (0.0 – 99.9%) [1]

Options 34.0 to 34.4 are only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

If oxygen trim proportional term is not required for any profile, then set option parameter 34.0 to **0**.

If oxygen trim proportional term is required, set option parameter 34.0 to **1**. Option parameters 34.1 to 34.4 will then become available. Options 34.1 to 34.4 allow the loop gain to be set individually for each profile selection to any value between 0.0 and 99.9%.

Oxygen trim proportional gain is not normally required.

Option 35.0 – Inlet temperature sensor serial number [2]

Each CANbus device connected to the system has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to uniquely identify each device.

When the system is in Commission mode the serial number of all the connected devices is read by the controller and displayed as a 'list' to allow the selection of the relevant serial number unit to be made.

Scrolling the list in an upward direction will scroll through all temperature sensor options available until '0, nothing' is displayed. Enter this value to disconnect the specified device from any hardware.

Scrolling the list downwards will stop when the currently selected item is displayed, and the value will stop flashing.

Options 35.1 to 35.4 - Hydrocarbon ratio of fuel per profile (0.00 – 9.99) [0]

If you need to display the calculated burner efficiency or 'Automatic Trim commissioning', you must enter the hydrocarbon ratios for the required fuels. You can set these between **0.0** and **9.99** inclusive, where the value entered is the hydrocarbon ratio x 10.
For example, for light oil the hydrocarbon ratio is 0.157.
Therefore, the value to enter for this parameter = 0.157 x 10 = **1.57**.

Note: When firing multiple fuels, the mixture between the fuels fired may vary across the firing range of the burner. When this happens, the effective hydrocarbon ratio and calorific value of the fuel combination will change. The accuracy of the calculated efficiency and the 'Automatic Trim commissioning' procedure will be adversely affected by this. It maybe that these functions should not be used, in which case these values should be entered as zero.

Options 35.5 to 35.8 - Calorific values of fuels/profiles 1 to 4 respectively (0.0 – 99.9) [0]

These option parameters are only available if option 35.0 (inlet temperature sensor) is not set to zero.

If you need to display the calculated burner efficiency, you must enter the calorific value of the required fuels. You can set this between **0.0** and **99.9 MJ/kg** inclusive.

Note: When firing multiple fuels, the mixture between the fuels fired may vary across the firing range of the burner. When this happens, the effective hydrocarbon ratio and calorific value of the fuel combination will change. The accuracy of the calculated efficiency and the 'Automatic Trim commissioning' procedure will be adversely affected by this. It maybe that these functions should not be used, in which case these values should be entered as zero.

The table below shows the calorific values and hydrocarbon ratios of several common fuels. Use these values as a guide only.

If you need display to show the gross efficiency, then in addition to entering the gross calorific values, you must enter a non-zero value for the boiler radiated heat loss.

Fuel	Gross calorific value	Net calorific value	Hydrocarbon ratio (x10)
Gas	52.8	47.6	3.20
Light oil	45.6	42.8	1.57
Medium oil	43.1	40.8	1.35
Heavy oil	42.9	40.5	1.28

Option 35.9 - Boiler radiated heat loss (0.0 – 9.9%) [0]

This option parameter is only available if option 35.0 (inlet temperature sensor) is non- zero.

If this option parameter is set to zero the unit will calculate the net efficiency, if non-zero it will calculate gross efficiency.
For accurate calculation of boiler gross efficiency, this option parameter must be set to the value of the heat lost through the shell of the boiler at High Fire as a percentage of the burner's output at High Fire. The range of this parameter is **0.0** to **9.9%**.

Option 36.0 - Flue temperature alarm select (0/1) [1]

This option parameter is only available if option 30.0 is nonzero.

If option 36.0 is set to **0**, the flue temperature high and low alarms are disabled.

If option 36.0 is set to **1**, this enables the flue temperature high and low alarms and enables option parameters 36.1 to 36.4 and 37.1 to 37.4.

Options 36.1 to 36.4 - Flue temperature low alarm values (0 – 999) [1]

Using option parameters 36.1 to 36.4, you can set a different flue temperature low alarm value for each profile combination. You can set each option parameter to any value between **0** and **999** inclusive. Set the temperature units with respect to option parameter 30.4.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the low alarm value for any profile selection.

When the flue temperature drops below the low alarm value for the selected profile, a fault number will appear.

Options 37.1 to 37.4 - Flue temperature high alarm values (0 – 999) [1]

Using option parameters 37.1 to 37.4, you can set a different flue temperature high alarm value for each profile selection. Each option parameter can be set to any value between **0** and **999** inclusive. The temperature units should be set with respect to option parameter 30.4.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the high alarm value for any profile selection.

When the flue temperature rises above the high alarm value for the selected profile combination, a fault number will appear.

Option 38.0 - Oxygen alarm select (0 – 2) [1]

Option parameter 38.0 is only available when option 30.0 (oxygen input select) is not set to zero, and the optional oxygen probe interface unit is connected.

Since the oxygen alarm values relate to the oxygen set point values, you must first enter the oxygen set point values in Adjust Ratio mode.

Option parameter 38.0 value	Meaning
0	**Alarms disabled.** Oxygen low and high alarms are disabled.
1	**Alarms enabled, no non-volatile lockout.** Oxygen low and high alarms are enabled and option parameters 38.1 to 41.4 are enabled. If an alarm value is exceeded, a fault number will appear but no non-volatile lockout will occur.
2	**Alarms enabled with non-volatile lockout.** Oxygen low and high alarms are enabled and option parameters 38.1 to 41.4 are enabled. If an alarm value is exceeded, a fault number will appear and a non-volatile lockout will occur.

Options 38.1 to 38.4 - Oxygen low alarm values at Low Fire (0.0 – 99.9%) [1]
Options 39.1 to 39.4 - Oxygen low alarm values at High Fire (0.0 – 99.9%) [1]

Options 40.1 to 40.4 - Oxygen high alarm values at Low Fire (0.0 – 99.9%) [1]
Options 41.1 to 41.4 - Oxygen high alarm values at High Fire (0.0 – 99.9%) [1]

Using option parameters 38.1 to 41.4, you can set different oxygen alarm values at High Fire and Low Fire for each profile.

At firing positions other than High and Low Fire, the alarm limit is set at the average of the two points. For example, if the oxygen limit has been entered as 5% of set point at Low Fire, and 10% of set point at High Fire, then the limit at mid fire will be 7.5%.

The alarm limits may set to any value between **0.0** and **99.9%**, where the value entered relates to a **percentage deviation** from each oxygen set point in the firing range.

An oxygen low alarm will be caused by one or more of the following events:

- The level drops below 0.5% O_2 for 30 seconds
- The level drops below the low alarm limit for 2 minutes 30 seconds
- The level drops below **twice** the low alarm limit for 30 seconds

An oxygen high alarm will be caused by one or more of the following events:

- The level rises above the high alarm limit for 2 minutes 30 seconds
- The level rises above **twice** the high alarm limit for 30 seconds

Option parameters 42.0 to 42.6.

Parameters in the range 42.0 to 42.6 may have 2 different functions depending upon the combustion monitoring and adjustment requirements. Setting the value of option 42.0 will determine the function of options 42.1 to 42.6.
For this reason, the parameters are listed and described twice in the following pages with their respective functions.

Option 42.0 – Second oxygen probe or CO trim selection [2]

In applications where the flue oxygen level is critical and large amounts of trim need to be applied, correct operation of the oxygen probe may become a safety issue. For normal applications, the commissioning engineer must determine the trim limits based on his or her judgement that if the oxygen probe gives an incorrect oxygen level, trim (or lack of it) within those limits will be safe.

For applications when the oxygen feedback is genuinely safety critical, two probes and probe interfaces must be used. Enter the serial number for the second controller here, selected from devices discovered on the CANbus, as for option parameter 30.0.

In applications where CO monitoring and trim are a requirement, enter the serial number for the oxygen probe controller entered in option 30.0.

Option 42.1 – Second oxygen probe calibration offset (0 – 999) [1]

The same as option parameter 30.1, but for the second oxygen probe.

Option 42.2 – Second oxygen probe calibration gain (0 – 999) [1]

The same as option parameter 30.2, but for the second oxygen probe.

Option 42.4 – Max oxygen variation (0 – 9.9 %) [1]

Where the second oxygen probe is being used as a cross check on the first one, enter the maximum permitted variation between the two oxygen readings here. It is suggested that a value of around 0.5 % be used, but the application may demand a higher setting if the two probes are not in exactly the same part of the flue. The controller will lock out within 30 seconds if the two oxygen readings are outside the specified variation.

When this parameter is non-zero, the flue oxygen limits will be checked on a ‘worst case’ basis. This means that the low oxygen limit (see options 38.X, 39.X) is checked against the lower of the two oxygen probe readings, and the high oxygen limit (see options 40.X, 41.X) is checked against the higher of the two oxygen probe readings. If there is a fault with second oxygen probe, the burner will also lock out.

If you leave this parameter at zero (0.0), no checking will be done, but you can still read the oxygen and temperatures associated with second oxygen probe in the Engineer's Key Data (EK75-79).

Note: When there are two probes for fail-safe oxygen monitoring, each probe must be tested and calibrated at least once every six months.

Option 42.5 – Max flue temp variation (0 to 999 ºC) [1]

If this value is non-zero, the burner will lock out if the two oxygen probes vary by more that this many degrees (Celsius). You would use this in applications where flue temperature is particularly critical.

Option 42.6 – Second oxygen probe calibration enable (0 to 2) [1]

This option is identical to option 30.6, except that it relates to the second oxygen probe. Note, the calibration gas concentration used must be as entered in option parameter 30.3.

Option 42.1 – CO measurement range ppm (0 – 9999) [1]

Set this to the span value (20mA) in ppm for the CO measuring device.

Option 42.2 – CO trim gain (0 – 250) [1]

CO trim gain sets the rate at which the CO trim acts – modifies the O2 Set point.
Fireye recommends setting this parameter to a value of 10% initially, and then adjusting to suit the application response.

Option 42.3 – CO Set point ppm (0 – 9999) [1]

Set this parameter to the desired CO value for all points in the firing range.

Option 42.4 – Maximum oxygen reduction (0 – 50 %) [1]

Set this parameter to a limit of oxygen Set point adjustment by the CO trim function. The number is a percentage of the normal oxygen Set point.
As an example, if this value is 10% then when the burner is at low-fire and the O2 Set point is 5%, the CO trim system will only reduce the O2 Set point to 4.5%. At High fire with the O2 Set point at 3% the CO trim system will only reduce the O2 Set point to 2.7%.

Option 42.5 – Maximum oxygen increase (0 – 50%) [1]

Set this parameter to a limit of Oxygen Set point adjustment by the CO trim function. The number is a percentage of the normal oxygen Set point.
As an example, if this value is 10% then when the burner is at low-fire and the O2 Set point is 5%, the CO trim system will only increase the O2 Set point to 5.5%. At High fire with the O2 Set point at 3% the CO trim system will only increase the O2 Set point to 3.3%.

Option 42.6 – High CO Alarm limit ppm (0 to 9999) [1]

Set this parameter to a level of CO at which an alarm will sound and F54 enunciated on the HMI.
Note: The Limit must be exceeded for a period of 30 seconds before the Alarm is made and burner lockout.

Option 42.7 – Air pressure profiling input (0 to 3) [2]

Set this value to the input number which is connected to the low-pressure sensor for pressure profiling when the burner is ON

Option 42.8 – Analog Air pressure sensor Span value (mbar) OR CANbus Air pressure sensor low limit (mbar) [2]

When the Air pressure sensor is connected to an Analog input as defined in Opt 42.7 above then set this value to the span value of the low-pressure sensor.

When the Air pressure sensor is a NX6087 CANbus device, set this value to the minimum air pressure for safe combustion.

Option 42.9 – Air pressure Error (%) [2]

Set this value to the maximum variation in air pressure allowed from set point before the burner will lock out.

Option 43.3 – CAN Boiler sensor serial number [2]

DEFAULT: 0
Where a CANbus sensor is used to measure the boiler or process measured value select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 15.x set the span and limits for the burner operation.

Option 43.4 – CAN Gas pressure sensor serial number [2]

DEFAULT: 0
Where a CANbus gas pressure sensor is used for the VPS and operating limits select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 10.x set the span and VPS test characteristics.

Option 43.5 – CAN Combustion air pressure sensor serial number [2]

DEFAULT: 0
Where a CANbus combustion air pressure sensor is used for the air:fuel profiling select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x.
Options 42.8 and 42.9 configure the operating limits for this sensor type.

Option 43.6 – CAN Gas pressure sensor2 serial number [2]

DEFAULT: 0
Where a CANbus gas pressure sensor is used for the VPS and operating limits select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 11.x set the span and VPS test characteristics.

Option 44.0 – FGR Hold-Off Mode (0 to 10) [1]

This option defines how the FGR function is delayed during start-up of the burner process. This may be from a measurement of the recirculation gases or a timer.

Option parameter 44.0 value	Meaning
0	FGR Hold-Off disabled.
1	FGR is held off until the temperature of the flue gas measured at Analog input 1 reaches the value defined in option 44.1. **IMPORTANT:** Set Option 28.0 = 0, then set options 28.1 and 28.2 for the sensor range.
2	FGR is held off until the temperature of the flue gas measured at Analog input 2 reaches the value defined in option 44.1. **IMPORTANT:** Set Option 28.3 = 0, then set options 28.4 and 28.5 for the sensor range.
3	FGR is held off until the temperature of the flue gas measured at Analog input 3 reaches the value defined in option 44.1. **IMPORTANT:** Set Option 28.6 = 0, then set options 28.7 and 28.8 for the sensor range.
4 to 9	No function. **Do Not Use.**
10	FGR is held off for the time set by Option 44.1.

Option 44.1 – FGR Hold-Off Limit. (0 to 999) [1]

This option defines the limit value when the FGR function is released to operate.

When Option 44.0 has a value 1, 2 or 3. the value set represents temperature as '°C or °F. The scaling for this value is set in Option 28.x, as appropriate to the input selected by the value in Option 44.0.

When option 44.0 has a value of 10, the value set represents a time interval, in seconds, from the point that the burner is released to modulate.

Option 44.9 – Reset Fault Log (0 - 1) [1]

This option clears the current the fault history.
Set the option parameter to 1 then press RUN then ENTER. The controller will erase the fault history and return to Run mode.

Option 45.0 - Erase / Restore enable (0 - 1) [2]

CAUTION

- If this value is displayed as a ‘2’, the option parameter data has been ‘uploaded’ into the control. Make sure all option parameters are set to match the requirements of the burner to which it is connected. Failure to do so could cause a hazardous condition to occur.
- After you have checked that all option parameters match the requirements of the burner to which it is connected, reset this option parameter to zero to allow the system to operate.
- If you try to operate the system with this option parameter set to ‘2’, it will generate a fault and the control will perform a non-volatile lockout, preventing the burner from firing.

In order to erase information in memory for a specific profile selection (see option parameter 45.1), this option must be set to '1'. When the controller is set back to RUN mode this parameter will automatically reset to '0'.

In order to restore information to the control from the back-up held in the display (see option parameter 45.2), this option must be set to a ‘1’. When the controller is set back to RUN mode this parameter will automatically be reset to '0'.

If this option parameter is set to ‘2’, read the Caution message above.

Option 45.1 - Erase command (0 - 5) [2]

When the erase enable (option 45.0) is set to '1', this option parameter determines which information will be erased when the controller is set back to RUN mode.

0- No erase.
1- Erase profile 1.
2- Erase profile 2.
3- Erase profile 3.
4- Erase profile 4.
5- Erase all set points and initialize all option parameters.

IMPORTANT: If you select **5**, **all profile set points will be deleted and all option parameters will reset to default values**. The controller will be initialized to the factory default settings.

Option 45.2 - Restore command (0 - 999) [2]

When erase / restore enable (option 45.0) is set to '1', this option parameter allows the back-up data held in the display to be loaded into the main unit, this may take up to 5 minutes to complete during which time the controller will not allow the burner to operate.

To restore the data from the back-up held in the display set this option parameter to ‘100’.

If you select **100**, **the data from the back-up data held in the display will download into the controller unit. Note: You must exit commissioning mode to cause restore to occur.**

A back-up of the data held in the main controller unit is automatically stored in the display when the controller is in modulation status for a period of 15 minutes.

WARNING: Setting the value in option 45.2 to a value of 817 must be used with extreme caution. ANY interlocks wired to the NXEXP300 will be ignored once option 43.0 is reset to 0.

This option allows the commissioning engineer to deselect the NXEXP300 by changing option 43.0 to a value of 0. After entering the value of 817, exit commissioning mode, then, without shutting the power to the control off, re-enter full commissioning mode. At this point, option 43.0 will allow a value of 0 to be entered. This disables the NXEXP300.

RESTORE 382:

This option value allows the commissioning engineer to replace a servomotor without having to verify the entire combustion profile for each of the profiles the servo is assigned to. After replacing the defective servomotor, enter the value of 382 at option 45.2, then exit commissioning mode. If the fault F64 Verify Profile was present when the value was entered, the fault will become clearable, C64. Clear the fault and the burner will run without the need for “nexting” through all profile points to high fire. After the burner is started, minor adjustments may be required using the adjust ratio mode.

WARNING: It is strongly advised that at least one profile be verified. It is vitally important that the servo be installed exactly as the previous servo. This assures the new servo is properly installed and reasonably close for safe combustion and burner stability.

Suggestion: After the burner is lit and warmed up at low fire, combustion should be checked with a calibrated portable analyzer. If the combustion is not acceptable, the problem may be due to oversized motor mounting holes or undersized mounting screws. It may be possible to correct this by loosening the mounting screws and turning the motor slightly. This is especially true with fuel servomotors as a slight adjustment may make a significant fuel flow change. Once low fire is corrected, the remaining curve may fall into place. **PLEASE BE AWARE OF THE DANGERS OF ABRUPT CHANGES IN FUEL FLOW.**

Option 45.3 and 45.4- Password Override [2]

The standard supplier passcode (903038) can be overridden by setting options 45.3 and 45.4 (set 45.0 = 1 first for access). Once a new passcode is set in these options, the code 903038 will no longer work. OEM’s may wish to prevent access in some situations, and this provides a method to do that.

If the non-standard passcode is forgotten then a ‘master passcode’ will need to be obtained, based on the unit serial number. This can be obtained using an on-line passcode system maintained by Fireye.

2. Glossary of Terms

Glossary Term	Explanation
Air-atomizing oil burner	A burner for firing oil in which the oil is atomized by compressed air which is forced into and through one or more streams of oil, breaking the oil into a fine spray.
Air damper	A valve that controls air flow for the combustion process.
Air purge	The removal of undesired matter by flushing through with air.
Ambient	Local environment e.g., ambient temperature.
Analog signals	Varying electrical signals e.g., 0-5 V or 4-20 mA.
Atomization	The process whereby a volume of liquid is converted into a cloud of tiny drops. The aim is to produce a high surface area to mass ratio, so that the liquid will vaporize quickly and burn more easily.
Atomizer	This is part of an oil burner that breaks up the fuel oil flow into tiny particles, either by mechanical means and/or the use of an atomizing medium. The oil and atomizing medium mix together in the atomizer and then flow to the oil nozzle to be discharged into the furnace.
Automatic lighter or igniter	A means for starting the ignition of fuel without manual intervention. Usually applied to liquid, gaseous, or pulverized fuel.
Auxiliary relay	Relay with a programmable function.
Backlash	See Hysteresis.
Balanced draft	The maintenance of a fixed value of draft in a furnace at all combustion rates by control of incoming air and outgoing products of combustion.
Banking	This means holding a boiler in a low-pressure or low-temperature standby mode, ready to respond to a demand for more output.
Bar	Absolute pressure in bar, where 1 bar = approx. 14.5 psi, which equates to the average atmospheric pressure at sea level.
Barometric pressure	Atmospheric pressure as determined by a barometer, usually expressed in inches of mercury or mbar.
Bar(g) or barg	Pressure in Bars measured at the Gauge, i.e., relative pressure, not absolute. This is the pressure in bars above ambient or atmospheric pressure.
Blowdown	The drain connection including the pipe and the valve at the lowest practical part of a boiler, or at the normal water level in the case of a surface blowdown. The amount of water blown down.
Blowdown valve	A valve generally used to continuously regulate the concentration of solids in the boiler. This is not the drain valve.
Blower	A fan used to force air under pressure.
Boiler	A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity, or nuclear energy.

Glossary Term	Explanation
Boiler down time	Time when a boiler is broken or not available for use.
Boiler, high-pressure, steam or vapor	A boiler in which steam or vapor is generated at a pressure exceeding 15 psig/1 barg.
Boiler, hot-water-heating	A boiler in which no steam is generated and from which hot water is circulated for heating purposes and then returned to the boiler.
Boiler, hot-water-supply	A boiler functioning as a water heater.
Boiler, low-pressure-steam or vapor	A boiler in which steam or vapor is generated at a pressure not exceeding 15 psig/1 barg.
Boiler modulation	The varying of the boiler output.
Boiler “online”	Boiler in operation.
Boiler Set point	The control temperature or pressure for the boiler.
Boiler water	A representative sample of the circulating boiler water after generated steam has been separated, and before the incoming feed water or added chemical becomes mixed with it so that its composition is affected.
Btu (British Thermal Unit)	A standard measure of energy in the British unit system. 1 Btu is the amount of heat required to raise the temperature of one pound of water by 1 degree Fahrenheit, equal to about 1055 joules.
Bumpless	Bumpless transfer allows the controller to switch from Manual to Automatic mode or vice versa, without the control output suddenly 'bumping' to a different value.
Burner	A device which combines fuel and air in proper proportions for combustion and which enables the fuel-air mixture to burn, in a stable manner, to give a specified flame size and shape.
Burner assembly	A burner that is factory-built as a single assembly or as two or more assemblies that include all parts necessary for its normal function when installed as intended.
Burner capacity	Amount of heat release a burner can deliver (i.e., amount of fuel which can be completely burned through a burner) at a given set of operating conditions.
Burner status	Shows an indication of the progress of the startup, modulation and shut-down stages of the burner controller.
Burner turn down	The ratio of maximum burner output to minimum burner output.
Burner utilization curves	Graphical information showing how the burner is used.
Burner wind box	An enclosed chamber around a burner, in which an air pressure is maintained to ensure proper distribution and discharge of combustion air.
Calorific value	The energy available from burning a fixed quantity of fuel.
Cam	Mechanical device that converts rotary motion to linear motion.

Glossary Term	Explanation
Combustible	The heat-producing constituents of a fuel.
Combustible loss	The heat lost because of incomplete combustion of fuel.
Combustion	The rapid reaction of fuel and oxidant (usually oxygen in air) to produce light, heat and noise. Major products of combustion for hydrocarbon fuels (e.g., natural gas, refinery gas, fuel oils) are carbon dioxide and water vapor. Trace products include carbon monoxide and nitrogen oxides, which are pollutants.
Combustion (flame) safeguard	A system for sensing the presence or absence of flame and indicating, alarming or initiating control action.
Combustion efficiency	The fraction of carbon in the fuel that is converted into CO_2 in the flue gas, customarily expressed as a percent.
Combustion rate	The quantity of fuel fired per unit of time.
Commission Mode	A general term to cover Commission Ratio and Option Set modes - with a red touch screen background.
ComFire2	ComView is a software tool from Fireye, used for viewing and handling the NX6000 controller settings by means of a PC or laptop, via a USB interface cable.
Controller	A device designed to regulate the fuel, air, water, steam, or electrical supply to the controlled equipment. It can be automatic, semi-automatic or manual.
Control algorithm	Method of control – normally software.
Curve set	A "Curve set" is a set of data that defines the relationship between the fuel and air 'drives' at each profile set point. If these were plotted onto a graph against the increasing set point numbers, it would show several curves increasing in value, starting at low fire and finishing at high fire.
Damper	A device for introducing a variable resistance of regulating the volumetric flow of gas or air.
Differential	In a control loop, this is the difference between cut-in and cut-out points.
Draft	The difference between atmospheric pressure and some lower pressure existing in the furnace or gas passages of the steam-generating unit.
Draft control, barometric	A device that controls draft by means of a balanced damper which bleeds air into the breeching on changes of pressure to maintain steady draft.
Draft differential	The difference in static pressure between two points in a system.
Drive	A "drive" refers to a motor that drives, say, a butterfly valve. The term is sometimes used for the variable frequency / variable speed Inverter Drive Unit, which is used to control the speed of a motor.
Drum	A cylindrical shell closed at both ends, designed to withstand internal pressure.
Dry back	The baffle provided in a fire tube boiler joining the furnace to the second pass to direct the products of combustion, which is constructed of heat-resistant material. (Generally refractory and insulating material).

Glossary Term	Explanation
Dry steam	Steam containing no moisture. Commercially dry steam containing not more than 0.5 percent moisture.
Duct	A passage for air or gas flow.
Dynamic plant mimic.	Graphical display showing information from a process, which is regularly updated.
Efficiency	Of boiler operation: Output in heat units divided by input in heat units. The number of BTUs contained in all steam evaporated is useful output. The number of BTUs contained in all fuel supplied to the boiler is input.
EK	Engineer's Key Data. See below.
Electronic Fuel: Air ratio control.	The process of controlling combustion using electronic devices to improve position and ratio accuracy.
ELV	Extra low voltage.
Emissions	Substances that are given off as a result of the combustion process.
Engineer's Key	This is a jargon term referring to **Engineer's Key Data**. These are the parameters stored on the system that have been programmed in by entering the Engineer's Key pass code. The abbreviation is **EK Data** or **EK**.
Excess air	The amount of air needed by a burner that is in excess of the amount required for perfect or stoichiometric combustion. Some amount of excess air, depending on the available fuel/air mixing energy, is required to assure through mixing of the fuel and air for complete combustion.
Exhaust	The gases that leave a combustion process.
Fan	A machine consisting of a rotor and housing for moving air or gases at relatively low-pressure differentials.
Fire rate	A number that represents, the burner output as a proportion of the power range of a burner (%).
Fire tube	A tube in a boiler having water on the outside and carrying the products of combustion on the inside.
Fire tube boiler	Boiler where hot gases from combustion flow through metal tubes which are surrounded by water (sometimes called package boilers).
Firing rate control	A pressure temperature or flow controller, which controls the firing rate of a burner according to the deviation from pressure or temperature set point. The system can be arranged to operate the burner ON-OFF, high-low or in proportion to load demand.
Flame	A luminous body of burning gas or vapor.
Flame scanner	A device that detects if fuel is burning. The indication of the presence of a flame is transmitted to a control system in the form of an electrical signal.
Flame supervision	Monitoring the presence of the flame at the correct time and also for **no flame** at the correct time.
Flue	A passage for products of combustion.
Flue gas	The gaseous products of combustion in the flue to the stack.

Glossary Term	Explanation
Forced Draft	Combustion air delivered by a fan blowing air into the burner.
Fuel: air ratio	The ratio of the weight or volume of fuel to air in the combustion mixture.
Gas valve proving (leak testing)	The process of checking the safe operation of the gas valves before starting the burner.
High Fire	The maximum output from a burner, as set during the commissioning process.
Hysteresis	Variations in a control system during operation introduced by worn linkages or mechanical connections.
Igniter	A small burner within the main burner that is ignited by a spark or other ignition source, and which provides the ignition energy required to light the main burner. It may also be called a Pilot burner.
Ignition circuit	Wiring and components that create the spark to ignite the fuel/air mixture.
Ignition point	The positions of fuel valve and air damper required in order to achieve successful ignition.
Ignition transformer	Spark generator used to ignite the fuel and air mixture
Induced Draft (I.D.)	Combustion air that is sucked into the burner by a negative pressure in the combustion chamber. Negative pressure, is commonly created by a fan in the flue (I.D. Fan).
I.D. fan	A fan that exhausts hot gases from a combustion process.
Interlock	A device (or circuit) to prove the physical state of a required condition and to signal that proof to a primary safety control circuit.
Intermittent firing	A method of firing by which fuel and air are introduced and burned in a furnace for a short period after which flow is stopped, this succession occurring in a sequence of frequent cycles.
Intermittent ignition device	An igniter which burns during Light Off (the ignition phases of the burner), and while the main burner is firing. It is shut off with the main burner.
Inverter / Inverter drive unit	An inverter drive unit provides variable-frequency electrical power for varying the speed of a pump or fan motor.
IR	Infra-red, usually referring to the type of flame sensor used.
Lagging	Heat insulation, an energy-saving covering on boilers, pipes and ducts.
Lambda control	Control of excess air levels in exhaust gases (Oxygen Trim).
Lead/lag	Multi-boiler system where the load is managed to maximize the efficient use of the boilers.
Lead boiler (lead/lag).	The master boiler which controls the sequence in which the boilers are started and shutdown in a multi-boiler sequenced system
Lag boiler	A boiler that responds to the commands of the Lead boiler in a sequence.

Glossary Term	Explanation
LFH	Low Fire Hold. When the LFH function is triggered by either a manual key press or a by an input in the Option program the burner modulates to Low Fire (P3) position until the until the Auto, Manual or LFH button is tapped again, or the input is released. This function could also come from a digital communications command.
Light off	An American expression that means the ignition phases of a burner, which includes spark, pilot ignition and then main flame ignition from the pilot.
Linkages	Rods and cables that join controllers to valves and actuators.
Linkage-less burners	Burners with electrically controlled servomotors to actuate valves and dampers.
Load	The required output from a boiler.
Low Fire	Minimum output of a burner.
Low Fire start	The firing of a burner with controls in a Low Fire position to provide safe operating condition during light OFF.
Low gas pressure switch	A pressure switch set to stop the burner if gas pressure is too low.
Low-oil-temperature switch	A thermostatic switch set to prevent burner operation if the temperature of the oil is too low.
mbar	Millibar, a metric unit of pressure mainly used in European countries and is derived directly from the Bar pressure unit which equals 1,000 mbar, or approximately 1 atmosphere pressure.
Mechanical cam Fuel:Air ratio control	A traditional mechanical system where the amount(s) of fuel(s) are set against the air damper, which is controlled from a single modulation motor via a cam.
Mid-fire	The mid-range power of the burner.
Modbus Interface.	Digital communications interface that uses the Modbus protocol.
Modulate	To vary the fire-rate (or burner output) in response to the boiler pressure or temperature. The analogy is the action of pressing or releasing the accelerator in a car according to traffic and road conditions.
Modulation motor	A large control motor on traditional linkage, burner control systems.
Modulation rate	See Fire rate.
Motors	The motors are the valve actuating motors that control the flow of fuel and air to the burner.
Multi-fuel burner	A burner that can fire more than one fuel, either individually or in combination.
Natural gas	Gaseous fuel occurring in nature.
Noise	An undesirable sound, electrical or electromagnetic disturbance.
Non-safety critical	Procedures or components that are not critical to the safety of the boiler/burner.

Glossary Term	Explanation
Non-volatile	This is a state that cannot be changed by removing power to the device. The state can only be changed by a pre-determined sequence of actions, such as key presses.
Oil burner	A burner that atomizes fuel oil and blows it into the combustion chamber in the form of a fine mist or vapour. Steam or mechanical motion plus air can be used as the operating medium.
Oil gun	The assembly of parts in a burner that provides atomized fuel oil mixture to the furnace for burning.
Oil tip	Part of the oil gun, which discharges the atomized fuel oil mixture into the furnace through multiple openings. The pattern of holes in the tip has a great effect on flame size and shape.
Option parameter	A number stored in the controller system that defines a function of the controller.
Oxygen trim	The process of adjusting the Fuel: Air ratio to improve the operating characteristic of the burner.
Packaged boiler	A boiler equipped and shipped complete with fuel-burning equipment, mechanical draft equipment, automatic controls and accessories; usually shipped in one or more major sections.
Packaged fire-tube boilers	Transportable boilers which heat a water jacket (the water surrounding the tubes through which hot gases pass) to produce steam or hot water.
PID	A Proportional-Integral-Derivative (PID) controller is a generic control loop feedback mechanism widely used in industrial control systems. It calculates an "error" value as the difference between a measured process variable and a desired set point, and then attempts to reduce the error by adjusting the process control inputs. For example, in the NX6100 systems, it is used to control the pressure / temperature of the boiler by modulating (varying) the fire rate.
PID Modulation	Modulation controlled by a three-term control algorithm.
Pilot	A small burner that is used to light the main burner.
Pilot flame establishing period	The length of time fuel is permitted to be delivered to a proved pilot before the flame-sensing device is required to detect pilot flame
Pilot, proved	A pilot flame that has been proved (tested) by flame-failure controls.
Plant Input	A Plant Input is a representation on the touch screen of a terminal, which may be connected to a line voltage electrical point within the boiler plant (systems). The digital status of the input (ON or OFF) is displayed within a display pane on the Touch screen. These inputs are for indication only, unlike the digital inputs on the main controller, which can be set to shut down or lock out the burner system.
Play	See Hysteresis.
POC	Proof of Closure used, for example, for gas valves and oil valves.
Post-purge	The process of clearing combustion gases from the boiler after the boiler has been shut down.

Glossary Term	Explanation
Pre-mixed flame	Situation when the fuel and air are intimately mixed before delivery to the source of ignition. The combustion process is controlled by heat conduction and diffusion of hydrocarbon and other radicals.
Pre-purge	The process of clearing the combustion chamber before starting the boiler.
Pre-purge period	A period on each start-up during which air is introduced into the combustion chamber and associated flue passages in volume to completely replace the air or fuel air-mixture before an attempt to initiate combustion.
Primary air	Air used to shape the flame from a burner.
Process heating	Heat provided to a process by steam or hot water or hot oil.
Process steam	Steam used for industrial purposes other than for producing power.
Profibus interface	Interface to the Siemens Profibus communications protocol.
Profile	A Profile is a collective term for a set of Fuel: Air ratio curves, O_2 and Flow characteristics. There can be up to 4 user-selectable profiles stored on the system. The profiles might relate to different fuel types or some other variation in combustion requirements.
Proportional control	A mode of control in which there is a continuous linear relationship the between value of the controller variable and the position of the final control element (modulating control).
PSIG	Pressure per square inch at the Gauge, i.e., relative pressure, not absolute.
Purge	Clearing or cleaning.
Purge interlock	A device to make sure that an air flow to the furnace above a minimum level exists for a defined time interval.
Regulator, gas pressure	A spring loaded, dead weighted or pressure balanced device which will maintain the gas pressure to the burner supply line
Relay outputs	Signal interface by means of a relay contact.
Retrofitted	Equipment fitted to existing equipment.
RS485 connection	Serial Communications interface using the RS485 system.
Safety shut down	The action of shutting OFF all fuel and ignition energy to the burner by means of safety control or controls, such that restart cannot be accomplished without operator action.
Safety valve	A valve that automatically opens when pressure attains the valve setting which is adjustable; used to prevent excessive pressure from building up in a boiler.
Secondary air	Main combustion Air.
SELV circuit	'Safety Extra Low Voltage', sometimes referred to as a 'Separated Extra Low Voltage' circuit.
Servomotor	A motor controlling the position of a valve or damper.
Set point	A preset value such as a specific speed or position that the controller is supposed to reach. Also known as the target value.

Glossary Term	Explanation
Slop	See Hysteresis.
Soot blower	A tube from which jets of steam or compressed air are blown for cleaning the fire tubes or other parts of the boiler.
Spray nozzle	A nozzle from which a liquid fuel is discharged in the form of a spray.
Stack	Flue or chimney.
Status, burner	Shows an indication of the progress of the startup, modulation, and shut-down stages of the burner controller.
Steam	The vapor phase of water substantially unmixed with other gases.
Steam Atomization	Injecting steam with oil to improve its atomization (ability to mix with air).
Steam atomizing oil burner	A burner for firing oil, which is atomized by steam. It may be an inside or outside mixing type.
Steam Gauge	A gauge for indicating the pressure of steam
Therm	A unit of heat applied especially to gas. One therm = 100,000 Btu
Thermal conductivity	The ability of a material to conduct heat, expressed as thermal power conducted per unit temperature and thickness. Metals and other thermal "conductors" have a large thermal conductivity. Refractories and other thermal "insulators" have a low thermal conductivity.
Thermocouple	A temperature-detecting device based upon the characteristics of a joining of two dissimilar metals.
Time delay	A deliberate delay of a predetermined time in the action of a safety device or control.
Trail for main flame ignition	A timed interval when, with the ignition source proved, the main valve is permitted to remain open. If the main burner is not ignited during this period, the main valve and means of ignition are cut off. A safety switch lockout follows.
Trail for pilot ignition	A timed interval when the pilot valve is held open, and an attempt made to ignite and prove (test) it. If the presence of the pilot is proved at the termination of the interval, the main valve is energized; if not, the pilot and ignition are cut off followed by a safety lockout.
Trail-for-ignition	That period of time during which the programming flame failure controls permit the burner fuel valves to be open before the flame-sensing device is required to detect the flame.
Tramp air	Any air that enters (infiltrates) the furnace through leaks. This air may be measured by the O_2 analyzer and often contributes to the burning of the fuel.
Trend data	Information that shows the operation of equipment over a time interval.
Turndown	The ratio of maximum boiler output to minimum boiler output.
UV	Ultraviolet, usually referring to the type of flame sensor.

Glossary Term	Explanation
Valve, fuel control	An automatic or manually operated device consisting essentially of a regulating valve and an operating mechanism. It is used to regulate fuel flow and is usually in addition to the safety shut-off valve. This valve can be automatic or manually opened.
Valve, manual gas shutoff	A manually operated valve in a gas line for isolating the gas supply.
Valve, manual oil shutoff	A manually operated valve in the oil line for isolating the oil supply.
Valve, manual reset safety shutoff	A manually opened, electronically latched, electrically operated safety shut-off valve, which automatically shuts OFF fuel when de-energized.
Valve, motor driven reset safety shutoff	An electrically operated safety shut-off valve designed to shut off fuel flow automatically upon being de-energized. The valve is opened and reset automatically by integral motor device only.
Vent	An opening in a vessel or other enclosed space for the removal of gas or vapor.
Vertical firing	The arrangement of a burner such that discharges air and fuel vertically into the furnace.
VFD	Variable Frequency Drive.
VPS	Valve Proving System: Valve Leak Testing for gas safety.
VSD	Variable Speed Drive, often refers to a variable-frequency inverter unit.
Waste fuel	Any by-product fuel that is waste from a manufacturing process.
Waste heat	Sensible heat in non-combustible gases.
Water Injection	Injecting water with oil to improve its atomization (ability to mix with air).
Water tube	A tube in a boiler having the water and steam on the inside and heat applied to the outside.
Water tube boiler	Boiler (usually large) where water flows in metal tubes that are surrounded by the hot gases from combustion.
Wet back	Baffle provided in a fire tube boiler joining the furnace to the second pass to direct the products of combustion that is completely water-cooled.
Wet steam	Steam that contains moisture, usually as fine water droplets.
Windbox	A chamber below the grate or surrounding a burner, thru which air under pressure is supplied for combustion of the fuel.
Windbox pressure	The static pressure in the windbox of a burner or stoker.
Zero and Span	**Zero adjustment** refers to the output value when the input is at 0%, its lowest possible range value (LRV) **Span Adjustment** refers to the full output range between the lowest and highest possible output.

3. Notice, Warranties, Exclusive Remedies, and Limitation of Damages

When Fireye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireye warranty, as stated in its General Terms & Conditions of Sale, pertains only to the Fireye products and not to any other equipment or to the combined system or its overall performance.

Fireye guarantees for one year from the date of installation or 18 months from the date of manufacture, whichever occurs first, to replace, or at its option, to repair any product or part thereof which Fireye, in its sole discretion, deems to be defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. Fireye's obligations pursuant to this warranty do not extend to any products or parts thereof which Fireye determines to have been installed, operated, maintained, repaired, or altered improperly or otherwise than in conformity to Fireye's applicable instructions, or which have been subject to misuse, accident, or neglect.

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4. Update History

New version	Date		Changes in brief
PE1	Jan 2019	GFS	General update for V1.4 Firmware.
1pt4C	July 2024	RAL	North American Version

——— End of Section 7 ———