



NEX-6301
April 10, 2024

NX6300

Single Fuel Integrated Burner Control

Commissioning Manual





Section 1: Introduction

The NX6300 is the newest member of the versatile 6000 series family of combustion efficiency burner controls that can be configured to control a variety of burner applications.

Many of the features of this controller are carried over from the established Fireye NX6100 controller. Auxiliary devices include servos, flame detectors, burner and boiler sensors, and Oxygen trim system components.

Features:

- Small footprint 6.3" (16cm) x 3.54" (9cm) x 2.56" (6.5cm)
- Onboard power supply
- PID load control with measurement from PT1000 / 4-20mA sensors.
- Track Modulation Selectable
- 2 profiles - Gas/Oil
- 1 VFD with 0 – 10V output and feedback from a 4-20ma loop or encoder
- Option for PWM fan speed output instead of VFD
- 3 CANbus servos may be connected – NXC04, NXC12, and NXC20 compatible
- Supports Combustion Air Pressure profiling using a CANbus sensor
- Six programmable digital inputs (2 Line Voltage 120Vac and 4 Low Voltage 24Vac)
- Supports UV (non-self-check) or Infrared scanner
- Support UV self-check using an CANbus Scanner
- < 24hr burner recycle for UV self-check (non-self-check)
- Valve proving utilizing pressure switch of CANbus analog sensor
- Proof of Closure input
- NX6330 Keypad allow for Modbus TCP/IP and BACnet TCP/IP
- Modbus RTU communications on board
- ComFire2 software compatible
- Option to add O2 trim (NX6083-1/NXO2TRIM)
- Onboard 2" OLED display with Bluetooth connectivity utilizing a smart phone or tablet with APP on selected models.
- Compatible with NX6220/NX6330



Section 1: Introduction

Part No	Description
NX6301 INTERGRATED PARALLEL POSTIONING CONTROL 120V	
NX6301-VFD	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 VFD, 120Vac, requires NX6220/NX6330/NXTSD.
NX6301-PWM	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 PWM, 120Vac, requires NX6220/NX6330.
NX6301-BTVFD	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 VFD, 120Vac, with OLED display Bluetooth capable. NX6220/NX6330 Optional.
NX6301-BTPWM	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 PWM, 120Vac, with OLED display Bluetooth capable. NX6220/NX6330 Optional.
NX6301 INTERGRATED PARALLEL POSTIONING CONTROL 220V	
NX6302-VFD	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 VFD, 220Vac, requires NX6220/NX6330.
NX6302-PWM	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 PWM, 220Vac, requires NX6220/NX6330.
NX6302-BTVFD	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 VFD, 220Vac, with OLED display Bluetooth capable. NX6220/NX6330 Optional.
NX6302-BTPWM	Integrated parallel positioning controller, with (3) CANbus servomotor outputs. 1 PWM, 220Vac, with OLED display Bluetooth capable. NX6220/NX6330 Optional.
NX8WC-HUB	Passive CANBus Hub with Screw terminals - Portrait profile.
DISPLAY MODULES FOR NX6300	
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 fitted 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 NX6300	
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 1/2" NPSM female adapter for NXC04, NXC12
35-322	PG11 male to 1/2" NPSM female adapter for NXC20
35-372	M20 male to 1/2" NPSM female adapter for NXC40
Type 2 O2 PROBES AND EXPANSION MODULE FOR NX6300	
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
NX224455	O2 probe assembly (for flues 300mm to 1000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NX224456	O2 probe assembly (for flues 600mm to 2000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NX224457	O2 probe assembly (for flues 1200mm to 4000mm). Includes NXIATS CANbus ambient temperature sensor, flange kit.
NX6083-1	Replacement O2 probe for NX224455. Does not include mounting flange, ambient air sensor, or transformer.
NX6083-2	Replacement O2 probe for NX224456. Does not include mounting flange, ambient air sensor, or transformer.



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NX6083-3	Replacement O2 probe for NX224457. 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 NX6300	
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. 1/4" 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. 1/4" 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. 1/4" 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. 1/4" NPT mounting. Screw terminal connections and conduit adapter cover.
NON-SELF TEST TEMPERATURE SENSORS	
TS350 (-2), (-4), (-8)	Temperature Sensor, Range 32°F-350°F (0-176°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°F-752°F (0-400°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.



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NX6087-1	CANBus Combustion Air Pressure sensor 90 mbar (1.3 psi) span and NPT process connection.
NX6087-2	CANBus Combustion Air Pressure sensor 90 mbar (1.3 psi) span and G1/4 P process connection.
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.
NXUV24UL	Flame detector Kit - UL. Comprising of: Wide band detector, 6' connection cable, mounting flanges for axial or radial viewing.
NXUV24CE	Flame detector Kit - CE. Comprising of: Wide band detector, 2m connection cable, mounting flanges for axial or radial viewing.
48PT2-1003	Infrared scanner, 8' straight head.

Health and Safety Issues

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 NX6300 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 installed on 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.



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- This equipment **must only** be installed on 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 NX6300 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 NX6300.
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.



Section 1: Introduction

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 Fireye Inc.

Disclaimer

The purpose of this manual is to provide instructions for commissioning the NX6300 single fuel Integrated Burner Control.

Nothing contained in this manual constitutes a warranty of any kind in respect of the equipment or of the results to be achieved by its use.

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

Table of Contents

This manual describes the installation, commissioning, operation and maintenance of the NX6300 single fuel integrated burner controller.

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

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1. NX6300 introduction

1.1 System Outline

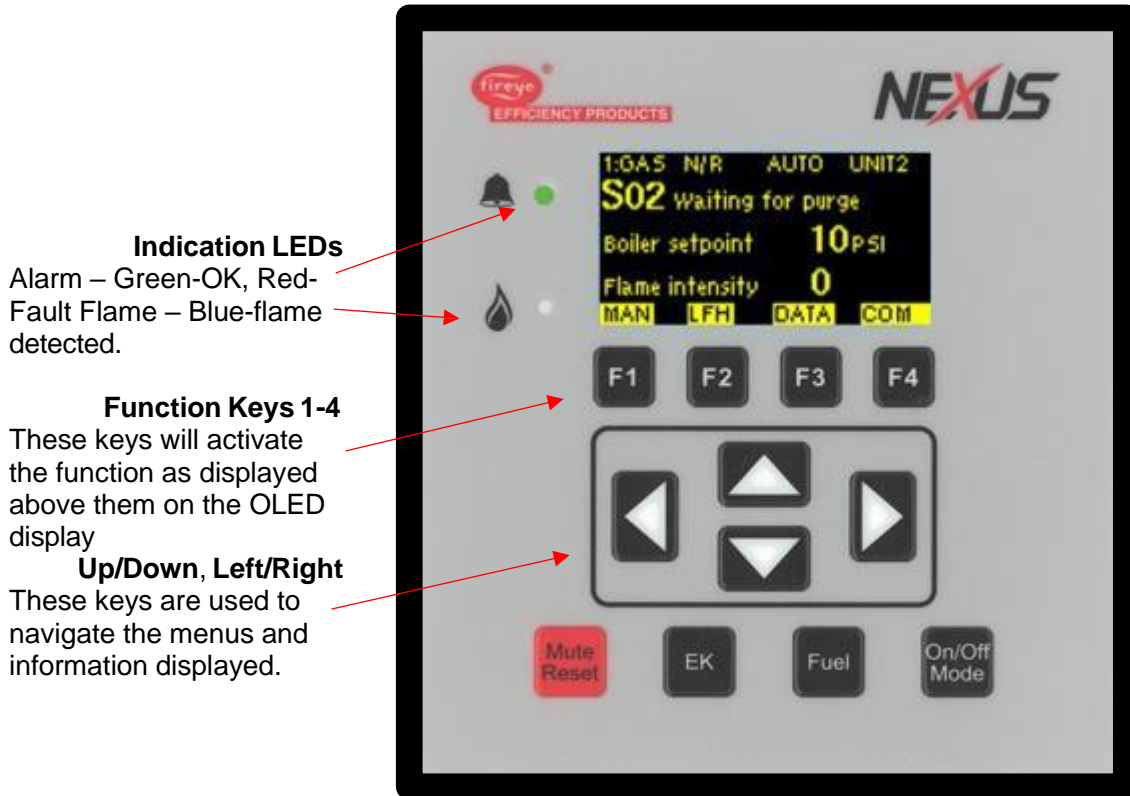
The NX6300 equipment described in this manual comprises a fully integrated burner control system for industrial burners. The system features are as follows:

- Full Burner Management functions, including flame and air pressure monitoring, and fuel valve shut-off control to EN298.
- Combustion air fuel ratio control to EN12067
- Valve leak testing for gas burners to EN1643.
- Compatible with NX6220 and NX6330 Keypads
- Compatible with NXTSD007 and NXTSD104 Touchscreens
- Compatibility with 6300 series flame detectors, sensors, and actuators up to 20Nm (14.75 ft pd) actuation force.
- PID (Proportional, Integral and Derivative) function to control the pressure or temperature of the boiler application by modulating (varying) the fire rate.
- Includes combustion fan speed control with speed feedback as a current signal or pulse signal.
- Two combustion curve sets using up to 3 actuators (Maximum of 1 x 20Nm, 20ft pd)
- Six programmable digital inputs for burner or plant interlocks.
- Fault history on-board.
- Modbus RTU communications (ProfiBus with external device).

2. Description of Operation

2.1 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 positive feedback of the actuation. This unit includes a lithium battery for the clock / calendar / event log functions.



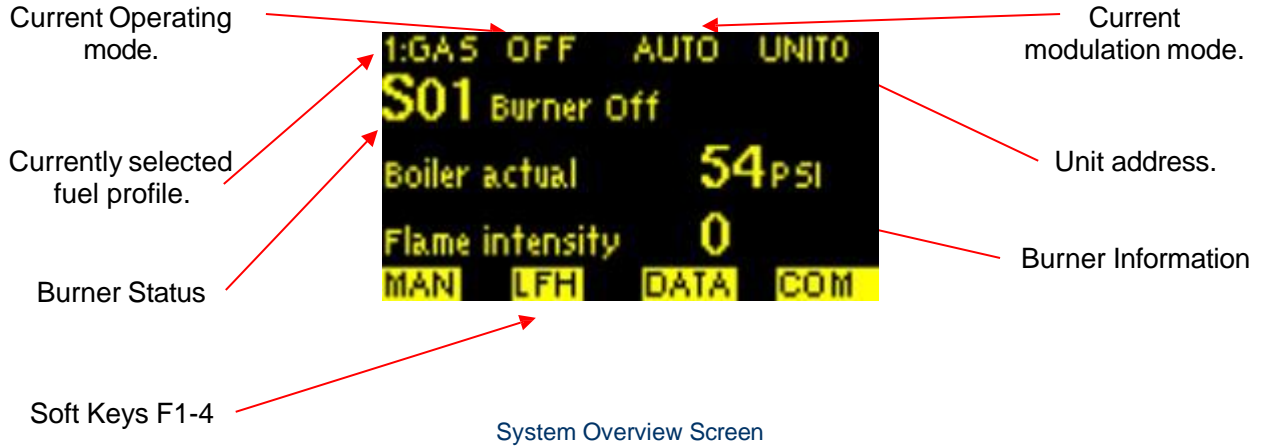
Key	Function
EK	Press this key to select the Status and <u>Engineer's Key Data</u> (EK) modes.
Fuel	Press this key to change the Fuel/Profile. If you change fuel when the burner is firing, the burner will go OFF and then restart, firing the new fuel selection.
On/Off Mode	Press this key to switch the burner ON or OFF, and to enable changes between Normal and Local operation. (For explanation, see section 2.6.1 and 2.6.1) Note: Terminal TB-1 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.



Section 1: Introduction

2.1.1 System Overview

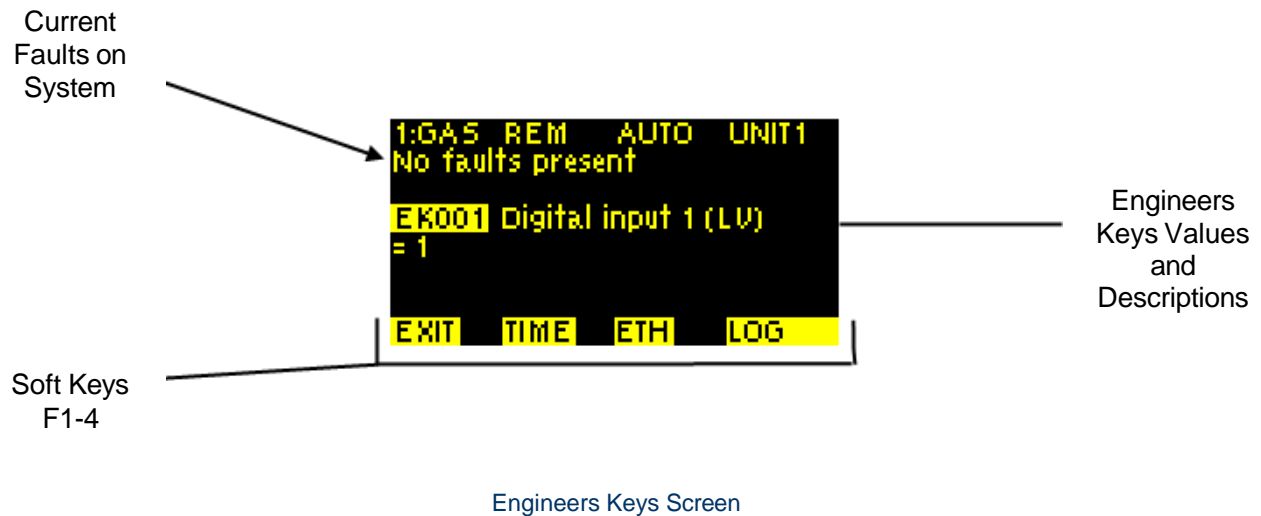
The system overview is the default information displayed during normal operation of the burner.



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.

2.1.2 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.





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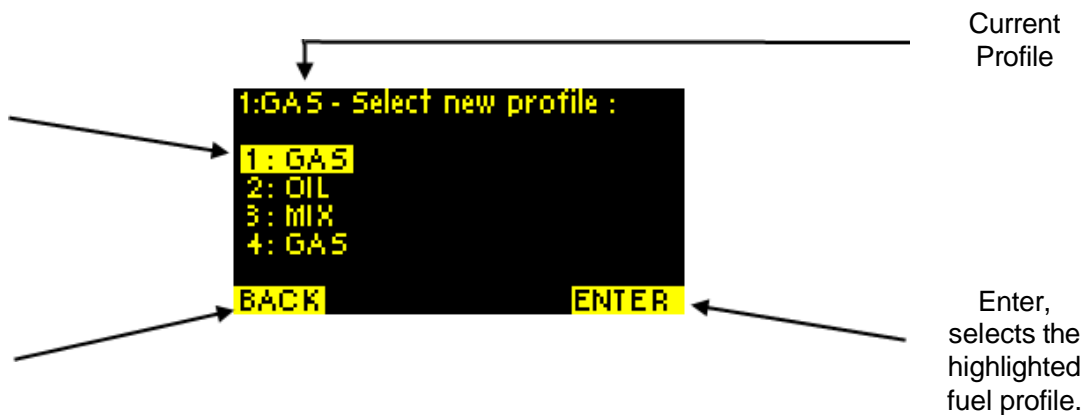
Key	Function
F1	Exit Engineers Key screen and return to the system overview.
F2	Set the display time and date, for fault logging.
F3	Displays Ethernet connection information.
F4	Displays the fault log for the display.

2.1.3 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.

Use arrow keys to select the desired fuel profile.

Back, exits the fuel profile select.



Fuel (Profile) Selection Screen

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



Section 1: Introduction

2.1.4 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 is accessed using the On/Off Mode key on the keypad.

Use arrow keys to select the desired mode.

Current Mode

Back, exits the fuel profile select.

Enter, Selects current mode.

```

REM - Select new mode :
REM Normal / Remote
LOC1 Local 1
LOC2 Local 2
OFF Burner Off
BACK ENTER

```

On/Off Mode Screen

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

2.1.5 Commissioning/Profile Adjust

The following are profile and option adjust screens, they are used to adjust the option parameters and the profile setpoints. These are accessed using the commissioning soft key (F4) from the system overview.

Currently selected profile setpoint

Current burner status, including flame intensity

Current values for the setpoint

```

1:GAS REM COM UNIT1
A13 516 Modulating
F:99,88
1GAS|3AIR |FLOW|O2SP|
88.0 | 88.3 | 99.9 | 0.0 |
OPTS ADJ RUN

```

Soft Keys F1,2 and 4

Profile Adjust Screen



Section 1: Introduction

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

Currently selected option group

```

1:GAS REM COM UNIT1
Options : ALL

0.1 Site Passcode (0 to 999
= 35 (additional info)
(0 to 999)

EXIT ALL GROUP ADJ
  
```

Currently selected option parameter showing value and description

Soft Keys F1, 2, 3 and 4

Option adjust Screen

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

2.1.6 Data Screen

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

Current profile setpoint and burner status.

```

Setup Display Module :
LANGUAGE
Time
Ethernet
Unit Address
About...

BACK ENTER
  
```

Current servo positions

Soft Keys F1,2,3 and 4

Data Screen



Section 1: Introduction

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

2.1.7 Setup Screen

This is the Setup screen; it is used to adjust various display module 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.



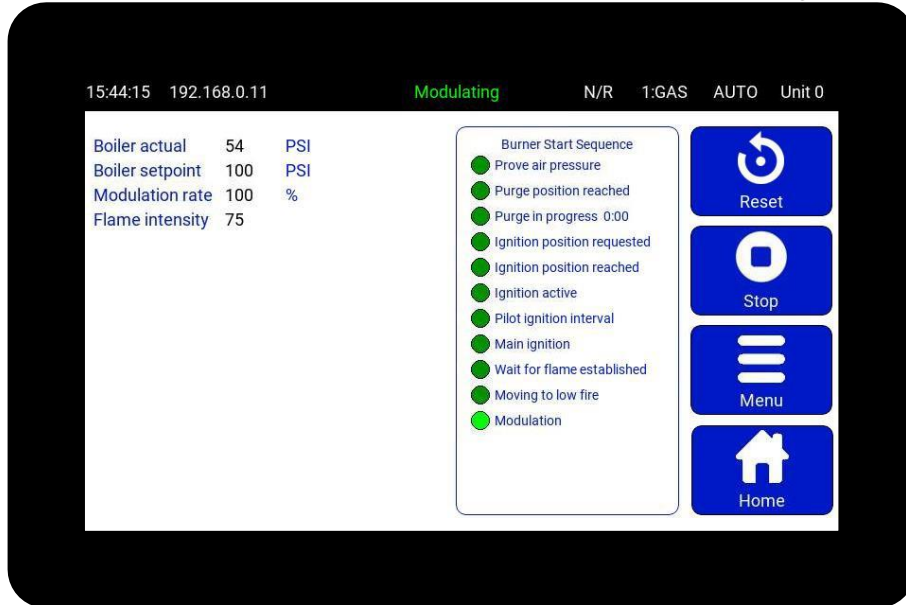
Key	Function
F1	Return to system overview.
F4	Enter highlighted menu selection.



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2.2 7" Touch-screen HMI 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 burner. This unit includes a lithium battery for the clock / calendar / event log functions.



2.2.1 Touch screen Power ON

After you switch the system ON, the controller and display will take a few 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.



During the "boot up" process, you will see a splash screen like the picture on the left.

After the initialization is complete, the Touch screen will show the overview screen and the controller will operate normally, changing the relays to operate according to the control status.



Section 1: Introduction

2.2.2 Overview of Touch screen Operation

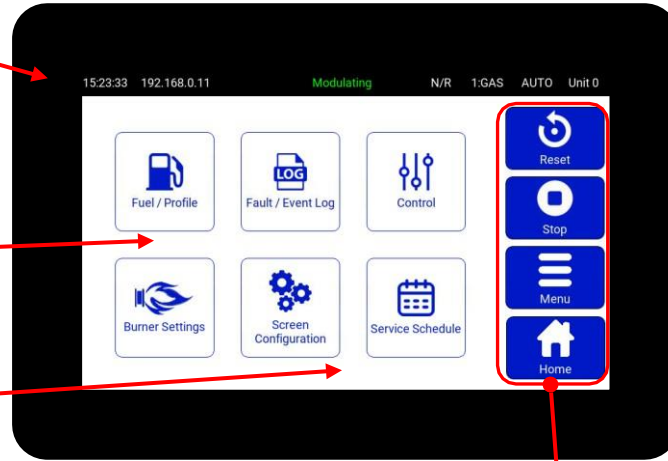
The NXTSD007 touch-screen HMI will have a familiar feel to existing users of the 10.4" NXTSD104. However, the boiler and burner mimic feature is not available.

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.

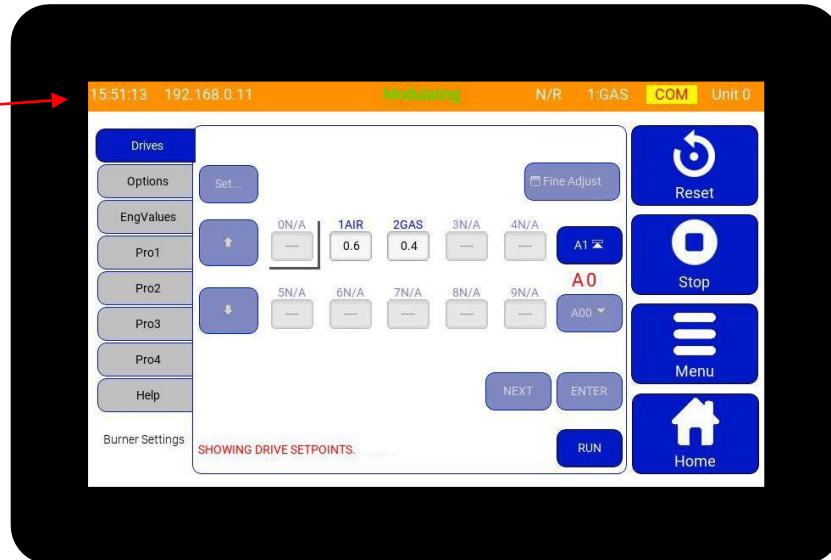


Section 1: Introduction

2.2.2.1 Status line color: Adjust Ratio mode – **ORANGE** banner.

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.

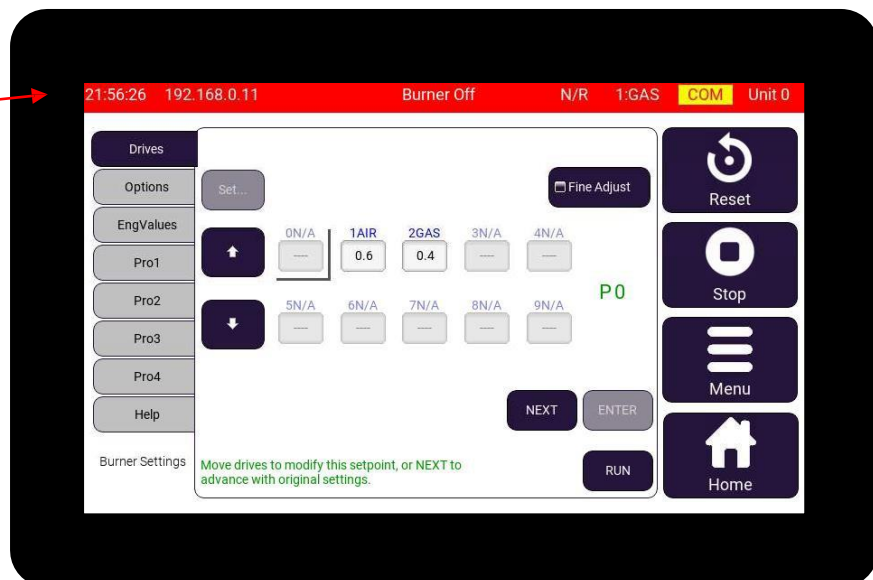


For more details, see “How to go into Adjust Ratio mode” in section 3, Commissioning.

2.2.2.2 Status line color: Commission mode – **RED** banner.

When 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.

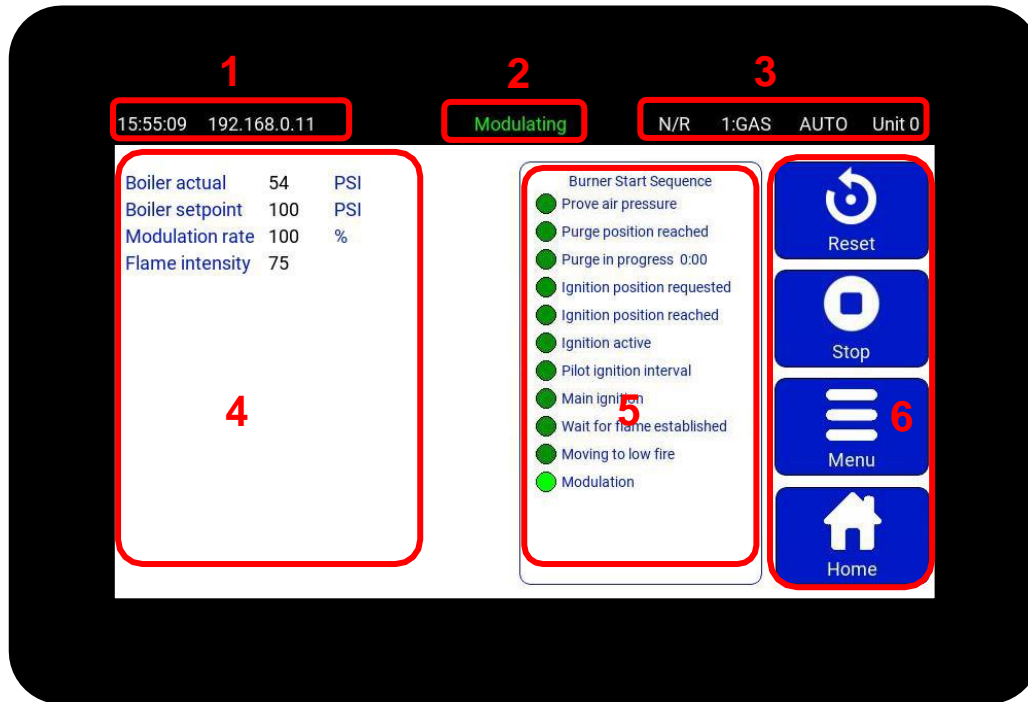


Because you can only enter Commission mode if the burner is OFF, you cannot monitor certain safety functions such as the Fuel Air ratio positions.

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

2.2.3 The system home screen

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



The areas numbered in the picture are explained as follows:

1. Time and Ethernet IP address.
2. **Burner Status** at this 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, setpoint 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.



Section 1: Introduction

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.

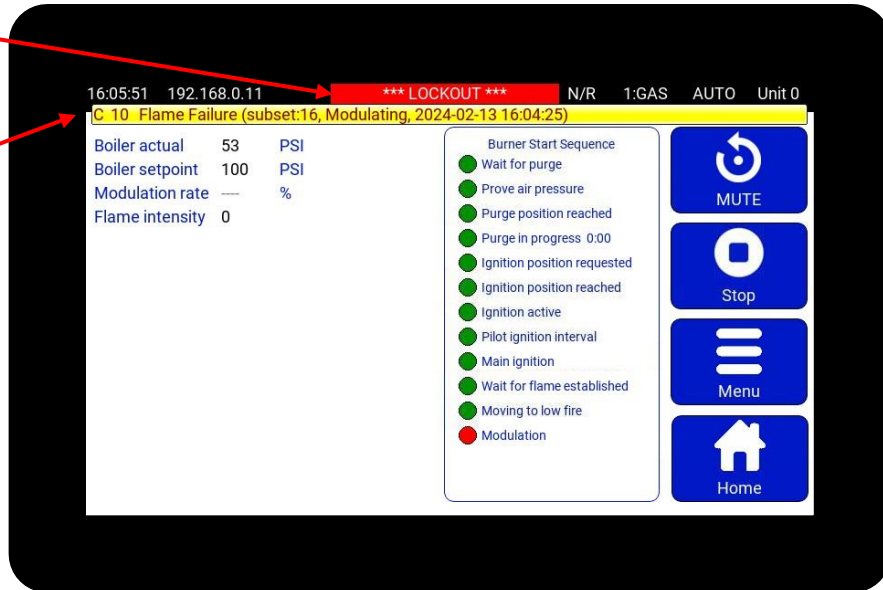
2.2.4 Touch screen Lockout mode

If the NX6300 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 muted, 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 muted, 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 muted, 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.

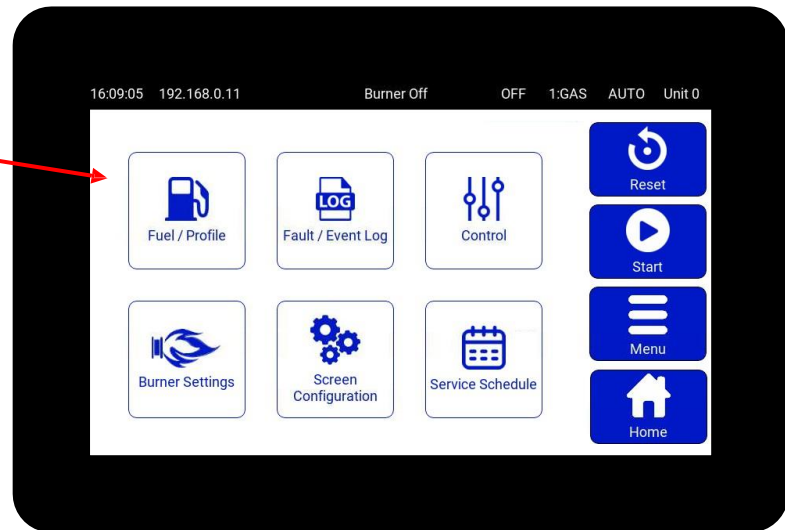
- If you press **Mute/ Reset** button while the controller is in safety shutdown and the fault is still present, the alarm will be muted, and the burner will remain in safety shutdown. After the fault clears, the alarm will sound once more.
- If you press **Mute/ Reset** button while the controller is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

2.2.5 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.



2.2.6 View Profile (curve) select information

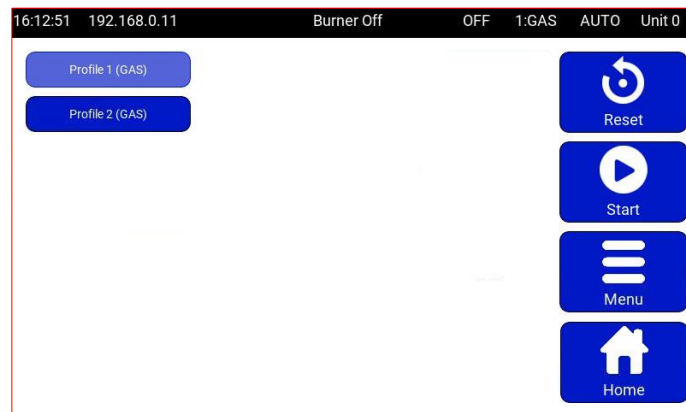
The **Fuel / Profile** button opens this screen which allows the user to change profiles.

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.

2.2.7 View Fault History / Event Log

Side menu > Menu button > Fault/Event Log button

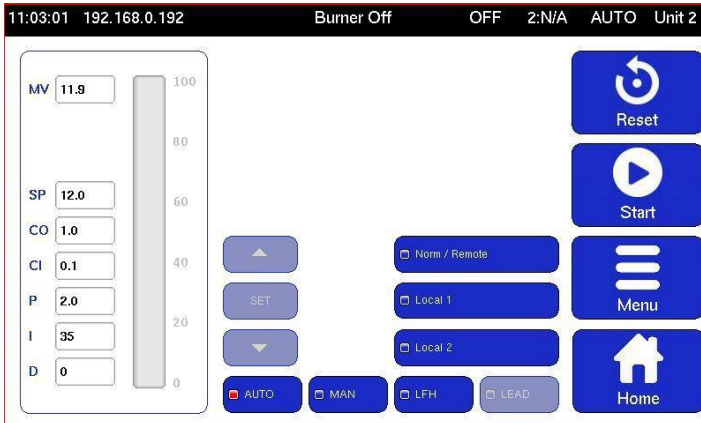


Example after tapping Menu > Fault/Event Log

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

2.2.8 View 'Control' information

Side menu > Menu button > Control button



Example after pressing the Control button

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.

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 'grayed out'; for example, Manual Modulation may be disabled during commissioning.

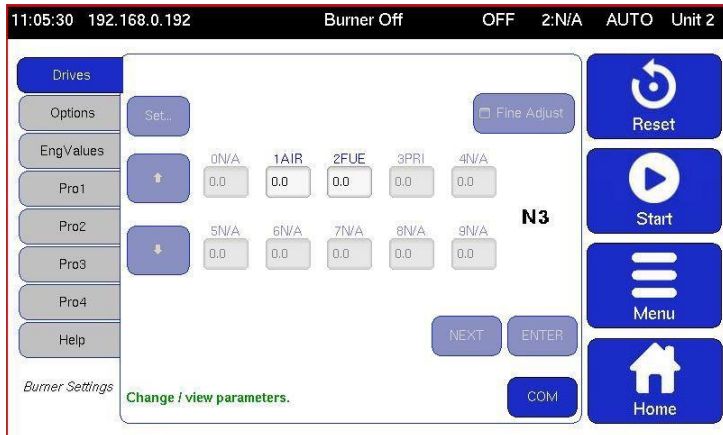
If the burner is firing, then the vertical gauge on the left will indicate the modulation rate (0 to 100).

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.

2.2.9 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.

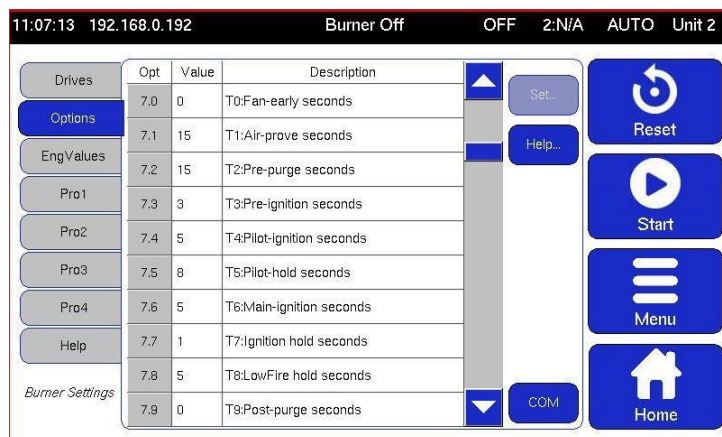
In this example here, you can see the Drive position settings.

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 color 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.

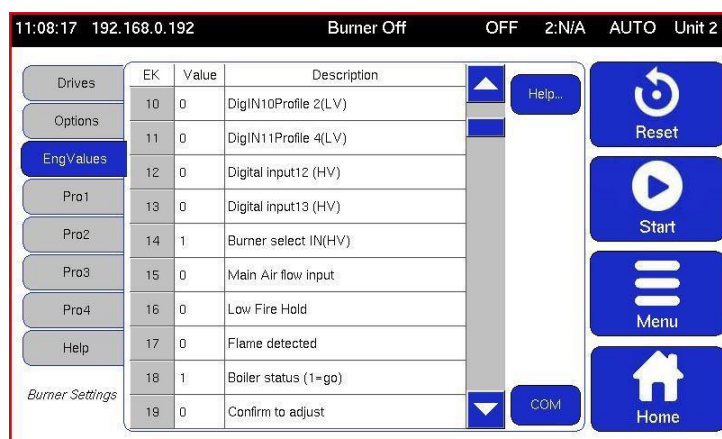


Example after pressing **Menu > Burner Settings > Options**

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.



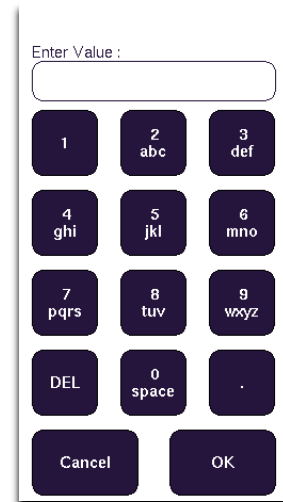
Example after pressing **Menu > Burner Settings > EngValues**

2.2.10 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.

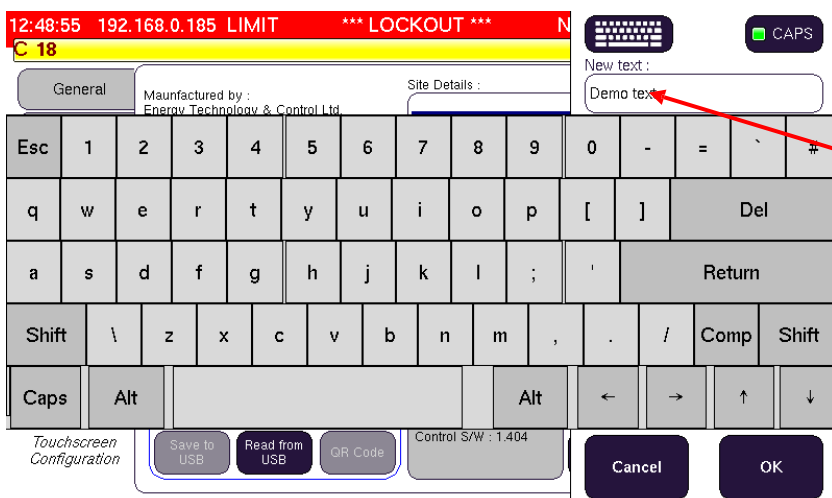


For mixed text and number fields the keypad looks like this with a **CAPS** button on the keypad. Initially this button is ON, shown by a bright green indicator on the **CAPS** key. When you start typing, the characters will be capital letters.

- 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.

2.2.11 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 touch panel, 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.

Side menu > Menu button > Screen Configuration > Clean Screen button

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. Tap the **Menu** button.

3. Tap the Screen **Configuration button**.

4. Select the **Clean Screen** tab, then a pop-up screen appears, asking you to confirm.

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

Clean screen now !

Time left = 15

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



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2.3 The Start-up Sequence

When a profile selection is made and the 'burner select' signal is given to start the burner, the controller performs the sequence described below.

If the controller is configured for gas firing 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
00.	Non-volatile lockout	The controller sets all fuel valve outputs OFF and the Alarm output is ON until muted. The burner remains locked out until all faults are removed.
01.	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.
02.	Wait for purge	The controller waits for both a burner select (TB1-1) and a fuel/air profile to be selected. External influences may prevent progression to stage 03 or 05, e.g., Digital Communications control, or digital input controlled by an external circuit.
03.	Open fuel valve	If gas firing and safety valve proving (leak testing) are selected, the gas valve actuator opens for five seconds to allow any gas in the test section to be vented easily during the leak test sequence.
04.	Hold fuel valve	The fuel actuators are held in its position until step 1 of the safety valve prove (leak) test sequence (open main valve 2, or vent valve) is completed.
05	Prove Closed positions	If the gas valve leak test has been programmed, then the controller will start the gas safety valve leak test sequence at stage 5 of the start-up sequence. If any step of the leak test sequence fails, then the controller will perform a non-volatile lockout, and lock out the burner. The fuel and air valve actuators 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.
06.	Prove air pressure	The burner motor output is set ON and the air pressure prove (leak test) time t1 is initiated. The selected valve actuators and Fan speed (<i>Drives</i>) are moved 'open' towards the purge position. If the 'fan start early' option parameter has been set, then the valve actuators will not move until the option time has expired.
07.	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 00. The selected <i>Drives</i> are driven 'open' until they reach their commissioned purge position.
08.	Pre-purge	When the <i>Drives</i> are verified at their purge positions, the controller starts the pre-purge t2 timer.
09.	Move to ignition positions	When pre-purge time t2 has elapsed, the <i>Drives</i> 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.



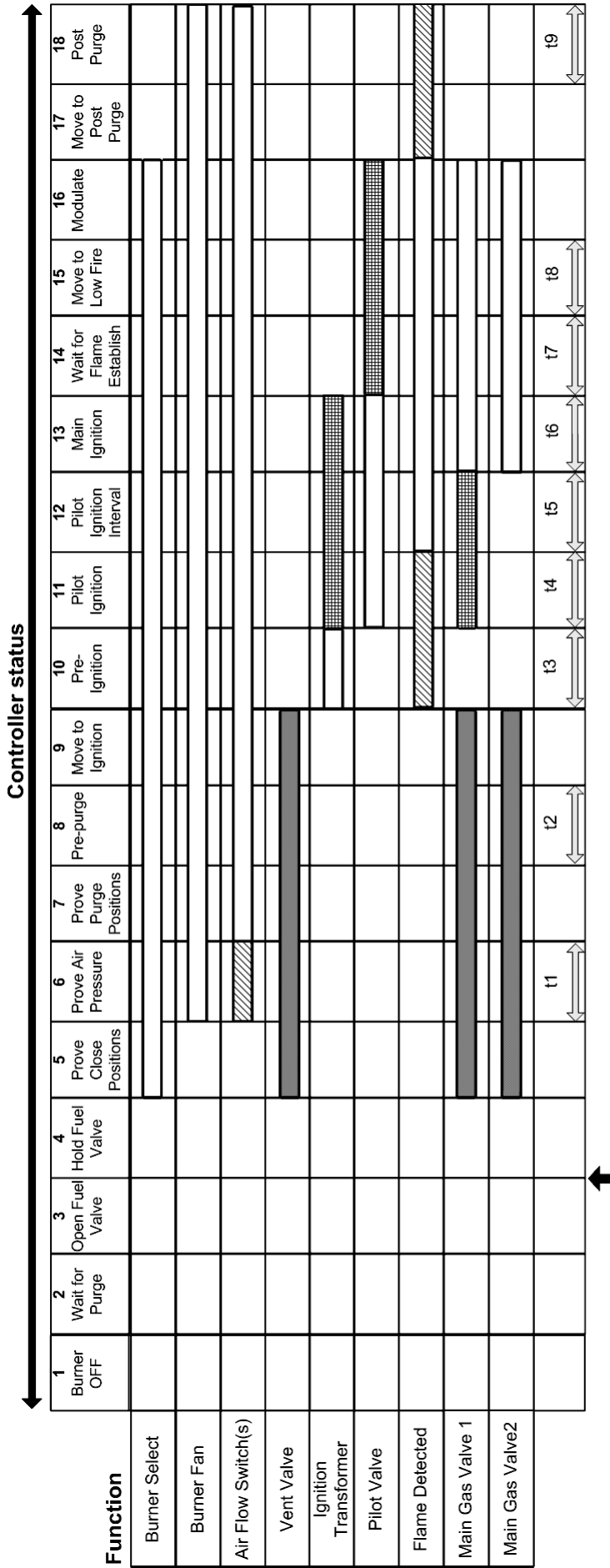
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State no.	State name	Description
10.	Pre-ignition	When the <i>Drives</i> have reached their ignition positions and if the leak test is complete, the ignition transformer output is energized, and pre-ignition time t3 starts.
11.	Pilot ignition	After 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 configured for 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 configured for 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.
12.	Pilot ignition interval	When t4 is complete, a flame must be detected, or the controller will lock out and move to stage 00. The ignition transformer may optionally be ON or OFF (See option parameter 14.6).
13.	Main ignition	After the pilot interval time t5 has elapsed, the second (and first if not already open) main valve output(s) are energized and the second safety time t6 is started. If configured for 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.
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 configured for 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 00.
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 <i>Drives</i> 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 00.
16.	Modulation	When t8 has elapsed, the <i>Drives</i> are modulated according to the demand placed on the burner. A flame and air pressure signal must be detected, or the controller will lock out the burner and move to stage 00. If the profile selection is changed, or the 'Burner Select' signal (TB1-1) is removed, then the main valve output(s) are turned OFF and the controller recycles to stage 01.
17.	Move to post-purge	If Post Purge is not selected, then the controller returns to state 01 to wait for another startup command. If Post Purge has been selected, then the fuel actuator is moved to its closed position, and the selected air <i>Drive(s)</i> are moved to the post purge position.
18.	Post-purge	When the air <i>Drive(s)</i> have reached the 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.



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Gas Firing Start-up Sequence



-Valve prove test begins
 -Energised or active
 -Don't care
 -See Valve Prove test
 - Optional ON or OFF. See options 14.x



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Oil Firing Start-up Sequence

Function	Controller status																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	Burner OFF	Wait for Purge	Open Fuel Valve	Hold Fuel Valve	Prove Air Pressure	Prove Air Pressure	Prove Purge Positions	Pre-purge	Move to Ignition	Pre-Ignition	Pilot Ignition	Pilot Ignition Interval	Main Ignition	Wait for Flame Establish	Move to Low Fire	Modulate	Move to Post Purge	Post Purge	
Burner Select																			
Burner Fan																			
Air Flow Switch(s)																			
Ignition Transformer																			
Pilot Valve																			
Flame Detected																			
Main Oil Valve 1																			
Main Oil Valve2																			

- Energised or active

- Don't care

- Optional ON or OFF. See options 14.x



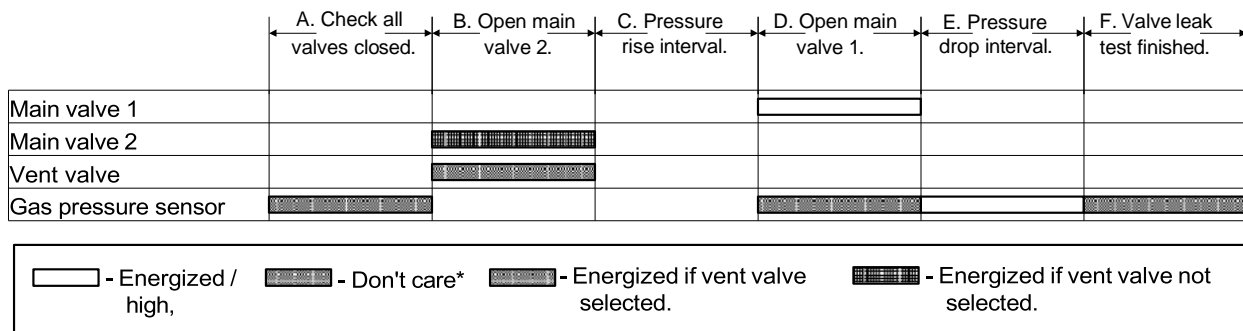
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2.4 Gas Safety Valve Leak Test (VPS) using a sensor

If the gas valve leak test has been programmed, then the controller will start the gas safety valve leak test sequence at stage 5 of the start-up sequence. If any step of the leak test sequence fails, then 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 t_4 , 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 t_4 , 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:



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

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} short and avoid lengthy pre-purges. You can see the calculated values of P_{test} and t_{test} in the Engineer's Key data.

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

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

If the gas valve leak test is enabled, then the controller will begin the gas safety valve leak test sequence at stage 5 of the start-up sequence. If any step of the 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 at <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.

For the leak test sequence using a single pressure switch, t_{test} is given by the following formula:



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

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 nominal gas pressure (Opt 10.2), test volume (Opt 10.5) and leakage rate (Opt 10.6). During the calculation, the controller will use P_{test} as 50% of nominal gas supply pressure P_G . The values for t_{test} and P_{test} can be seen on EKs 52 and 53.

The test switch **must** be connected to input 3, TB5-9, 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.

Conversion Facts:

1 cu. ft. = 28.32 L

1 cc = 0.061 cu. in.

1 cu. ft. / min. = 472 cc per sec.

1 cu. ft. = 1728 cu. in.



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2.6 Modulation of the Burner

"Modulation" means varying the burn rate.

During stage 16 (Modulation), the controller will position the fuel and air valve actuators and fan speed within the programmed profile appropriate to the requirement for heat. The controller has two modes of operation using the standard Fireeye modulation functions, Normal and Local. The mode of operation is set via the keypad by pushing the "ON/OFF MODE" key and then selecting the mode.

2.6.1 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.

2.6.2 Normal mode

In Normal mode, the modulation rate is determined by the internal PID control settings and in this case, [AUTO] is shown on the HMI status line. Alternatively, the modulation rate can be influenced by remote signals, and when this is the case, [REM] is shown on the HMI status line:

When the controller is set to run under Setpoint control the measured process value is determined from a 4-20mA sensor or Fireeye 'fail-safe' sensor. The Setpoint loop applied to the input is determined from the following:

- Local 1 or Local 2 (Highest priority).
- Serial communications sending SP1 or SP2 control values.
- Digital input set by Option 20.0.

In addition to influencing the Setpoint control system, Normal mode allows external devices to control the fire rate of the burner, over-riding the setpoint control loops. This can be in one of two ways in the following priority:

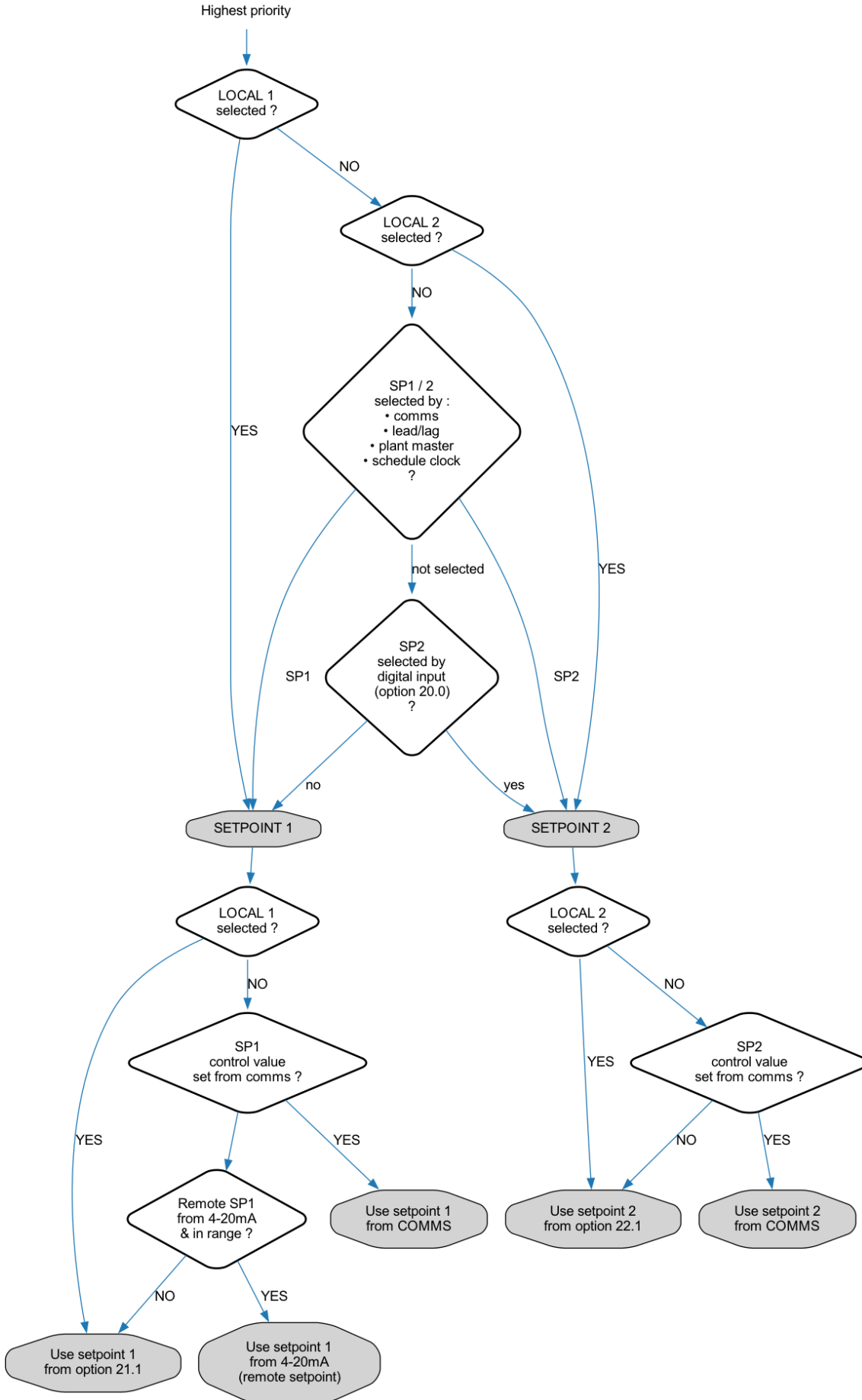
- Aux Modulation Input set as Remote Setpoint control or as Remote Modulation control (Highest priority).
- Modulation rate commands from serial communications (ModBus / ProfiBus).

The following diagram will help to explain how the Setpoint loop priority is set.



Section 1: Introduction

Determination of PID SETPOINT





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2.7 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 (see 2.4)
- 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.

2.8 Post Purge Operation

If a post combustion purge is selected (with option parameter 7.9), a normal shutdown post purge will be performed at either Low Fire or the pre-purge air settings. The post-purge time will start when the fuel safety valves have been closed and the air drives will move to the correct purge position during the purge time. If the burner has turned OFF by removal of the Burner select signal, then no post-purge will be performed.

If the burner locks out, at or after ignition, and a post-purge time has been entered, 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 moment 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
V1pt4.docx	10.29.23	RAL	North America Version

