



# NEXUS INTEGRATED BURNER CONTROL SYSTEM



## DESCRIPTION

The Fireeye NEXUS™ 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, Wiring sub-panel, Temperature / Pressure Sensors, Servo-Motors and ComFire 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 Fireeye Flame Scanners and amplification circuits using UV, UV-Self Check and Infrared sensors, provide fast reliable scanning of most commonly burned fuels. Ten user defined auxiliary inputs provide supervision of safety critical and non-safety critical inputs.

Control of up to four Channels using an independent Servo-Motor for each controlled element allows precise positioning, accurate to 0.1°, of the fuel and air metering devices over the burner's firing range. One of two fuel profiles can be selected for each fuel channel with 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 servo-motor's position and speed are verified and lockout will occur should either of these parameters be exceeded.

Modulation control is provided via the pressure/temperature sensor's input. The Fireeye NX1025, NX1030 or NX1040 sensors provide checking circuits for fail safe operation. 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 NX550 Display allows commissioning and current status of the system through the use of its tactile membrane keypad. Multi-function keys allow the commissioning engineer the ability to access the various Ratio Modes and Option Select menus. The two line 20 character Vacuum Fluorescent 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 ComFire software. Lead/Lag and Standby set points for up to ten (10) boilers can be configured.



“Site”, “Adjust Ratio”, and “Supplier” passcodes are issued with each Control for maximum protection of the commissioned values. All Setpoints and Options are password protected through the three levels of protection. The various password levels provide Operators with “Site” protection, Owners with “Adjust Ratio” protection and Commissioning Engineers with “Supplier” protection.



The content on or accessible through CombustionDepot.com, (*including, but not limited to*) text, graphics and other materials, are provided by CombustionDepot.com, for informational purposes only. CombustionDepot.com does not claim ownership to any of the photos, images, or pictures of products on the site. These depictions are solely for information purposes and may not be an exact replication of the related product available for sale. All PDF and specification pages are gathered from the OEM web sites or publicly available information. CombustionDepot.com does not claim responsibility for any of the information found on these bulletins, documents, literature, specification charts, etc. and such information is subject to change without notice.



# Table of Contents

This manual (NEX-1001) describes the installation, commissioning, operation and maintenance of the NX3000/3100/4000/4100/5100\* integrated burner controllers with software revision up to and including Version 3.10.

It may be used in conjunction with the following other manuals:

- NEX-1501 - ComFire combustion analysis tool user manual
- NEX-SO - Boiler sequencing manual
- NEX-1002 NEXUS Expansion Interface and Expanded Burner Control System
- NEX-2004 Nexus, NX04-1, -2 Servo-Motor Installation
- NEX-2020 Nexus, NX20-1, -2 Servo-Motor Installation
- NEX-2050 Nexus, NX50-1, -2 Servo-Motor Installation
- NEX-1001/3.1 Supplement - Describes special operation of the NX5100

Description.....	1
Technical Specifications .....	4
Approvals.....	7
Safety Information .....	7
Installation .....	8
Wiring .....	13
Option Link Selection.....	21
Flame Scanners.....	23
Operation in Run Mode .....	24
Start-Up Sequence .....	25
Gas Safety Valve Proving Sequence.....	26
The Display.....	28
Control LED Indicators .....	29
Servo-Motor Adjustment.....	30
Operation in Commissioning Mode.....	32
Operation in Adjust Ratio Mode.....	36
Option Parameters .....	38
Faults and Fault Finding .....	53
Engineer's Key .....	59
Trouble Shooting .....	63
Commissioning Sheet.....	66
Ordering Information.....	81
Wiring Base Layout .....	83

\*Refer to NEX-1001/3.1 Supplement for NX5100 wiring and operation details.



---

## Technical Specifications

### General

Supply Voltage:	120/230 VAC
Power Consumption:	Approx. 20VA
Supply Frequency:	50/60Hz
Ambient Temperature Range:	32 -140°F (0 to 60°C)
Maximum Connected Load:	2000 VA
Control Unit Protection Category:	NEMA 1 (IP 00) The unit must be situated in a clean environment according to EN 6730-1. Indoor: Unit must be mounted in a NEMA 12, IP52 rated enclosure Outdoor: Unit must be mounted in a NEMA 4, IP rated enclosure
Unit Dimensions:	Wiring Base, UL listed: 6 7/32" (158mm)W x 13.0" (330mm)H Wiring Base, UL Recognized: 6 1/8" (155.2mm)W x 11 1/16" (280mm)H Control unit: 3.0" (78mm)W x 9.0" (225mm)H x 5 7/8" (148mm)D 5 7/8" (148 mm) tall, installed in wiring base
Weight:	6.6 lbs (3.0kg) including wiring base
Type of Display:	2 line 20 character dot-matrix vacuum fluorescent

### Servo-Motor Control

Type:	AC up/down with feedback potentiometer.
Maximum Number of Servo-Motors:	3 Channel = 2 Fuel, 1 Air 4 Channel = 2 Fuel, 2 Air
Maximum Number of Fuels/Profiles:	2/4
Max. Number of Setpoints 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°
Maximum Motor Current:	150mA rms
Maximum Motor Voltage:	250VAC rms
Motor Speed Range:	10s/90° to 60s/90°
Potentiometer Feedback Voltage:	+ 5Vdc for potentiometer with full range travel +15Vdc for 340° potentiometer with 90° travel (selected using a link).
Potentiometer Resistance Range:	1 to 5K ohms @ 5V 3 to 15K ohms @ 15V

### Relay Outputs

#### Alarms

Type:	On-off relay, de-energize for off.
Maximum Current:	2A rms (pilot duty) / 4A rms (power factor > 0.6)
Maximum Voltage:	250VAC rms



### **Ignition**

Type: On-off relay, de-energize for off.  
Maximum Current: 1.9A rms (ignition load) / 4Arms (power factor > 0.6)  
Maximum voltage: 250VACrms

### **Burner motor, vent, main and pilot valve outputs**

Type: On-off relay, de-energize for off.  
Maximum current: 2A rms (pilot duty) / 4A rms (power factor > 0.6)  
Maximum voltage: 250VAC rms

### **Digital Inputs**

**Pri. Air on & off, Sec. air on & off, oil& gas select, fault, mute, auxiliary 1 to 5.**

Type: Pulsed digital, 0V for off, +5V for on. Output for these digital contacts must be taken from correct supply terminal as described in the manual.  
Maximum Current: 250 mA approximately (supplied from unit)

### **Burner Select**

Type: Digital, 0V for off, 90-264VAC for on. Also provides feed for the pilot, main 1 and main 2.  
Maximum Current: Supplying circuit must be able to provide sufficient current for the pilot, main valve 1 and main valve 2 simultaneously.

### **Pressure/temperature Input**

#### **0-5V**

Maximum Current: Less than 2 mA  
Maximum Voltage: +/-50V absolute maximum  
Accuracy: +/-1% of full scale

#### **4-20mA**

Maximum Current: +/-50 mA absolute maximum  
Burden Resistor: 220R nominal  
Accuracy: +/-1.2% of full scale

### **Communications Interface**

2-wire RS485 plus ground, with termination resistor selected using a link.  
See NEX-1501 serial communications protocol manual for details.

### **External Display Interface**

Interface: Fireye specific



### **NX1020-1, -2 Gas Pressure Sensor**

Supply Voltage: 24Vdc +/-10%  
Supply Current: Approximately 10mA  
Ambient Temperature Range:32 - 160°F / 0 to 70°C  
Protection Category: NEMA 3 / IP44  
Dimensions: 1 3/4" (44mm) dia x 3 3/8" (85mm) long (incl. connector)  
Pipe Thread Mounting Dimensions:8Ø" NPT (-1), 8ḡ " BSP (-2)  
Weight: 1 lb./450g  
Working Pressure: NX1020; 0-8.5 PSI (0-600 millibar)  
Burst Pressure: 15psi/1bar  
Accuracy: +/-1.2% of span, +/- 1.2% of value  
Signal: 0-5 VDC

### **NX1025-1, -2 and NX1030-1, -2 Steam Pressure Sensor**

Supply Voltage: 24Vdc +/-10%  
Supply Current: Approximately 10mA  
Ambient Temperature Range:32 - 160°F / 0 to 70°C  
Protection Category: NEMA 3 / IP44  
Dimensions: 1 3/4" (44mm) dia. x 3 3/8" (85mm) long (incl. connector)  
Pipe Thread Mounting Dimensions:8Ø" NPT (-1), 8ḡ " BSP (-2)  
Weight: 1 lb./450g  
Working Pressure: NX1025; 0 - 58psi (0 - 4 bar)  
NX1030; 0 - 375psi (0 - 20 bar)  
Burst Pressure: 1200psi/80bar  
Accuracy: +/-1.2% of span, +/-1.2% of value  
Signal: 0-5 Vdc

### **NX1040 Boiler Temperature Sensor**

Supply Voltage: 24Vdc +/-10%  
Supply Current: Approximately 10mA  
Ambient Temperature Range:32 - 160°F / 0 to 70°C  
Protection Category: NEMA 3 /IP44  
Probe Dimensions: 1/4" (6mm) dia x 7 7/8" (200mm) long  
Body Dimensions: 2 5/8" (66mm) dia. x 3.0" (75mm) long  
Weight: 1/2 lb./200g  
Working Temperature Range:0 to 350°C /32 - 662°F  
Maximum Temperature: 842°F / 450°C  
Accuracy: Sensor element +/-0.5% of span  
Sensor circuit +/-1.0% of span  
+/-0.8% of value  
Working Temperature: 32-300°F (0 - 150°C)  
Signal: 0-5 VDC  
Insertion Well: Notincluded

## Approvals

UL 372 Primary Safety Controls for Gas and Oil Fired Appliances

Classification in accordance with EN298: F/T/L/L/J/B

Tested in accordance with the Gas Appliance Directive (GAD 90/396 EEC), encompassing the following standards:

- ENV1954, Internal and external behavior of safety related electronic parts
- EN298, 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
- prEN1643, Valve proving systems
- prEN1854, Pressure sensing devices for gas burners and gas burning appliances
- EN230, Monobloc oil burners - safety, control and regulation devices and safety times

## SAFETY INFORMATION



**WARNING: The equipment in this manual is capable of causing property damage, severe injury or death. It is the responsibility of the owner or user to ensure that the equipment described herein is installed, operated and commissioned in compliance with the requirements of all national and local legislation which may prevail.**

When this equipment is mounted on a burner/boiler, due regard must be given to the requirements of that appliance.

**Before attempting to install, commission or operate this equipment, all relevant sections of this document must be read and fully understood. If in doubt about any requirements consult the supplier. Installation, commissioning or adjusting of this product MUST be carried out by suitably trained engineers or personnel qualified by training and experience.**

The manufacturer of this equipment accepts no liability for any consequences resulting from the inappropriate, negligent or incorrect installation, commissioning or adjustment of operating parameters of the equipment.

This equipment MUST only be mounted on to burners as detailed in the contracted specification. The supplier must approve any change in the specification in writing.

Control panels MUST NOT be left uncovered while power is on. If it is essential to do so while rectifying faults, only personnel qualified by training and experience should 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, the electrical supplies MUST be isolated.

Safety interlocks MUST NOT be removed or over-ridden. Any faults detected MUST be corrected before the unit is operated.



**CAUTION: Some versions of this equipment contain a lithium battery.**

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



**WARNING: Explosion of fire hazard can cause property damage, severe injury or death. To prevent possible hazardous burner operation, verification of safety requirements and interlocks must be performed each time a control is installed on a burner.**

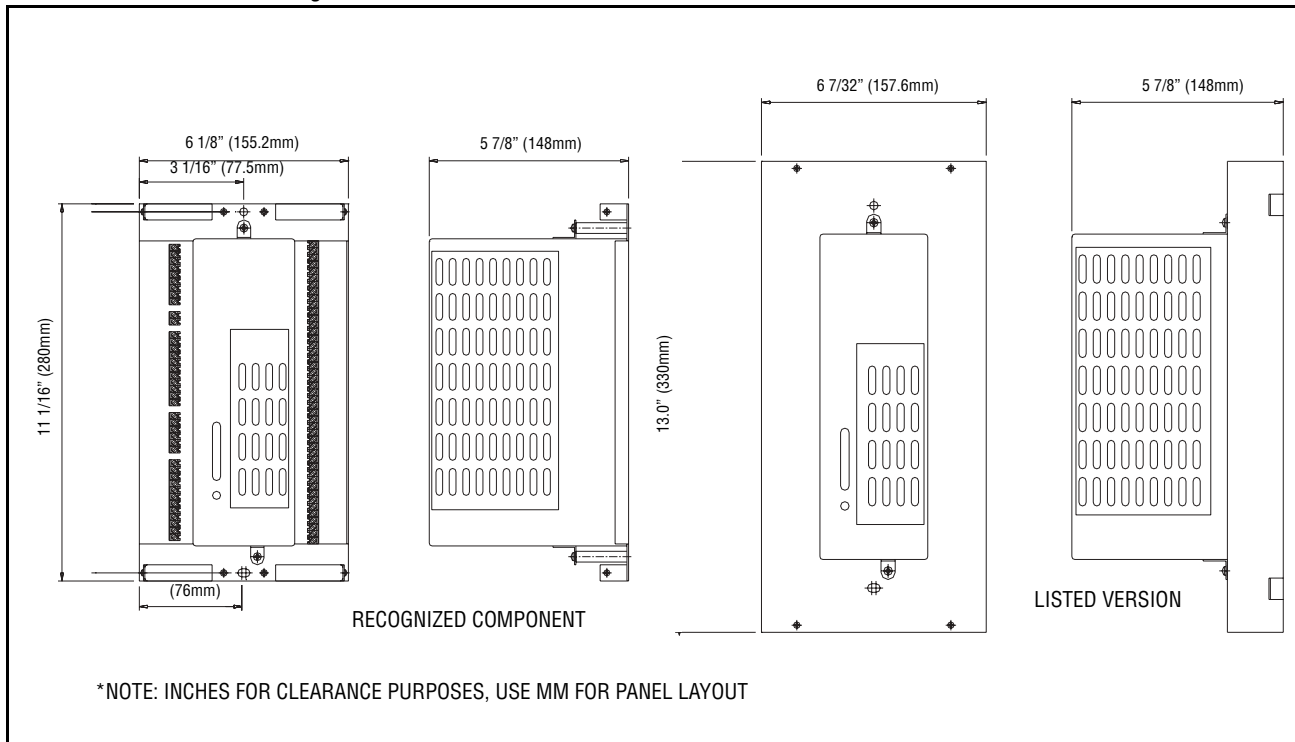
## INSTALLATION

This section contains basic installation information concerning choice of enclosure and servo-motor environment, wiring specification and connection details.



**CAUTION:** Read these instructions carefully and ensure 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 ensure the product is suitable for your application. After installation is complete, check the product operation is as described in these instructions.

**FIGURE 1. Mounting the Control Unit**



The control unit is designed to be mounted inside the burner control cabinet. The cabinet should have a minimum protection level of NEMA 12, IP52 for indoor use or NEMA 4, IP54 for outdoor use.

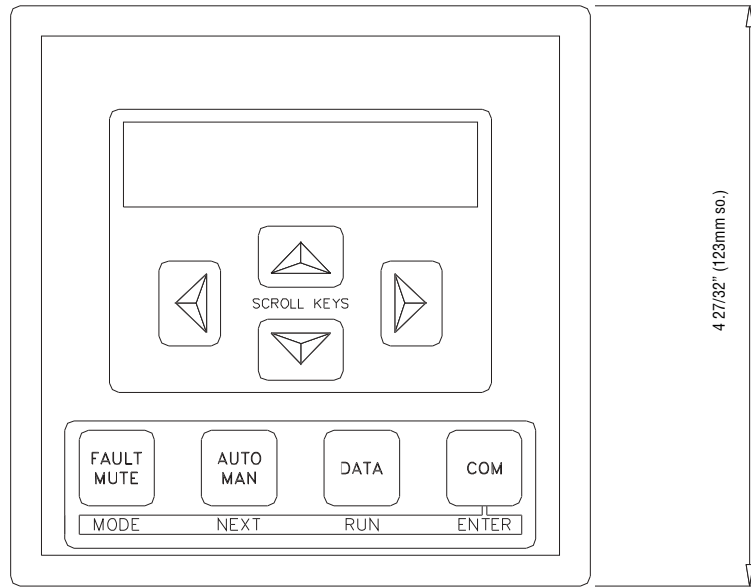
The control unit should be mounted so that the circuit boards within it are vertical, to maximize cooling efficiency. A clearance is required of a least 3.15"(80mm) above and 0.8"(20mm) below and at the sides of the controller enclosure.

The ambient operating temperature range of the equipment is 32-140°F (0 - 60°C). Refer to pages 4 -6 (Technical Specification) for more details.

The unit must be installed in a clean environment, in accordance with EN6730-1.



**FIGURE 2. Mounting the Display**



**Keypad Dimensions**

The display should be mounted on the front of the burner cabinet, or similar accessible location. It extends for 1. 2" (40mm) behind the panel, and 0.2" (3mm) in the front of the panel.

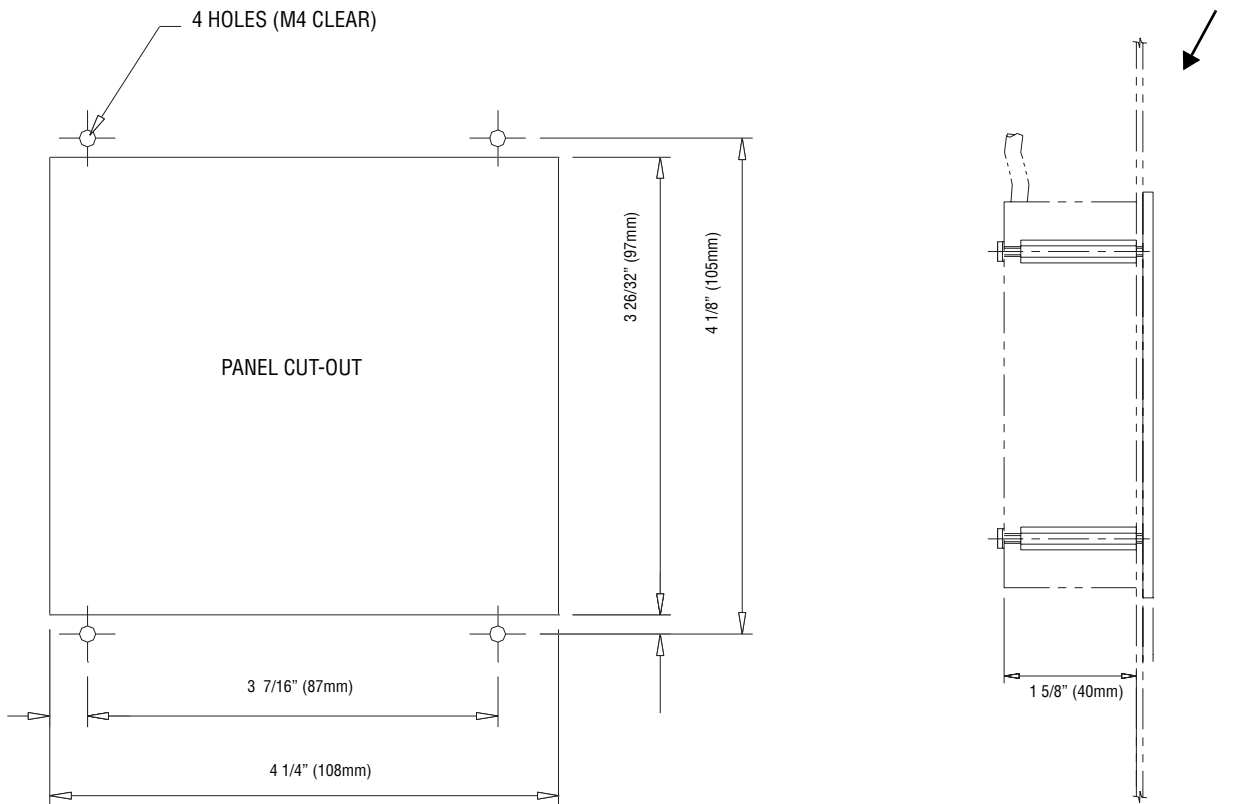
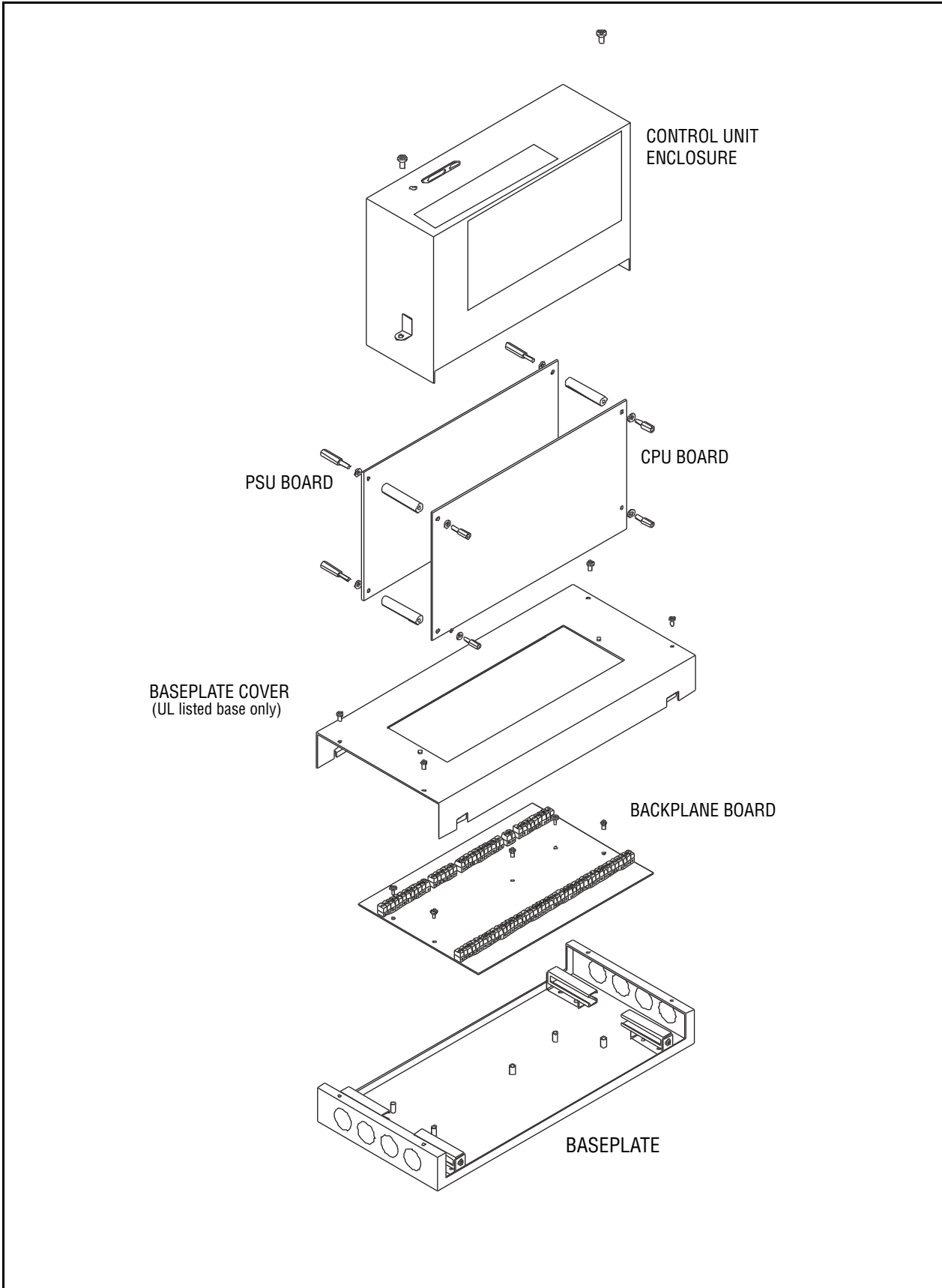


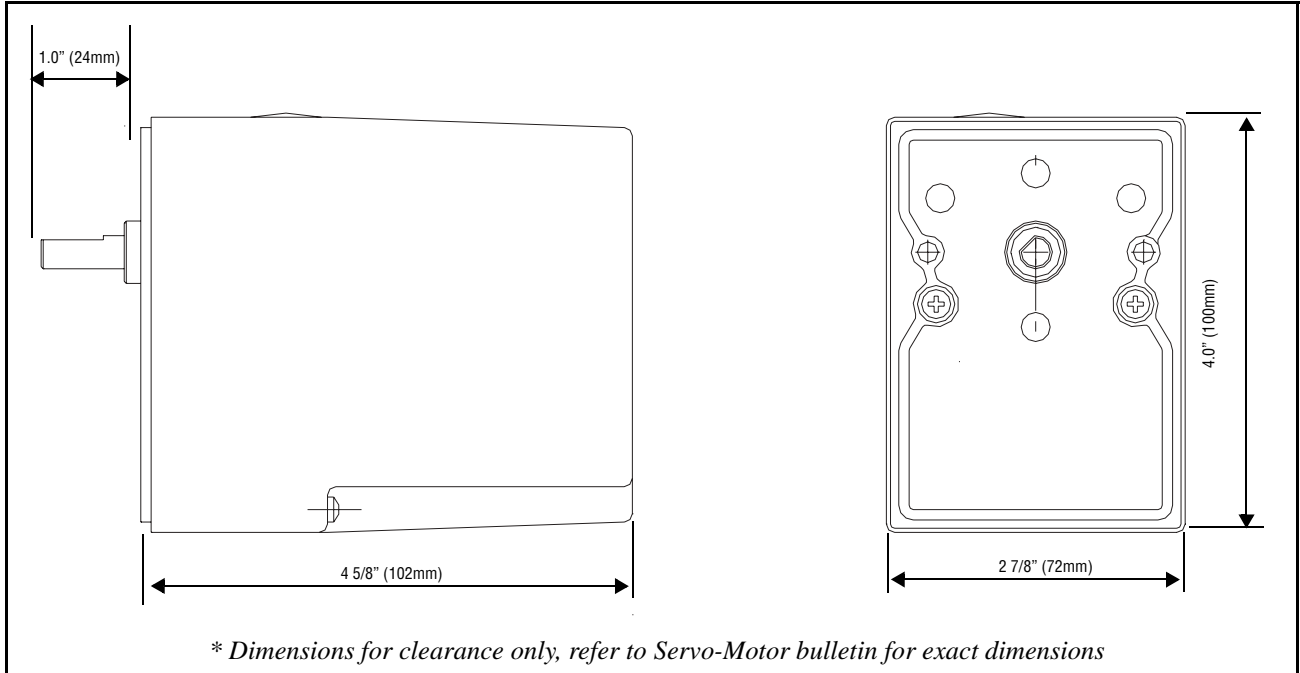
FIGURE 3. Control Unit Exploded View (listed wiring base)



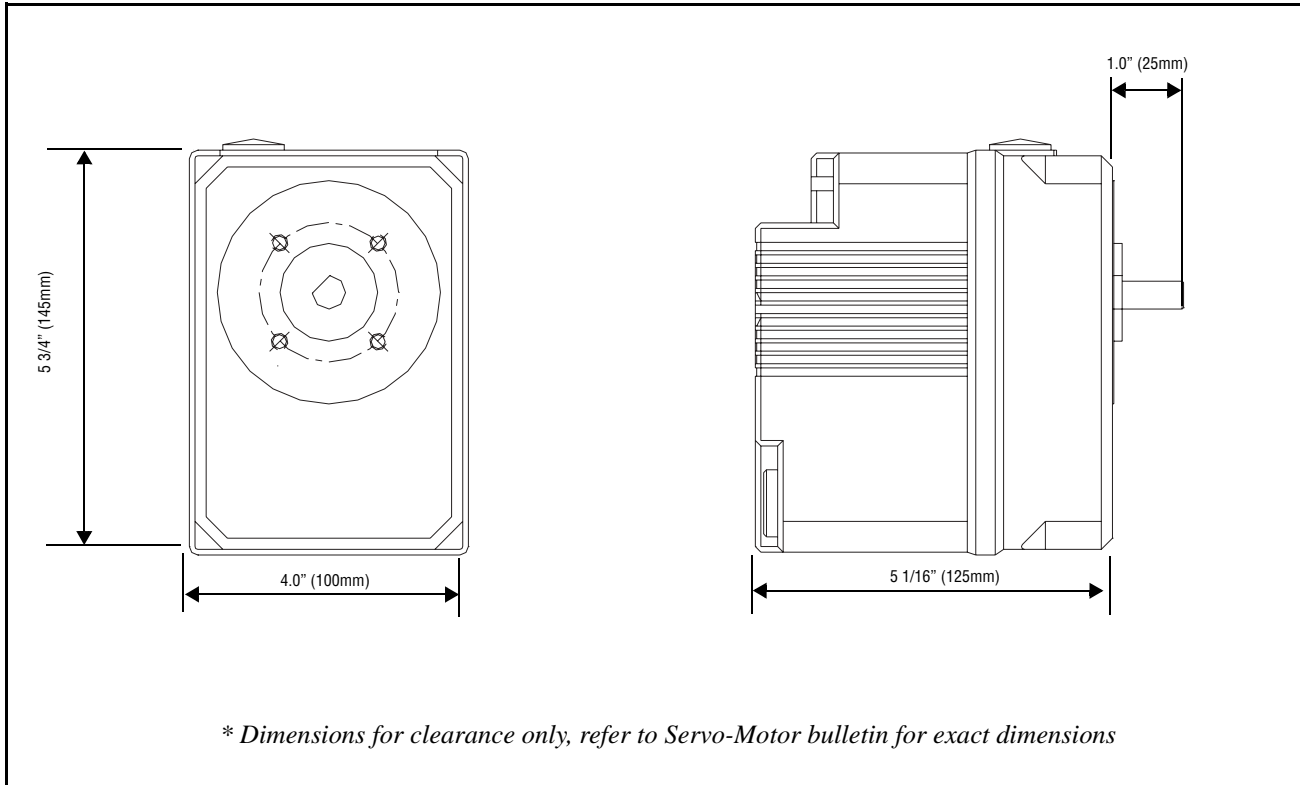
### Servo-Motor Installation

Fireye NX04, NX20 and NX50 Servo-Motors are available in 3 ft. lbs (4 Nm), 15 ft. lbs (20Nm) and 37 ft. lbs (50 Nm) versions. The accuracy of the final setup is contingent on the proper application of the motor to the controlled element. Extreme care should be given to the secure mounting of the Motor to the Air Damper or Fuel Valve being controlled. The Servo-Motor **MUST** provide permanent connection to the controlled element to provide safe, reliable and repeatable operation.

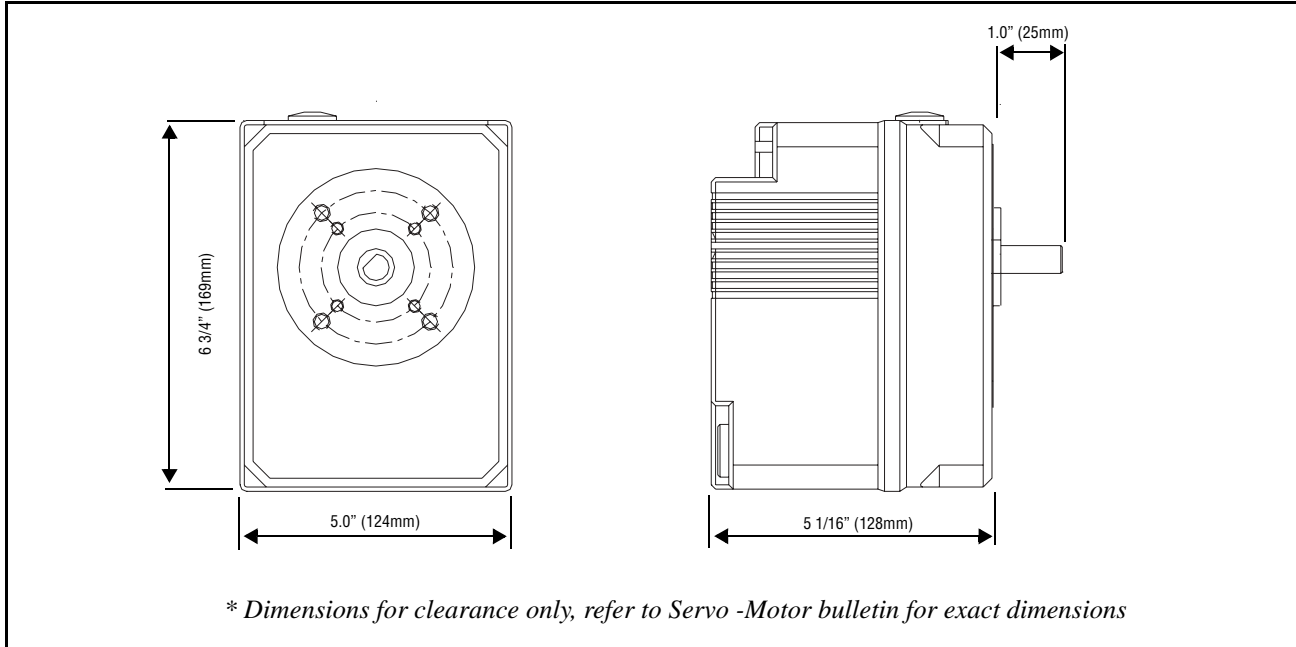
**FIGURE 4. NX04 Servo-Motor**



**FIGURE 5. NX20 Servo-Motor**



**FIGURE 6. NX50 Servo-Motor**



*\* Dimensions for clearance only, refer to Servo -Motor bulletin for exact dimensions*

**Optional Servo-Motor Requirements**

Should the Servo-Motors not be supplied by Fireye the following guidelines should be followed when selecting suitable motors;

All servo-motors must be of the same operating voltage, not exceeding 250V rms (high voltage version), 50V rms (low voltage version).

All motors must be AC 50 or 60Hz.

The servo-motor current must not exceed 150mA rms (high voltage version), 750mA rms (low voltage version).

If the motor voltage is lower than the supply voltage then a suitable power supply (such as a transformer) must be provided.

The motor supply to the Controller must be protected with a suitable fuse for the motors being used, to ensure that damage to the control unit does not occur, the absolute maximum fuse value is 4A.

The servo-motor time for 90° movement must not be less than 10 seconds or more than 60 seconds.

All servo-motors must have internal limit switches fitted which are adjusted to prevent excessive rotation.

All servo-motors must be able to drive the load imposed on them.

All servo-motors must have suitable protection for the burner environment (for example, NEMA4/IP65 for applications exposed to the weather).

If in any doubt about a particular servo-motor’s suitability, seek confirmation from your equipment supplier, who have a list of suitable units.

**Potentiometer requirements:**

All servo-motor potentiometers should be good quality plastic film types, with high resolution.

Depending on the supply voltage, a minimum resistance is allowed for the feedback potentiometers to prevent excessive current consumption. See page 21, Option Link Selection - “Pot Supp” for details.

**The potentiometer must be securely attached to the output shaft of the gearbox in such a way as to give accurate indication of the shaft position under all conditions and at all times.**

## Wiring



**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.**

**Wiring, where required, must comply with NEC, Class 1 (Line Voltage) wiring.**

**Loads connected to the Controller must not exceed those listed in the specifications as shown in this manual.**

**All external controls connected to this unit must be listed or recognized by authorities who have jurisdiction for the specific purpose for which they are used.**

**Maximum connected load must not exceed 2000VA**

The controller/wiring base **MUST** be mounted within a burner cabinet or similar enclosure and **MUST** be earthed to the overall enclosure to ensure safe and reliable operation.

The clamping bars on the control unit perform only an earth function and do not provide strain relief, the signal cable shields only connect at the clamping bar. Secure all cables carried in conduit at both ends using a suitable anchorage method in the cabinet.



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

Use multiple conductor braid shielded cable similar to Belden 8735 for 3 conductor application, or Belden 9939 (3 conductor), 9940 (4 conductor), or 9942 (6 conductor).

For UL approval, all single conductor wiring should be TEW, AWM or MTW within the cabinet. Conductors to be pulled through conduit should be THHN or TFFN. The maximum wire size that the wiring base will accept is a single 16 AWG. Should multiple conductors be required on a single terminal, an interposing terminal strip will be required.

For multi-conductor shielded requirements, use multiple conductor braid shielded cable similar to Belden 8735 for 3 conductor application, or Belden 9939 (3 conductor), 9940 (4 conductor), 9942 (6 conductor).

For CE approval, all cabling operating above 50V must be multi-strand single core PVC insulated 16/0.2mm and should meet the requirements of I.E.C. 227 or I.E.C. 225.

Do not use a green/yellow conductor for any purpose other than earth.

To comply with EMC requirements, wire the control unit using the specified cable sizes and shield connections. Clamp all signal cable shields to earth using the clamping bars provided on the control unit. Connect all cable shields to earth at the control unit end only, with the exception of the cables that connect the display and pressure sensors.

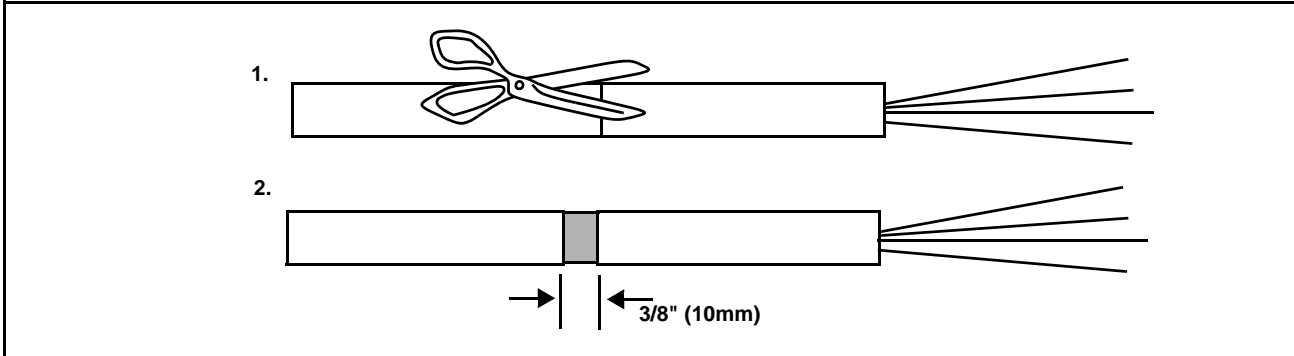
The equipment described in this manual has been tested for compliance to the UL Standards and CE Directives listed in the section headed "approvals".

However, once connected to a burner and other associated controls, it is the responsibility of the installer to ensure the complete installation meets the local authority's requirements of the UL Standard and/or CE Directives relevant to the particular installation.

**Using the cable clamp:**

Clamping bars are provided on the control unit for termination of cable screens where necessary. The cable should be prepared by cutting around the outer sleeve, taking care not to damage the shield (1). Pull the sleeving apart to expose 3/8" (10mm) of the screen (2). Slide the exposed length of shield between the clamping bars (3). Refer to figure 7.

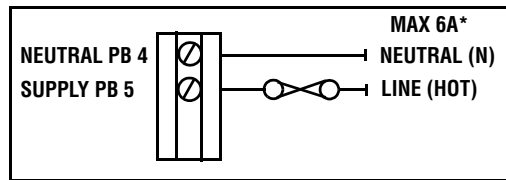
**FIGURE 7.**



**EARTH connection:**

Make the earth connection to the unit using the earth stud provided. Ensure that a good electrical connection is made both between the control unit and the burner panel and between the burner panel and earth. Where necessary, scrape any paint away from connection points and use locking star washers to obtain a reliable electrical connection. Always use the largest cross-sectional area earth wire possible.

**LINE (HOT and NEUTRAL) supply:**

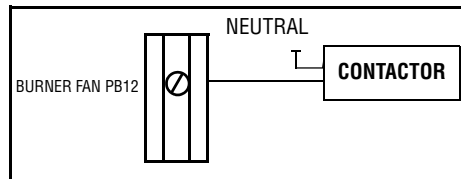


The LINE (HOT/L1) and NEUTRAL (N/L2) must be connected using multi-strand single conductor PVC insulated 16, 18, 20 AWG, 600V 90°C (16/.02mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line

Voltage) wiring.

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

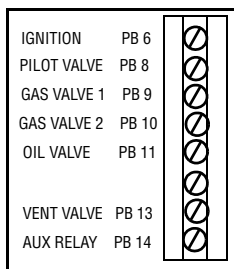
**Burner fan output:**



The burner fan output must be connected to the external motor contactor using multi-strand single conductor PVC insulated 16, 18, 20 AWG, 600V 90°C (16/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring.

**If a fuse greater than 4A is used in the supply to the unit, the burner fan output terminal MUST be separately fused at 4A maximum, to protect the relay contacts from 'welding'.**

### Ignition, pilot valve, main valves, vent, and auxiliary relay outputs:



If using proof of closure switches for either fuel valve, ensure they are wired to the relevant auxiliary inputs and the corresponding option parameter is set accordingly (refer to option parameter 10.1 -10.9).

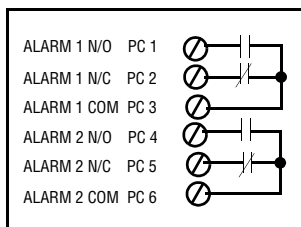
**Fuses not exceeding 4A must protect all relay outputs. Using a fuse in the unit supply of 4A or where the total current exceeds 4A, use a separate fuse on each relay output to achieve this. (See cautionary note in Burner select input).**

These outputs must be connected using multi-strand single conductor PVC insulated 16, 18, 20AWG, 600V 90°C (16/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and, where required, must comply to NEC Class 1 (Line Voltage) wiring. In most cases, the outputs can be connected directly to the ignition transformer, alarm device and valves without the use of external relays.

**It is recommended that the ignition transformer should be mounted as far away from the control unit as possible.**

Ensure all connections to the ignition transformer are as short as possible and where possible, do not run adjacent to any other wiring and that the ignition transformer earth connection is made to the panel earth and not the wiring base earth.

### Alarm Relays:



Alarm relays are shown with NO power to Terminal PB5. When power is applied to Terminal PB5, the alarm relays will change state. In the event of a limit fault or forced alarm, alarm relay 1 will go OFF, connecting alarm 1 COM (PC3) to alarm 1 N/C (PC1). In the event of a safety shutdown, alarm relay 2 will go OFF, connecting alarm 2 COM (PC6) to alarm 2 N/C (PC5).

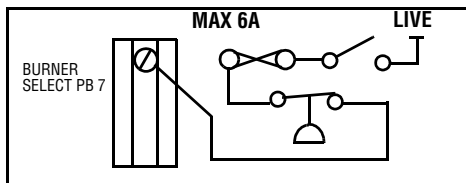
These outputs must be connected using multi-strand single conductor PVC insulated 16, 18, 20AWG, 600V 90°C (16/0.2mm) wire

### Burner select (ON/OFF-LIMITS) input:



**WARNING: Any external limit device must be connected into the burner select (ON/OFF-LIMITS) line, unless connected into the auxiliary inputs and the correct function selected.**

- If a limit device is utilized in the burner select (ON/OFF-LIMITS) line, it must be capable of supplying the total current required by the main and pilot valves.
- Any limit device connected to this unit must be listed or component recognized by authorities who have jurisdiction for the specific purpose for which they are used.
- Wiring must comply with all applicable codes, ordinances and regulations.
- Wiring, where required, must comply with NEC Class 1 (Line Voltage) wiring.



This input should be connected to the burner select switch and/or external limit circuit using multi-strand single conductor PVC insulated 16, 18, 20 AWG 600V, 90°C (16/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring.

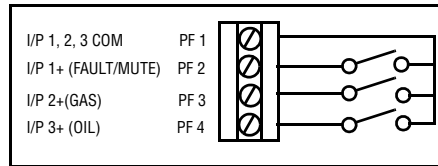
**The device connected to this input must be capable of supplying the current required by the main and pilot valves and fused up to a maximum of 6A. If a fuse greater than 4A is used, each fuel valve output MUST be separately fused at 4A maximum, to protect the relay contacts from ‘welding’.**

### Oil, Gas, Fault Mute(Reset) Inputs:

These inputs, if not required for the functions shown, can be wired in the same way and used for non-safety related functions. Refer to Option Parameters 10.0, 10.6 and 10.7.



**WARNING: The fault mute (reset/silence) switch must be within sight and sound of the burner.**

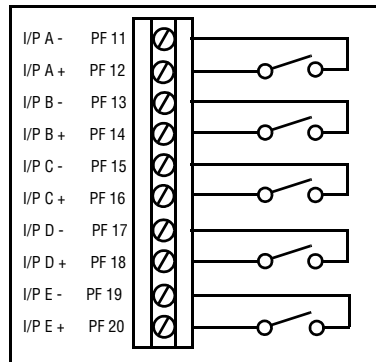


These inputs should be connected using multi-strand overall shielded multi-conductor PVC insulated 22 AWG-7/30, 300V 80°C (16/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. Note that these inputs expect dynamic low

voltage (0/5V) signals and must be taken from the MAIN COMMON terminal provided. **Do not connect these inputs to Line Voltage. PF2 (Fault/Mute) input is not required if NX550 display is used.**

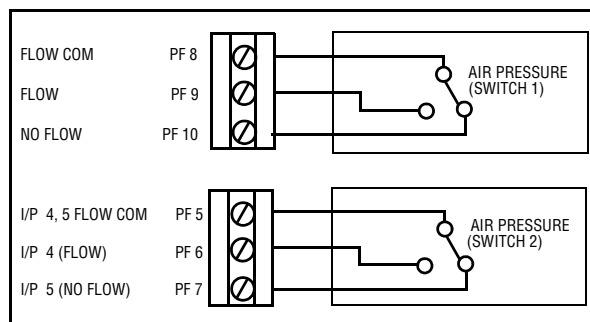
### Aux A to Aux E inputs:

These inputs can be used for safety related functions, refer to Option Parameters 10.1 to 10.5.



These inputs should be connected using multi-strand overall shielded two conductor PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. Note that these inputs expect dynamic low voltage (0/5V) signals and must be connected between the relevant terminals provided. **Do not connect these inputs to Line Voltage.**

### Flow com output and flow/no flow inputs:



These terminals should be connected to the appropriate terminals on the burner's air pressure switch using multi-strand overall shielded 3-core PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire.

Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. The flow input (PF9) should be energized when air pressure is present.

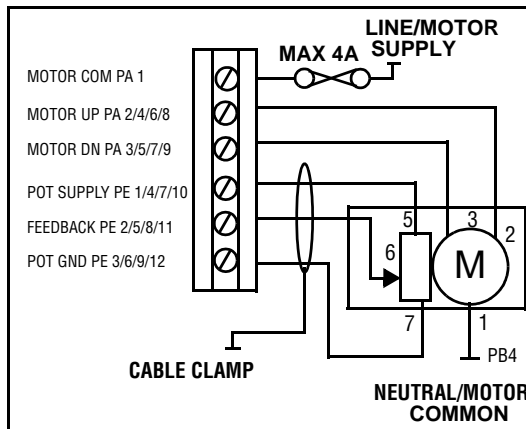
If required, a second air pressure switch may be connected using the separate terminals as required. If the second airflow switch is not required, two digital inputs may be wired using the flow COM (PF5) as common for each external switch. These two switches may be used for non-safety related functions, as listed for option parameter 10.8 and 10.9.

A SPDT switch is required for the air proving circuit. Flow and no flow conditions are verified and lockout will occur in the event of no flow during run sequence, or flow during an off condition.

**Under no circumstances should these inputs be connected to Line Voltage.**



**Motor up/down outputs and feedback potentiometer inputs:**

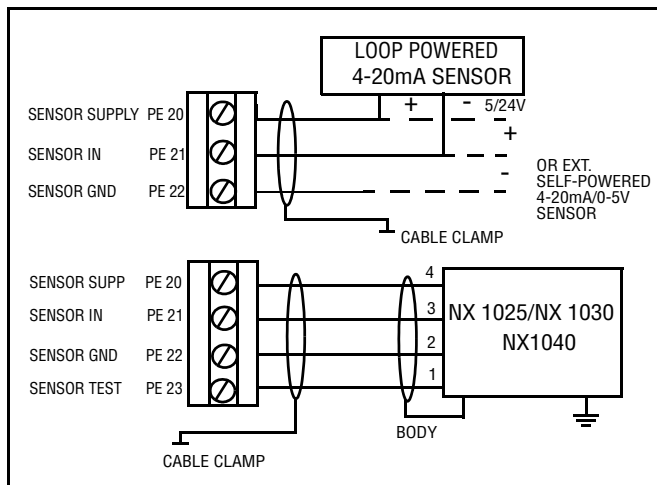


The motor up/down outputs should be connected using multi-strand single conductor PVC insulated 20AWG, 600V 90°C (16/0.2MM) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. The connections to the motor should be made via its switched inputs, so that the internal microswitches prevent the motor being damaged if it is driven to either end of its travel. Motor supply must be fused to protect the unit and the motors. Ensure the fuse rating is selected to suit the current rating of the triac output option fitted.

Motor feedback potentiometer cabling must be overall shielded 3-conductor PVC insulated 22AWG-7/30AWG, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. Since this cable may be run in conduit with other wiring, its voltage rating must exceed the maximum voltage carried by any other cable in the same conduit.

Connect the shield with the use of the clamping bar. Make all connections at the servo-motor first. **Incorrect connection may damage or destroy the motor potentiometer.**

**Pressure/temperature sensor input:**



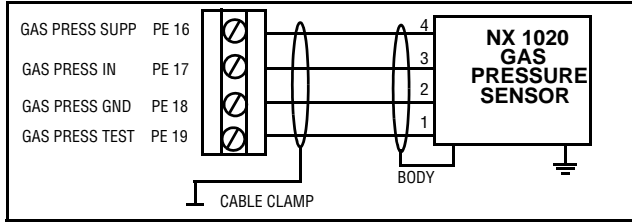
The pressure/temperature cabling must be overall shielded multi-core (number of conductors as required by the relevant sensor) PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. Since this cable may be run in conduit with high voltage wiring, its voltage rating must exceed the maximum voltage carried by any other cable in the same conduit.

The input is suitable for use with 0-5V or 4-20mA signals (externally or internally powered), the NX1025 / NX1030 steam pressure sensor or the NX1040 boiler temperature sensor. Refer to option link section (page 21) for details on setting the option links for the correct voltage and input type.

Connect the cable shield to the controller with the use of the clamping bar. In the case of the NX1020, NX1025 and NX1030 steam pressure sensor and NX 1040 temperature sensor, connect the cable shield at both ends.

Make all connections at the sensor/transmitter first.

**Gas pressure sensor input:**

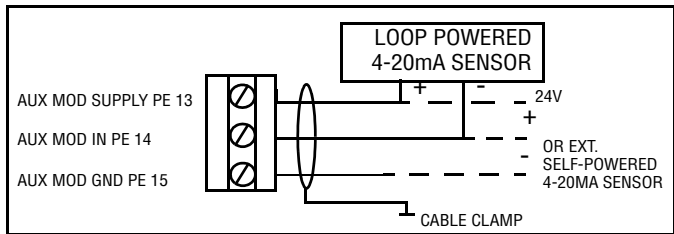


The pressure/temperature cabling must be overall shielded 4-conductor PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and where required must comply to NEC Class 1 (Line Voltage) wiring. **Since this cable may**

**be run in conduit with high voltage wiring, its voltage rating must exceed the maximum voltage carried by any other cable in the same conduit.**

Connect the cable shield at both ends, using the clamping bar at the controller end. Make all connections at the sensor first.

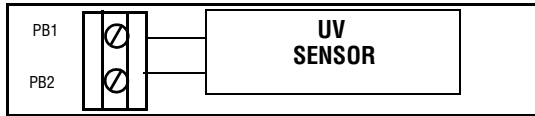
**Auxiliary modulation input:**



The auxiliary modulation input cabling must be overall shielded multi-conductor (number of conductors as required by the relevant sensor) PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations

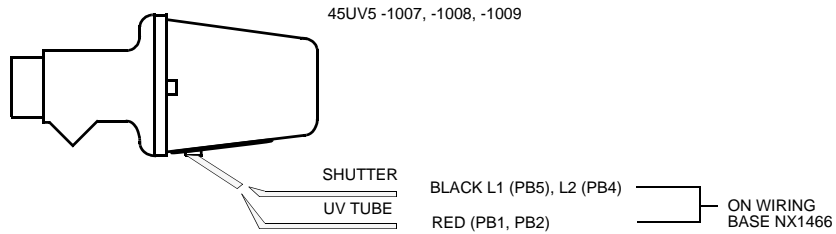
and where required must comply to NEC Class 1 (Line Voltage) wiring. Since this cable may be run in conduit with high voltage wiring, it's voltage rating must exceed the maximum voltage carried by any other cable in the same conduit.

**UV Flame Sensor**



In the case of a non-self checking scanner (UV1A, UV2, UV8A, 45UV3), connect the scanner leads to terminals PB1 and PB2. Refer to bulletin SC-102 for more information.

For a self checking scanner (45UV5--1007, -1008, -1009), connect the signal leads (red) to terminals PB1 and PB2, connect the shutter leads (black) to the Hot and Neutral of the main power supply terminals PB5 and PB4. Refer to bulletin SC-101 for extended wire run recommendations and wire type.



**Mount the UV sensor in such and way that an ignition spark will not simulate the presence of a flame.**

**IR Flame Sensor**



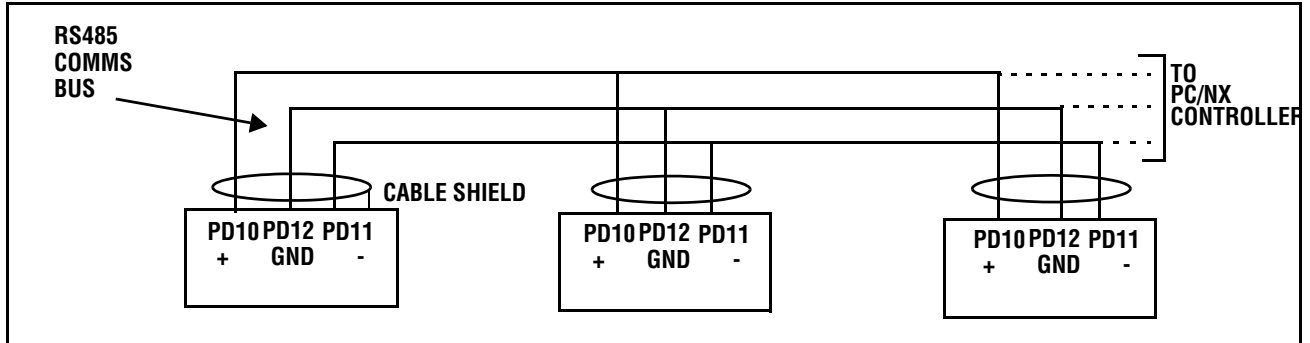
Install and wire the 48PT2 IR scanner according to the instructions supplied with the scanner in Bulletin SC103.

### RS485 interface

The RS485 cabling must be overall shielded 3-conductor PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Terminate the screen shield at one unit only using the cable clamp provided.

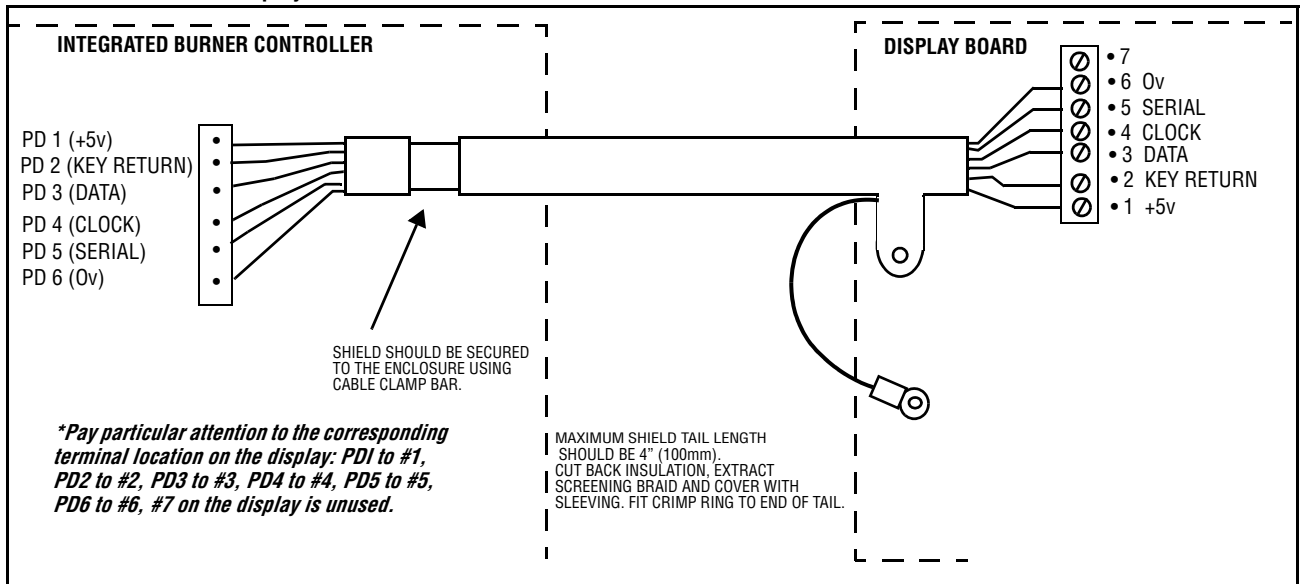
For details on connecting NX Series integrated burner controllers and a PC onto the communications bus, refer to bulletins NEX-1501(ComView combustion analysis tool) or NEX-SO (boiler sequencing). Refer to the following table for terminal identification.

**FIGURE 8.**



RS485	EXPANSION MODULE/SEQUENCING	COMFIRE/COMMUNICATIONS
+	PD8	PD11
GROUND	PD7	PD10
-	PD9	PD12
SHIELD	ON ONE UNIT ONLY	ON ONE UNIT ONLY

**FIGURE 9. Display Connection**



The display cabling must be overall shielded 6 conductor PVC insulated 22AWG-7/30, 300V 80°C (7/0.2mm) wire. Wiring must comply with all applicable codes, ordinances and regulations and, where required, must comply to the NEC Class 1 (Line Voltage) wiring. Since this cable may be run in conduit with other wiring, its voltage rating must exceed the maximum voltage carried by any other cable in the same conduit.

It is imperative the shield of this cable is connected to the display unit's metal housing. This should be achieved as follows:

1. Cut back approximately 4" (100mm) of overall insulation.
2. Open the braided shield adjacent to the remaining insulation and pull all 6 cores through the opening.
3. Fold the shield back down the insulated cable.
4. Fit sleeving to the braid to insulate the earth cable formed by the braid.
5. Fit adhesive lined heatsink to cover the folded back screen and hold the earth sleeving.
6. Adjust the earth connection as required (length must not exceed 4" (100mm) to reach either 4mm securing/earthing studs and fit a suitable crimp ring terminal.
7. The shields of all cables must be connected at the main unit by cutting back the insulation where the cable passes them throughout the cable clamp to ensure a good earth connection is made.

## OPTION LINK SECTION

The NX1486,1366 Wiring Bases have a number of option selection links, located on the circuit board. The function and settings are marked on the board alongside each link. These links must be set to the correct position before power is applied to the unit.

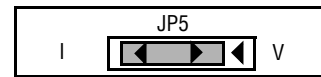
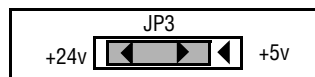
### Line Supply Voltage (LK1 - 4)

The possible supply voltages are listed below, together with the necessary fuse rating. The correct fuse must be installed.

SUPPLY VOLTAGE	LINKS REQUIRED	FUSE RATING (mA)
110	LK1 and LK3	200 ANTI-SURGE
230	LK2 and LK4	100 ANTI-SURGE

### SENS IN and SENS SUPP (boiler temp/pressure sensor) JP3 and JP5:

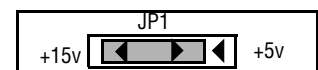
If a boiler pressure/temperature sensor or modulation potentiometer is used, these links must be set to suit the type of sensor. For example:



SENSORS	JP3	JP5
NX1025	+24V	V
NX1030	+24V	V
NX1040	+24V	V
4-20 mA LOOP POWER SENSOR	+24V	I
0-5 V MODULATION POTENTIOMETER	+5V	V

### POT SUPP (potentiometer supply voltage) JP1:

The Controller can either supply +5V or +15V DC to the potentiometers and is selected with link JP1.



If the potentiometer moves over its entire 270° range for 90° of servo-motor travel, select a +5V supply.

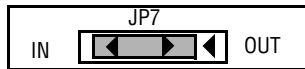
If the potentiometer is a 340° type but only moves over 90° of its range for 90° of servo-motor travel, select a +15V supply.

POTENTIOMETER TYPE	SUPPLY VOLTAGE	MINIMUM POTENTIOMETER Ohms	MAXIMUM POTENTIOMETER Ohms	JP1 JUMPER
NEXUS 340° with 90° TRAVEL	15V	3K	15K	15V
270° WITH FULL TRAVEL	5V	1K	5K	5V

### RS485 TERM (RS485 serial communications termination resistor)



Please note there are two RS485 connections to the unit, one non-isolated and one optional, which is isolated.



The position of the termination link is important only if the RS485 serial communications are to be used, JP7 if the optional isolated RS485 output and JP6 is for the non-isolated RS485 output. The two units at the end of the communications bus should have this link set to the IN position. All other units should have the link set to the OUT position. If only two control modules are on the communications bus, set the links on both units to the IN position.

### Final Checks

Before applying power, make the following checks:

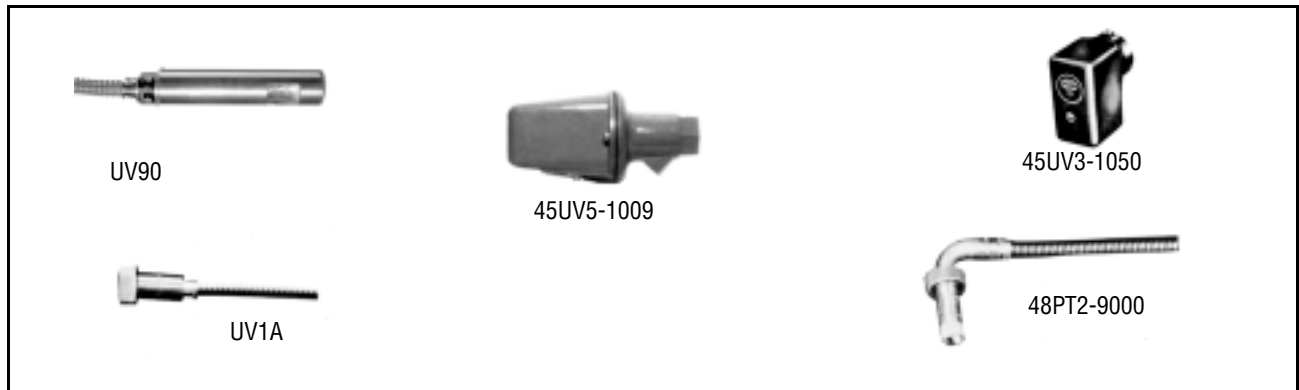
The unit is set for the correct line supply voltage.

All other link positions are correct.

The fuse within the unit is intact and of the correct value.

All wiring and connections have been made according to the specifications detailed in this chapter.

## FLAME SCANNERS



**CAUTION:** The UV1, UV2, UV8A, UV90 and 45UV3 ultra-violet flame scanners are non-self checking UV systems and should be applied only to burners that cycle often (e.g.: a minimum of once per 12 hours) in order for the safety checking circuit to be exercised. If component checking is required during burner operation for constantly fired burners, utilize the self-checking ultra-violet flame scanners (45UV5) or the infrared flame scanner (48PT2) which uses auto-check amplification circuit.

## SCANNER SELECTION

FIREYE P/N	BULLETIN	DESCRIPTION
48PT2-1003 48PT2-9003 48PT2-1007 48PT2-9007	SC-103	Infrared 1/2" straight mount 96" (2.4m) cable Infrared 1/2" 90° angle mount 96" (2.4m) cable Infrared 1/2" straight mount 48" (1.2m) cable Infrared 1/2" 90° angle mount 48" (1.2m) cable
UV1A3 UV1A6 UV8A UV2 45UV3-1050 UV90-3  UV90-6  UV90-9	SC-102	UV 1/2" straight 36" (0.9m) flex conduit UV 1/2" straight 72" (1.8m) conduit UV 1/2" 90° head 72" (1.8m) unshielded leads UV 3/8" straight 36" (0.9m) flex conduit UV 3/4" cast aluminum housing 8' (2.4m) cable UV non-self checking scanner for frontal or side (90°) viewing. Complete with mounting fixture and 3' (900mm) flex conduit. UV non-self checking scanner for frontal or side (90°) viewing. Complete with mounting fixture and 6' (1800mm) flex conduit. UV non-self checking scanner for frontal or side (90°) viewing. Complete with mounting fixture and 9' (2700mm) flex conduit.
45UV5-1007 45UV5-1008 45UV5-1009	SC-101	Self-check UV 1" British thread mounts, 230V, 6' (1.8m) unshielded leads Self-check UV 1" British thread mounts, 120V, 6' (1.8m) unshielded leads Self-check UV 1" N.P.T. threads, 120V, 6' (1.8m) unshielded leads



## OPERATION IN RUN MODE

### Start-up sequence

When a fuel selection is made and the burner select signal is given to start up the burner, the control unit runs through the sequence described below. If gas is the selected fuel and gas valve proving has been selected, the unit also performs safety valve pressure proving in parallel with the start-up sequence (see option parameter 2.0 Gas Pressure Select).

STAGE NO.	STAGE NAME	DESCRIPTION
0	Safety Shutdown	The burner is held in this state until all faults are removed.
1	Burner Off	The burner is checked to make sure that it has switched off completely. This includes main fuel safety valves closed, no flame signal and a no air pressure signal.
2	Wait for Purge	The unit waits for a both burner select and a gas or oil select signal.
3	Open Fuel Valve	If gas valve proving is selected, the fuel motor is moved up for five seconds to allow any gas in the test section to be vented easily during the proving sequence.
4	Hold Fuel Valve	The fuel motor is held in position until step 1 of the safety valve proving sequence (open main valve 2, or vent valve) is completed.
5	Prove Closed Position	If gas is selected, the gas valve proving sequence begins. The fuel and air motors are moved down until they stop. The final positions are compared with the closed positions stored in memory.
6	Prove Air Pressure	The fuel and air motors are moved up towards the purge position, the burner motor is started and air pressure prove time t1 is initiated.
7	Prove Purge Positions	When the air pressure prove time t1 has elapsed, the air pressure switch must give a 'pressure' signal or the unit will lockout the burner. If firing on oil and primary air is selected, both primary and secondary air signals must change from 'no pressure' status. If firing on gas and primary air is selected the primary air signal must remain at 'no pressure' status. The fuel and air motors are moved up until they stop. The unit measures the time taken for each motor to travel from the close to the purge position and the final measured positions are compared with the purge positions stored in memory.
8	Pre-Purge	The timed pre-purge t2 is initiated. The fuel motor is moved towards the closed position during this time.
9	Move to Ignition Positions	When t2 has elapsed, the fuel and the air motors are moved to the ignition position for the selected profile. The unit will wait for the gas valve proving sequence to finish if it is still in progress
10	Pre-Ignition	Once the fuel and air motors are at their ignition positions, the ignition transformer output is energized and pre-ignition time t3 is initiated.
11	Pilot Ignition	Once t3 has elapsed the ignition transformer, pilot valve outputs are energized and the first safety time t4 is initiated. If oil is selected, use timing in the start-up sequence table for main valve 2.
12	Pilot Ignition Interval	When the first safety time t4 has expired, a flame must be detected or the unit will lockout the burner. The ignition transformer output is turned off and interval time t5 is initiated.
13	Main Ignition	Once the pilot interval time t5 has elapsed, both main valve outputs for gas, main oil valve output for oil is energized and the second safety time t6 is initiated.
14	Wait for Flame Established	When the second safety time t6 has expired, the pilot valve output is turned off. If permanent pilot is selected and the burner is firing on gas the pilot will remain open with main valve 2. Main interval time t7 is initiated.
15	Moving to Low Fire	When interval time t7 has elapsed, the flame is considered established and the fuel and air motors are moved from their ignition positions to their low fire positions.
16	Modulation	Once the fuel and air motors reach their low fire positions, they are modulated according to the demand placed on the burner.
17	Move to Post-Purge	If the fuel selection is changed or the 'burner on' signal is removed, the main valve outputs are turned off. The fuel motor is moved to its closed position, the air motor is moved to its purge position and the post purge time is initiated.
18	Post-Purge	When the post purge time has elapsed, the burner motor is turned off and the unit returns to stage 1 to wait for another start-up.



**Table 1: Start-up Sequence\***

	1. Burner off	2. Wait for purge	3. Open fuel valve	4. Hold fuel valve	5. Prove closed positions	6. Prove air pressure	7. Prove purge positions	8. Pre-purge	9. Move to ignition positions	10. Pre-ignition	11. Pilot ignition	12. Pilot ignition interval	13. Main ignition	14. Wait for flame establ.	15. Move to low fire	16. Modulate	17. Move to Post-Purge	18. Post-Purge***			
Burner Select																					
Air Flow Switch(s)																					
Flame Detect																					
Main Valve #1																					
Main Valve #2																					
Pilot Valve																					
Vent Valve																					
Fan Motor																					
Ignition Transformer																					
						t1		t2		t3	t4	t5	t6	t7							Post-purge time

↑ VALVE PROVE TEST BEGINS

\* THIS CHART REFLECTS OPERATION WITH OPTION PARAMETER 4.0 SET TO 8 OR 10. REFER TO TABLE 2 FOR OPERATIONAL SEQUENCE WITH VALVE PROVING SEQUENCE ENABLED.

\*\*\*POST PURGE TIMING SET IN OPTION PARAMENTER 4.3

## GAS SAFETY VALVE PROVING SEQUENCE

If the gas valve proving is enabled (refer to section option select 2.0) and a gas profile is selected, the unit will begin the gas safety valve proving sequence on stage 3 of the start up sequence. If any step of the gas valve proving sequence fails, the unit will perform a safety shutdown and lockout the burner.

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 unit will indicate a fault. A check is made to ensure 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 may not rise by more than  $P_{test}$ . If this occurs, the unit 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 unit 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 unit will indicate a fault. A check is also made to ensure that the test section pressure is between the low gas pressure limit and high pressure range of sensor.
5. **Valve prove finished.** The gas safety valves have been proved satisfactorily and the unit may proceed with ignition. The unit remains in state 5 until the burner is switched off. The gas pressure high and low limits are checked for burner status between 11 and 16.

## VALVE PROVE TEST SEQUENCE

Table 2:

	A. Check all valves closed	B. Open main valve 2	C. Pressure rise interval	D. Open main Valve 1	E. Pressure drop interval	F. Valve prove test finished
Main valve 1						
Main valve 2						
Vent valve						

	-Energized/high		-Energized if N.O.V.V. valve selected		-Energized if vent valve not selected
--	-----------------	--	---------------------------------------	--	---------------------------------------

For the proving sequence,  $T_{test}$  is given by the following formula:

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

Where:  $V$  = Volume of test section (l/cu. ft.)

$P_G$  = Measured gas pressure above atm. (mBar/psi)

$P_{test}$  = Max. test pressure drop/rise (mBar/psi)

$P_{atm}$  = Atmospheric pressure (1013mBar)

$Q$  = Maximum permitted leakage rate ([l/cu.ft.]hr<sup>-1</sup>)

The unit automatically calculates  $P_{test}$  and  $t_{test}$  based on the entered gas pressure, test volume and leakage rate.

During the calculation, the unit chooses  $P_{test}$  to keep  $t_{test}$  low and avoid lengthy pre-purges.

The calculated values of  $P_{test}$  and  $t_{test}$  may be seen on the engineers key (see the engineer's key EK37, 38, 39).

### Modulation

During stage 16 (modulation), the unit will position the fuel and air motors as programmed for the profile selected.

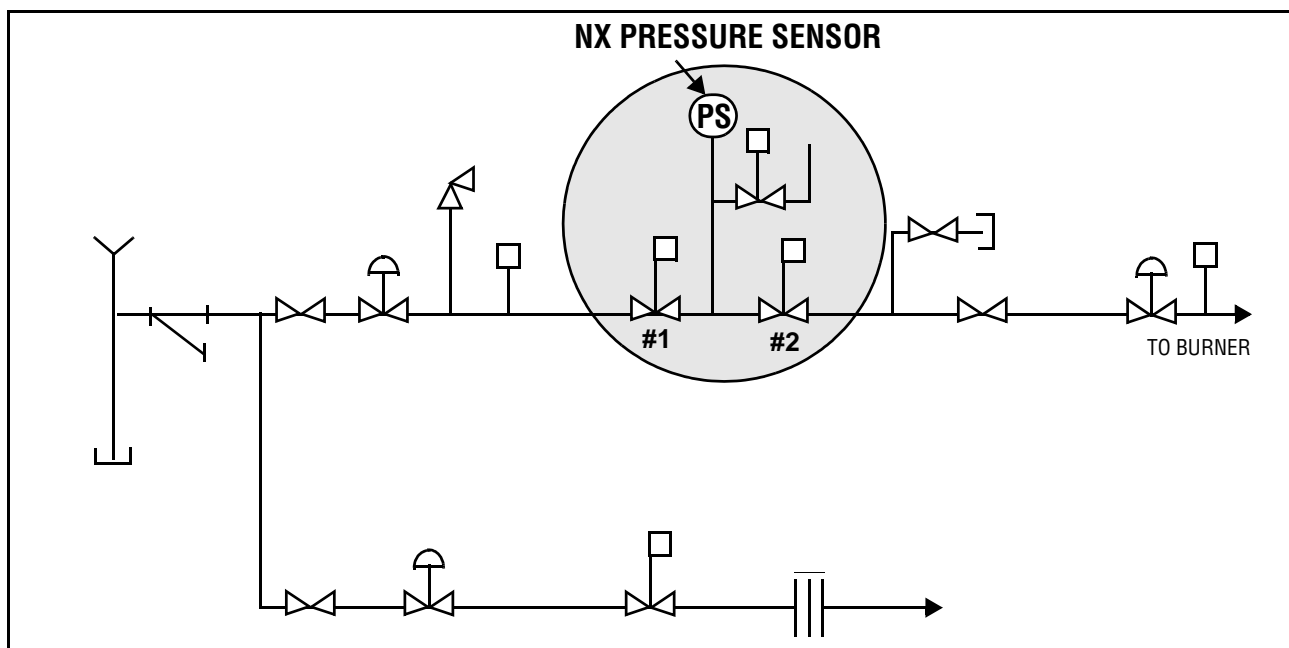
In auto modulation mode, the system will modulate as necessary to either track the input or maintain the pressure/temperature of the boiler at the entered setpoint (see Option Parameter 5.3 - 5.8). If boiler sequencing is enabled and active, the unit will start, stop and modulate according to instructions issued from the unit controlling the lead boiler.

In manual modulation mode, the system will either modulate in response to the keyboard up/down keys (if the NX550 Display is mounted) or the external up/down signals.

### Safety Shutdown

A safety shutdown will occur under the following conditions:

- If any step of the gas proving 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 and Fault Finding).

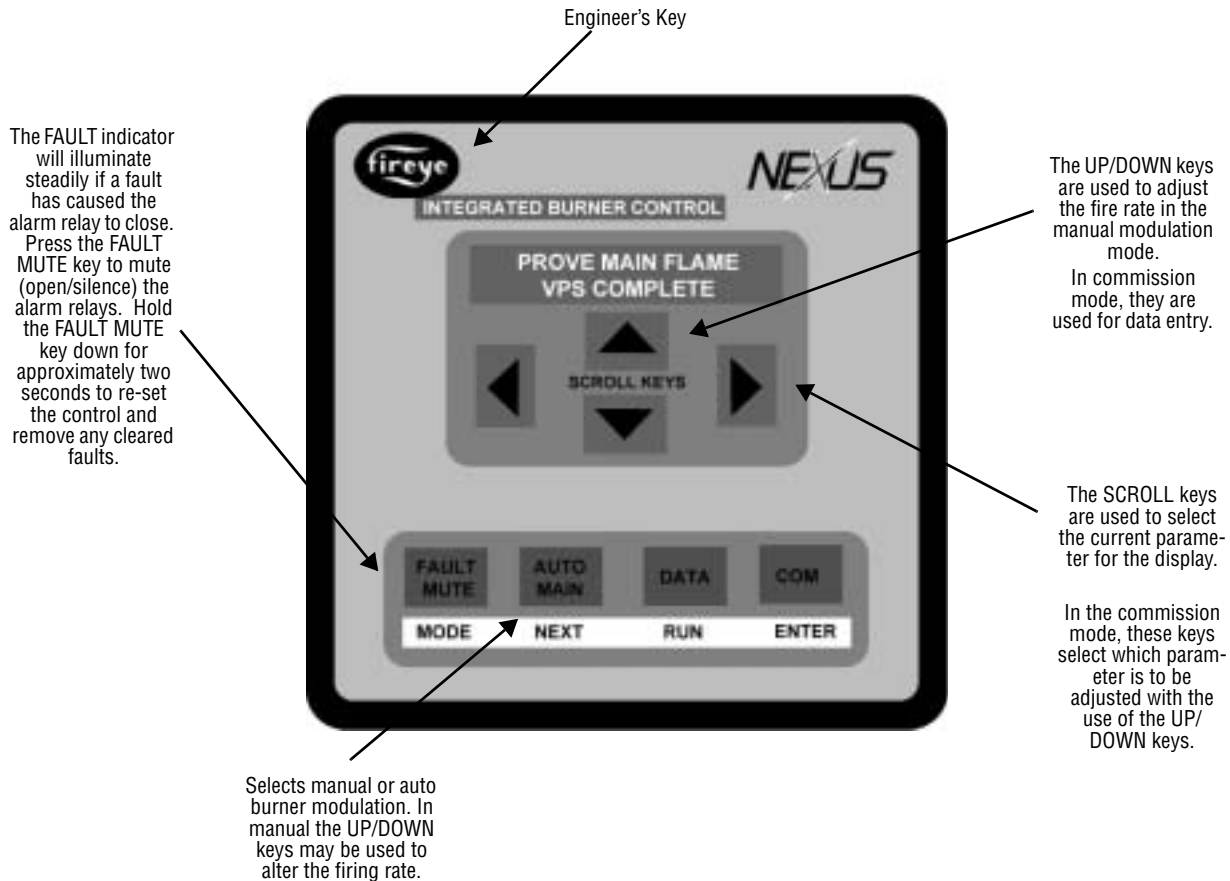


## THE DISPLAY

### Description

The display is a 2 line 20 character per line dot matrix vacuum fluorescent unit allowing the use of plain text messages for most display parameters. The display must be mounted to allow commissioning of the system but once commissioning has been completed, the display may be removed, providing external switches and/or lamps are mounted for fault indication and reset. Ensure that the power is off when connecting or disconnecting the display.

### Description of Keys



### Description of Display Parameters

The dot matrix display will indicate all display information as plain text messages, with the exception of the engineer's key values.

<b>MOTOR 1 MOTOR 2 MOTOR 3</b>	Indicates the position of each motor connected to the system in angular degrees. When the burner is on, only the motors used for the fuel being fired will be available.
<b>ACTUAL VALUE</b>	Indicates the measured pressure or temperature of the boiler, according to the zero and span values entered as option parameters. If the input current drops below 3.0 mA, the display will flash 'Lo'. If the input current rises above 21 mA, the display will flash 'Hi'. This display parameter is not available if tracking modulation input is selected.
<b>SETPOINT</b>	Indicates the required pressure or temperature of the boiler, according to the zero and span values entered as option parameters. If a tracking modulation input is selected, this display parameter shows percentage modulation rate.
<b>FAULT NUMBER</b>	If no faults are present, this display parameter will not be available. If the unit detects an internal or external fault, this display will indicate the number of that fault (see section on Faults and Fault Finding for details).

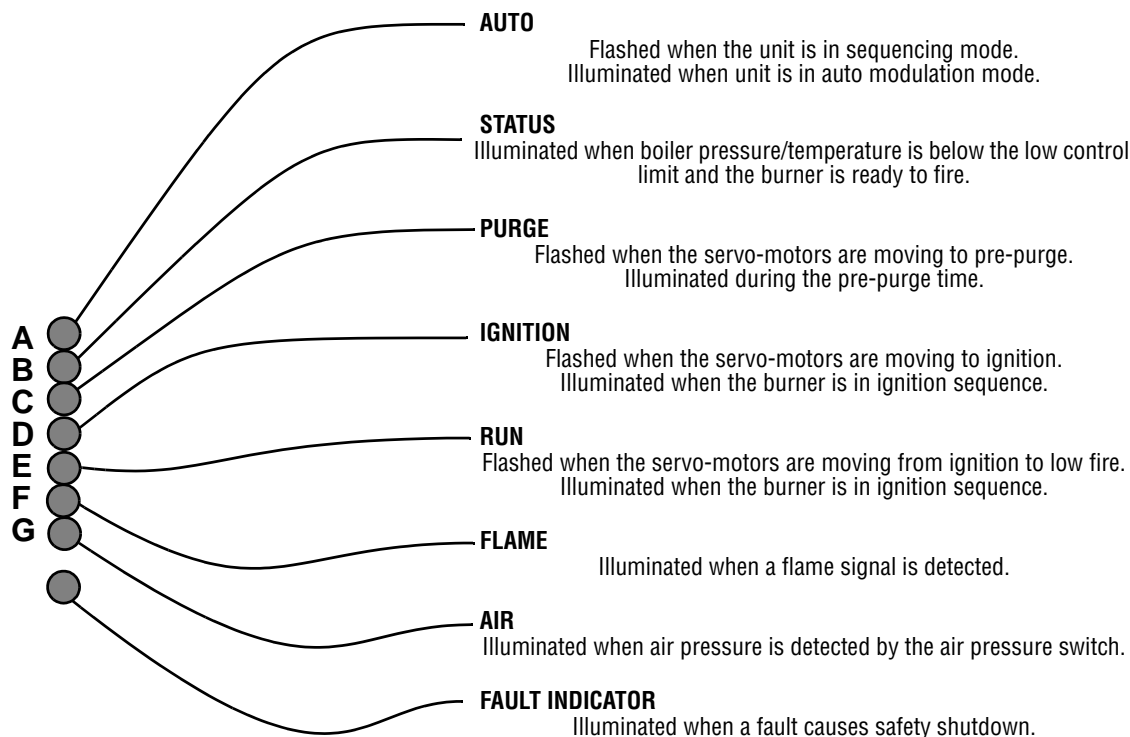
<b>HOURS RUN</b>	Displays the hours run for the current profile selection. If no profile is selected, the display will show '---'.
<b>P n</b> <b>A n</b>	This display parameter is used in commission ratio. This display is used in adjust ratio mode. They indicate the profile setpoint currently under adjustment or being displayed. If the display is flashing, the unit is waiting for an event to occur before the point may be altered. When the display stops flashing, the point may be altered. PROFILE SET is not available in run mode.
<b>MODULATION</b>	This is the percentage modulation rate based on the position of the lead drive, where 0% is low fire and 100% is high fire.
<b>GAS PRESSURE</b>	Measured gas pressure in mBar. This parameter is only available if the gas pressure sensor input is enabled (see section on Option Parameters for details).
<b>FLAME SIGNAL</b>	0 - 100 display of flame signal, values above 5 are taken as flame present. A signal of 10 should be maintained for normal burner operation

## CONTROL LED INDICATORS

The control unit display is comprised of one red (fault) indicator and seven green (operational) indicators.

During normal operation, the red indicator is off and the seven green indicators show status information (see below).

If a fault occurs, the red indicator is illuminated and the green indicators show the fault number (see Fault Listing).



---

## SERVO-MOTOR ADJUSTMENT

---

### Feedback Potentiometer



**WARNING: The servo-motor internal feedback potentiometer must be secured within the servo-motor to ensure that there is no possibility that the potentiometer can become disconnected from the motor output shaft.**

For each servo-motor, it is necessary to adjust the potentiometer's position relative to its shaft in order to obtain the correct open and closed positions on the display. To do this, follow the procedure below:

1. Move the valve/damper to its fully closed position and adjust the potentiometer's position on the motor shaft so that approximately 2° to 3° is shown on the display.
2. Move the valve/damper to its fully open position and check that the display reads approximately 85° to 88° or the maximum angular opening required from the servo-motor if this is less than 90°. If the displayed position decreases as the valve is opened, reverse the supply connections (motor terminals 5 & 7) to the feedback potentiometer. If the displayed position range is incorrect, check that the correct potentiometer supply voltage has been selected.

### Control Direction

It is necessary to ensure that each motor travels in the correct direction when moved using the UP/DOWN keys on the keyboard. To do this, follow the procedure below.

1. Enter commission ratio mode (refer to Commission Ratio Mode page 34).
2. Check that when the DOWN key is pressed, each motor moves its valve/damper towards the closed position. If not, reverse drive signals on motor terminals 2 & 3.
3. With the display showing P00, use the UP/DOWN keys to move each servo-motor. If the displayed position decreases as UP is pressed, or increases as DOWN is pressed, reverse the servo-motor output UP/DOWN connections.

### Adjusting microswitch positions

Each time a burner start-up sequence is initiated, the unit will move the fuel and air damper servo-motors to their closed and purge positions to prove correct servo-motor and potentiometer operation. Each servo-motor must have microswitches to limit the close and purge positions obtainable during this proving operation. To set the microswitch positions, follow the procedure below.

1. Enter commission ratio mode.
2. Move each servo-motor to approximately 45°, either by hand or using the UP/DOWN keys.
3. Holding the DOWN key, adjust the low limit microswitch until the servo-motor will no longer move down.
4. Holding the DOWN key, gradually slacken off the low limit microswitch until the servo-motor starts moving down. Continue to slacken off the microswitch until the servo-motor stops with a reading on the display of approximately 2° to 3°.
5. Move the servo-motor up and down a few times to check that the servo-motor stops each time at approximately 2° to 3°, and readjust 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 servo-motor will no longer move up.
7. Holding the UP key, gradually slacken off the high limit microswitch until the servo-motor starts moving up. Continue to slacken off the microswitch until the servo-motor stops in the desired purge position. This position does not have to be 90°, but it is recommended that it is more than 45° and less than 88°.
8. Move the servo-motor up and down a few times to check that the servo-motor stops each time at the desired purge position. Repeat steps 3 to 7 if necessary.

## Locking the Servo-Motor to the Valve and Damper Shaft



**WARNING: Once the control and feedback connections to the servo-motors are correct, each servo-motor must be locked to its shaft for all dampers and fuel valves.**

In order to prevent the joint between servo-motor and shaft moving, it is recommended that the device used to link the two items is pinned together.

**It is imperative these units remain connected correctly to ensure safe operation of the equipment.**

## OPERATION IN THE COMMISSIONING MODE (Using the Commissioning Display)

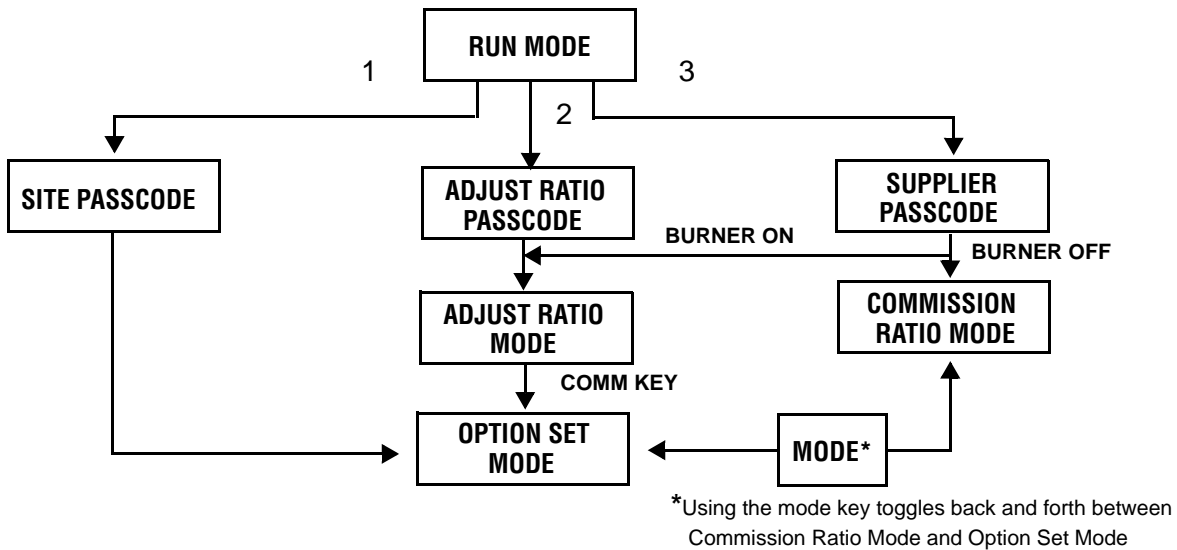


**WARNING:** While the unit is in commissioning mode or adjust ratio mode certain safety checks cannot be performed by the NX Series Controller and therefore the safety of the system operation is the sole responsibility of the commissioning engineer. Do not allow the fuel to accumulate in the combustion chamber for longer than a few seconds without igniting, an explosive mixture could result. If a flame failure occurs at any point the unit will not attempt a re-start until the fault is cleared and will perform any selected post-purge and pre-purge, before moving to the ignition position.

### General

If any settings in the unit are to be changed, it is necessary to enter a commission mode. Three passcodes are available for this purpose.

1. Site passcode - allows adjustment of some option parameters.
2. Adjust ratio passcode - allows adjustment of some option parameters and entry to adjust ratio mode.
3. Supplier passcode - allows entry to all commissioning modes.



### Commissioning Data

#### Option parameters

Option parameters contain information about the configuration of the burner and the boiler. Option parameters may be adjusted in *option set mode*, but it may not be possible to adjust all of them if the burner is on.



### Profile Setpoints

Setpoints contain information about required servo-motor positions. There are four tables of setpoints (or four profiles), which may be visualized using the diagram below:

#### PROFILE 1/3

GAS POSITION (°)	AIR 1 POSITION (°)	AIR 2 POSITION (°)
2.1	2.2	1.9
89.5	87.3	88.9
24.6	22.4	30.6
21.3	25.6	25.8
76.8	70.3	85.6

#### PROFILE 2/4

OIL POSITION (°)	AIR 2 POSITION (°)	AIR 1 POSITION (°)
1.7	2.2	1.9
90.1	87.3	88.9
10.6	22.4	28.7
10.6	25.6	28.7
50.2	70.3	83.5

CLOSE (P00)  
PURGE (P01)  
IGNITION (P02)  
LOW FIRE (P03)  
HIGH FIRE (PXX)

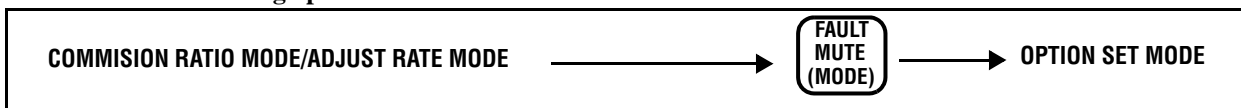
Up to 24 setpoints may be entered for each profile, including close, purge, and ignition. New setpoints may be entered in *commission ratio mode*. Existing setpoints may be modified in *adjust ratio mode* or *commission ratio mode*.

### Option Set Mode

#### Description:

Option set mode is used for changing the values of option parameters. If the burner is on, it may not be possible to adjust all of the option parameters.

#### Entering option set mode:



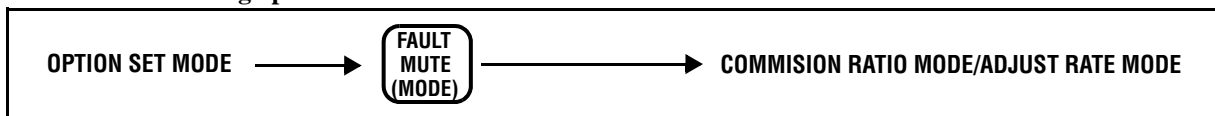
To enter option set mode, enter commission ratio mode or adjust ratio mode (see page 34) and press the key labelled **FAULT MUTE (MODE)**.

In commission mode the display will flash **COM**.

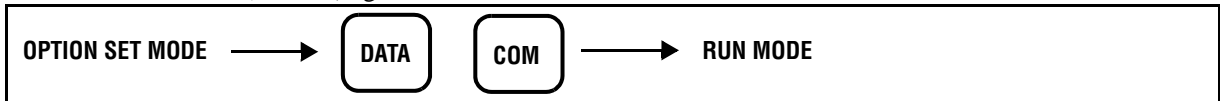
#### Using option set mode:

- Use the **LEFT/RIGHT** scroll keys to point the select arrow at the option number on the top line of the display and use the **UP/DOWN** scroll keys to display the option parameter to be changed.
- Then use the **LEFT/RIGHT** scroll keys to point the select arrow at the option value and use the **UP/DOWN** keys to change the value of the option parameter.
- If the value has been changed, the value will flash. Press the key labelled **COM (ENTER)** to store the new value.

#### Leaving option set mode:



To exit option set mode and return to commission ratio or adjust ratio mode, press the key labelled **FAULT (MODE)** again.



To exit option set mode and return to run mode, press the key labelled **DATA (RUN)** and then **COM (ENTER)**.

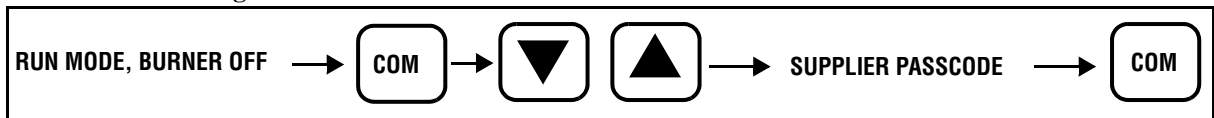
### Commission Ratio Mode

#### Description

Commission ratio mode is used for entering a new profile or changing an existing profile.

Using commission ratio mode, it is possible to step through each setpoint including close, purge and ignition. Once a setpoint has been entered, it is not possible to go back and modify it again in the same commissioning session. To do this, adjust ratio mode must be used after all the required setpoints have been entered.


#### Entering commission ratio mode:



To enter commission ratio mode, turn the burner off. Once the burner has completely shut down, press the key labelled **COM** and obtain the supplier passcode value using the **UP/DOWN** keys. Press the key labelled **COM (ENTER)**.

If the entered passcode was correct, servo-motor positions will be seen on display, **COM** will be flashing, in addition to P00. This represents the closed position setpoint.

#### Using commission ratio mode:



**CAUTION: Use extreme care while commissioning the system. While operating in commissioning mode the safety of the system is the sole responsibility of the commissioning engineer. Incorrect positioning of either fuel or air could cause a hazardous situation to occur. If the servo-motor positions have been up-loaded, it is essential that the combustion is verified at each firing position to ensure that a hazardous condition cannot occur and to allow the data to be stored in the controller.**

To adjust the position of a servo-motor, use the scroll keys to point to the servo-motor to be adjusted and then use the **UP/DOWN** keys to adjust its position. Depending on the profile selected, fuel 1 servo-motor or fuel 2 servo-motor may not be available.

Each setpoint in the profile is referred to with a letter and number (refer to the table below).

NO	NAME	COMMENTS
P00	Close	This defines the positions the servo-motors will move to when the burner is off, and must be set to the lowest position each servo-motor can reach.
P01	Purge	This defines the positions the servo-motor will move to when the burner is purging, and must be set to the highest position each servo-motor can reach. Burner select input must be on for P01 and above.
P02	Ignition	Position during ignition. May be outside the normal firing range.
P03	Low Fire	Low fire setpoint.
.....	.....	
PXX	High Fire	High fire setpoint, which is the last setpoint entered (max. P23)

The procedure for entering or modifying a profile is as follows:

1. Enter commission ratio mode (see page 34). P00(close) is displayed.
2. If the close setpoint has been entered before and no change is required, press **AUTO MAN (NEXT)**. Otherwise, move each servo-motor to its lowest position and press **COM (ENTER)**. P01 (purge) is displayed.
3. Select the burner (energize PB7) and the required profile on. The servo-motors will automatically move to their highest positions and stop. If the purge setpoint has been entered before and no change is required, press **AUTO MAN (NEXT)**. Otherwise, press **COM (ENTER)**. P02 (ignition) is displayed.
4. Wait for the pre-purge time to elapse. If the ignition setpoint has been entered before, the drives will move to their ignition positions. If a change is required or the ignition setpoint has not been entered before, move all the servo-motors being used to their required ignition positions and press **COM (ENTER)**.
5. **To attempt ignition of the burner, hold down the AUTO MAN (NEXT) key for approximately three seconds.** If a change is required to the ignition position move all of the servo-motors to their required positions and press **COM (ENTER)**, if no change is required press **AUTO MAN (NEXT)**.
6. Wait for the display to show P03 (low fire) after the relevant safety times have elapsed. If ignition is unsuccessful and a safety shutdown occurs, investigate the problem and repeat steps 2-5 to attempt ignition again.
7. If the low fire setpoint has been entered before and no change is required, press **AUTO MAN (NEXT)**. Otherwise, move each servo-motor to the required low fire position and press **COM (ENTER)**. P04 (next profile setpoint above low fire) is displayed.
8. Repeat step 6 for each required profile setpoint, up to a minimum of P04 and a maximum of P23.
9. Leave commission ratio mode. The last profile setpoint entered will become the high fire setpoint.

If a controlled shutdown occurs, the unit will return to step 2. The setpoints entered in the current commissioning session are not lost and the **AUTO MAN (NEXT)** key may be used to step through the start-up sequence and fire the burner.

If a safety shutdown occurs, the setpoints 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.

#### Leaving commission ratio mode:



To leave commission ratio mode and return to run mode, press the key labelled **DATA (RUN)** followed by the **COM (ENTER)** key.

- **If P03 (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 unit without returning to run mode.

- **Only the setpoints used in the current commissioning session will be stored.** For example, if an existing profile has setpoints up to P15 but only the setpoints up to P10 were viewed or altered, then only the setpoints up to P10 will be stored. Therefore, it is vital that **FAULT MUTE (NEXT)** is pressed to get to the last setpoint in the profile before leaving commission ratio mode. This does not apply if only the close or purge setpoints (P00 or P01) are altered.

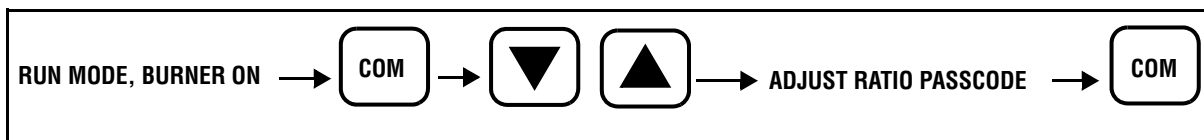
## Adjust Ratio Mode

### Description

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

- Using adjust ratio mode, it is possible to modify the servo-motor positions for any setpoint in the firing range from low to high fire (P03 and higher).
- It is also possible to view all setpoints (P00 and higher), even with the burner off.
- The setpoints may be chosen in any order.
- It is not possible to modify a servo-motor position so that it is higher than the next setpoint or lower than the last setpoint.
- It is not possible to modify any servo-motor position so that it is higher than the high fire setpoint.
- It is not possible to modify the close, purge or ignition positions (P00, P01 or P02 respectively). For this commission ratio mode must be used.

### Entering adjust ratio mode:



To enter adjust ratio mode, turn the burner on. Once the burner begun its start-up sequence, press the key labelled **COM (ENTER)** and obtain the supplier passcode value using the **UP/DOWN** keys. Once the correct passcode value has been obtained, press the key labelled **COM (ENTER)**. Alternatively, the adjust ratio passcode may be used if the burner is on or off.

If the entered passcode was correct, “A n” will be seen on the display in addition to the servo-motor positions for the servos being used for the selected profile, where n is the number of the setpoint currently under adjustment.

### Using adjust ratio mode:



**CAUTION: 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 either fuel or air could cause a hazardous situation to occur.**

To adjust the position of a servo-motor, use the **LEFT/RIGHT** scroll keys to point to the servo-motor to be adjusted and then use the **UP/DOWN** keys to move the servo-motor. Depending on the profile selected, some servo-motors may not be available.

To change the setpoint being modified, use the **LEFT/RIGHT** scroll keys to point to the profile point number “A n” and use the **UP/DOWN** keys to adjust the value.

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

NO	NAME	COMMENTS
A00	Close	The close setpoint cannot be altered in adjust ratio mode.
A01	Purge	The purge setpoint cannot be altered in adjust ratio mode.
A02	Ignition	The ignition setpoint cannot be altered in adjust ratio mode.
A03	Low Fire	Low fire setpoint.
.....	.....	
Ax	High Fire	High fire setpoint, which was the last setpoint entered (max P23).

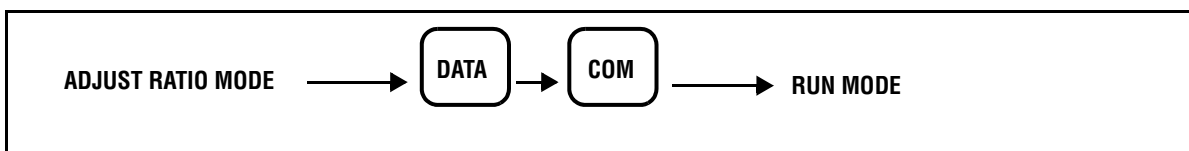
The procedure for modifying a setpoint is as follows:

1. Enter adjust ratio mode. “A n” is displayed in addition to the servo-motor positions, where n is the number of the setpoint which is closest to the current firing position.
2. Use the **LEFT/RIGHT** scroll keys to point to the profile point number “A n” to be adjusted and use the **UP/DOWN** keys to move to the setpoint in the firing range to be altered.
3. Wait for the “A n” display to stop flashing and modify the fuel and air servo-motors as required.
4. If the modified positions are not required, press the **AUTO MAN (NEXT)** key to return the motors to their original positions or use the scroll keys to select a different setpoint.
5. Press the **COM (ENTER)** key to store the new motor positions for the current setpoint.
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 n” display is flashing, it will not be possible to adjust the position of any of the motors. This may be for one of the following reasons:

- The burner is not firing. Switch the burner on and wait for the unit to begin modulating.
- The current setpoint is A0, A1 or A2. Use commission ratio mode to adjust these setpoints.
- The servo-motors are moving to the required positions. Wait for the servo-motors to stop moving.

#### Leaving adjust ratio mode:



To leave adjust ratio mode and return to run mode, press the key labelled **DATA (RUN)** followed by the **COM (ENTER)** key.

#### Finding the Software Engineering Code

There are two methods for finding the software Engineering Code:

1. From run mode, press the **COM** key. The software engineering code is shown on the display.
2. Use the engineer’s key. Refer to Engineer’s Key section for details.

## OPTION PARAMETERS



**CAUTION: Use extreme care when entering option parameters. Incorrect data entry could cause a hazardous situation to occur.**

### Option Parameter List

*Note: If an option parameter is marked with \*, it is not possible to adjust its value using the site passcode. The option parameters marked with \* can only be adjusted in the commissioning mode after entering the supplier passcode. If using the supplier passcode and it is still not possible to adjust the value of an option parameter, the burner must be turned off first.*

#### Option 0.1 - Site passcode (0 - 999)\* - 154 is the default site passcode

This is a three digit passcode which will allow the site engineer or end-user to enter option set mode and adjust a limited range of option parameters (those not marked with '\*' in this section).

#### Option 1.1 - Power supply frequency (50/60)\*

The unit must be configured for the correct power supply frequency. The setting is either 50 or 60Hz.

#### Option 1.2 - Serial communications unit address (0 - 15)\*

If the unit is to be connected to other equipment via the serial communications interface, it must be given a unique address using this option parameter.

#### Option 1.3 - Air damper 2 select (0 -4)\*

This option parameter is used to select an additional air damper.

- 0 - Deselected, no second air damper.
- 1 - Second air damper selected as primary air for oil firing.
- 2 - Second air damper selected as flue gas recirculation for gas firing.
- 3 - Second air damper available for both fuels.
- 4 - Second damper stays open during purge for both fuel options.

If a second air damper is selected (option 1.3 = 3), the air servo-motor is available for both fuels, air switch #2 is not required. The second air servo-motor is driver open and closed during purge to check the operation of the end switches and speed of the servo-motors selected (option 1.3 = 2 or option 1.3 = 3).

*Note:* Once the second air damper is selected, the only way to deselect it is to erase all profiles and option parameters using parameter 15.0 and 15.1.

If a second air damper is selected (option 1.3 = 1), as the primary air Flow and No Flow will be checked on oil to equal the secondary air Flow and No Flow. On gas the primary air Flow and No Flow will be checked to on if no primary air is present.

#### Option 1.4 - Auxiliary Relay Function Select (0 - 4)\*

The auxiliary relay output can be used to perform several different functions as set by this option parameter.

- 0 - Deselected, auxiliary relay output not used.
- 1 - Auxiliary relay output used to control the oil pump-off unless firing on oil and burner status between 10 and 16 (Table 1 - Set up sequence).
- 2 - Auxiliary relay output used to control a steam atomizing valve-off unless firing on oil and burner status between 6 and 16 (Table 1 - Set up sequence).
- 3 - Auxiliary relay output used to control a steam purge valve-on firing on oil and burner status 17 or 18.
- 4 - Auxiliary relay output used to control boiler sequencing valve, relay-off unless the boiler is selected as sequencing slave, in standby and the measured value is below setpoint.
- 5- Output energized when flame signal is above on threshold, off when below threshold.

### Option 1.5 - Reset hours run (0 - 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 back to 0.

### Option 1.6 - servo-motor Display (0 - 3)

0	xx.x°	Angular degrees to 1 decimal place.
1	xx°	Angular degrees, no decimal place.
2	xx.x%	Percentage to 1 decimal place.
3	xx%	Percentage, no decimal place.

### Option 2.0 - Gas pressure select (0 - 2)\*

If an NX1020 gas pressure sensor is connected to the system, it is possible to select gas pressure monitoring and/or gas valve proving using this option parameter.

0	Gas pressure input not used. The gas valve leak test is not performed and the gas pressure limit values are ignored.
1	NX1020 gas pressure sensor used. The unit monitors the gas pressure (including the gas pressure limits) if a gas profile is selected but does not perform gas valve proving.
2	NX1020 gas pressure sensor used. The unit monitors the gas pressure (including the gas pressure limits) and performs gas valve proving if a gas profile is selected.

### Option 2.1 - Gas pressure sensor zero (0 - 999 mBar)\*

This is the minimum gas pressure rating of the installed gas pressure sensor (in mBar).

### Option 2.2 - Gas pressure sensor span (0 - 999 mBar)\*

This is the gas pressure (above atmospheric) measured by the sensor (in mBar) at its maximum output (range of sensor).

### Option 2.3 - Gas pressure nominal (0 - 999 mBar)\*

This is the nominal line pressure of the gas supply delivered to the burner (in mBar).

### Option 2.4 - Gas pressure low limit (0 - 999 mBar)\*

This is the minimum gas pressure (above atmospheric) permitted by the unit before a gas pressure limit fault is given. For safety reasons, this value should not be set to more than 200mBar below the nominal gas pressure.

### Option 2.5 - Gas pressure high limit (0 - 999 mBar)\*

This is the maximum gas pressure (above atmospheric) permitted by the unit before a gas pressure limit fault is given. Ensure the value is set within the capability of the sensor if being used for an 'S' class application. (250 mBar for NX1020 sensor).

### Option 2.6 - Test volume (0.0 - 99.9 liters)\*

This must be set to the volume (in liters) of the test pipe section between the two safety valves, including the volume in each valve on the test section side. Refer to "Valve Prove Test Sequence" page 26.

**Option 2.7 - Maximum permissible leakage rate (0 - 99.9 l/h)\***

This is the maximum permissible leakage rate allowed during the valve leak test (in liters per hour). this value must be set according to the installation and local regulations. Refer to “Valve Prove Test Sequence” page 26.

**Option 2.8 - Vent valve select (0 - 2)\***

This option parameter is used to select the operation of the vent valve.

0	No vent valve used. Use main valve 2 to vent into the boiler, when using V.P.S.
1	Vent valve used, output energized to open valve (used for V.P.S.).
2	Vent valve used, output energized to close valve, (powered at sequence 5).

**Option 2.9 - Fuel Valve Proof of Closure select (0 -3)\***

This option parameter is used to select the proof of closure function. Use option 10 to map digital outputs.

0	Deselected, no proof of closure function selected
1	Gas main valve 2 checked
2	Oil valve checked
3	Both main gas valve 2 and oil valve checked

**Option 3.0 - Flame detection device (0 - 2)\***

Depending on the application, one of three different flame detection options must be chosen.

0	IR detector
1	Ultraviolet (UV) detector, non self-checking.
2	Ultraviolet (UV) detector, self-checking use with 45UV5-1009

**Option 3.1 - False flame detection time**

This option parameter is only applicable to the UL only product (NX3100, 4100). NX3000, 4000 is always less than 3 seconds.

0	False flame detection time < 3 seconds
1	False flame detection time < 30 seconds

**Option 3.2 - Flame failure response time**

This option parameter is only applicable to the UL only product (NX3100, 4100). NX3000, 4000 is always less than 1 second.

0	Flame failure response time < 1 second (0 left to retain compatibility with CE product)
1	Flame failure response time < 1 second
2	Flame failure response time < 2 seconds
3	Flame failure response time < 3 seconds

**Option 3.5 - Fan establish time (0 -120 sec)\***

This option delays the opening of the valve and damper servos for the time entered in this option, this aids blower start-up. The timing in T1 (prove air pressure) is adjusted to include this delay.





#### Option 4.0 - Safety time configuration (0 - 10)

Determines which set of safety times are used. This value must be set according to the application and local regulations.

Configuration	Prove Air Pressure t1	Supervised Purge t2	Pre-Ignition t3	Pilot Trial for Ignition t4*	Pilot Ignition Interval t5	Main Trial ** for Ignition t6	Wait for Flame Established t7
0	6	15	4	2	4	2	2
1 (EP113)	8	36	4	2	8	2	8
2	10	37.5	5	2.5	10	5	7.5
3 (EP113)	8	66	4	2	8	2	8
4	10	67.5	5	2.5	10	5	7.5
5	15	30	4	5	8	5	2
6	15	60	4	5	8	5	2
7 (EP170)	10	30	0	5	5***	10	2
8 (EP160)	10	30	0	5	5	10	2
9 (EP170FGR)****	10	60	0	5	5***	10	2
10 (EP160FGR)****	10	60	0	5	5	10	2

*Note: Times are shown in seconds. For a full explanation of each safety time, see Operation in run mode. For response times to flame failure during operation, see Option 3.2. Safety time configurations similar to Flame Monitor timings are indicated by the Flame Monitor programmer model number in parenthesis.*

\* If an oil profile is selected, t4 will always be 5 seconds regardless of the times chosen.

\*\* See Option 4.4 for extended MTFI.

\*\*\* Using configuration #7 or #9 the ignition transformer is off during t5.

\*\*\*\* Options 9 and 10 allow an additional 30 second purge allowing the FGR damper to fully close. A 30 second purge with the FGR damper closed is then achieved.

#### Option 4.1 - Ignition time (0 - 999 sec)\*

The time at which the drives remain in their ignition positions before the unit moves the drives to low fire. During status 14 of the start-up sequence, this time or time t7 is used, depending on which one is the larger.

#### Option 4.2 - Low fire hold time (0 - 999 sec)\*

During status 15 of the start-up sequence, this is the time at which the drives remain in their low fire positions before modulation.

#### Option 4.3 - Post purge time (0 - 999 sec)\*

The time at which the drives remain in their purge positions after the burner has turned off.

If this option is set to 0, the drives will move straight to their closed positions after the burner has turned off and there is no post purge.

No post-purge will be performed if the burner did not reach pre-purge when turned off.

*Note: This optional postpurge must not be used to replace the pre-purge time as dictated by the setting of option 4.0. The correct pre-purge time must still be chosen.*

#### Option 4.4 - Extended pilot time (0 - 20 sec)\*

The time for which the pilot valve remains open after the main fuel valve opens, oil only. If the time entered is less than the safety time configuration set by Option 4.0 the table time will be used.



**Option 4.5 - Permanent gas pilot select (0 -1 intermittent pilot)\***

This option parameter allows the selection of permanent pilot operation when the burner is firing on gas. When firing on oil this operating parameter is ignored.

0	Non permanent pilot. (Interrupted pilot)
1	Permanent pilot operation, when firing on gas. (Intermittent pilot)

**Option 4.6 - Pilot valve with/without main valve selection (0-1)\***

This option parameter allows the selection of pilot operation with or without the main gas valve (#1) when firing gas. When firing oil, this parameter is ignored and the pilot valve always operates without the main gas valve. The option parameter should be set to suit the configuration of the gas train.

0	Pilot operates without the main gas valve when firing on gas.
1	Pilot operates with the main gas valve (#1) when firing on gas.

**Option 4.7 - Limit Modulation**

By default, the control modulates the burner between the set-points P3 (low fire) and Px (high fire), where Px is the last set-point entered in commission rate mode. If oxygen trim is used, it is not possible for any drive position to be trimmed lower than point P3 (low fire) or higher than point Px (high fire).

This option parameter allows the normal modulation range of the burner to be limited so that the burner may only modulate between points P4 (one set-point above low fire) and Px-1 (one set-point below high fire). Since oxygen trim is not affected by this limitation, each drive may be trimmed between the points P3 and Px. This means that it is not possible to over-fire or under-fire the burner, but full trim may still be achieved and high and low fire.

0	Not limited. Burner modulates from P3 to Px -Oxygen trim works over full range from P3 to Px
1	Normal modulation range limited to P4 to Px-1 -Oxygen trim works over full range from P3 to Px

**Option 4.9 - Direct Ignition on Oil (0/1)\***

This Option allows the selection of direct ignition when firing oil. The main oil valve is energized at Stage 11, refer to Table 1.

**Option 5.1 and 5.2 - Lead drive for gas and oil respectively (0 - 1)\***

These option parameters set the lead drive for the gas and oil profiles.

0	Lead drive is air damper
1	Lead drive is currently selected fuel

*Note: The other drives do not 'lag' behind the lead drive - all drives move in step and stay in ratio during modulation. Instead, the lead drive is used to calculate the current modulation rate and for drive position checking. For this reason, the lead drive position should not be the same for any two profile setpoints. If this is the case, the lead drive should be changed from fuel to air or vice versa. Choose the servo-motor that has the furthest travel. Do not choose a servo-motor with a flat curve.*



### Option 5.3 - Bumpless transfer operation (0 - 2)\*

This option parameter determines how the modulation rate is affected when **power to the unit** is interrupted or the **modulation mode** is changed. The options are as follows:

0	If the burner is fired up in MANUAL mode, the drives remain at low fire until modulated manually. If the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives remain at their current positions.
1	If the burner is fired up in MANUAL mode, the drives are modulated to the last positions used in MANUAL mode. If the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives are modulated to the last positions used in MANUAL mode.
2	The unit powers up in the last selected modulation mode. If the burner is fired up in MANUAL mode, or the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives are modulated to the positions used last time in MANUAL mode.

### Option 5.4 - Modulation speed (25 - 100%)\*

This option allows adjustment of the modulation speed between 25% and 100% of the fastest modulation possible, while still obtaining the correct fuel/air ratio. When not modulating, all drives move at their maximum speeds.

### Option 5.5 - Modulation sensor input type (0 - 3)\*

The modulation sensor input is configured to receive a standard 0-5V or 4-20mA signal or a Fireeye fail safe pressure/temperature sensor. When using a Fireeye sensor, the unit may be used to monitor the boiler high safety limit and perform a safety shutdown if it is exceeded. Ensure that the links on the backplane board are set to correspond with the setting of this option parameter (see Options Link section for details).

0	0-5v operation. Set the SENSOR IN link to "V". Set the SENSOR SUPPLY link as required.
1	4 - 20mA operation. Set the SENSOR IN link to "I". Set the SENSOR SUPPLY link as required.
2	NX1040 fail safe boiler temperature sensor. Set the SENSOR IN link to "V" and the SENSOR SUPPLY link to +24V.
3	NX1025 and NX1030 fail safe boiler pressure sensors. Set the SENSOR IN link to "V" and the SENSOR SUPPLY link to +24V.

### Option 5.6 - Boiler high safety limit (0 - 999[NX1040] / 0.0 - 99.9[NX1030])\*

If a Fireeye fail safe boiler sensor is used (such as the NX1025, NX1030 or NX1040) and track modulation input is not selected, the unit may be used to monitor the boiler high safety limit and perform a shutdown if the limit is exceeded (see Fault Code Listing F41 for details).

### Option 5.7 - System modulation units (0 - 3)\*

The system modulation units may be selected as shown below.

0	PSI - (pounds per square inch)
1	Bar
2	°F
3	°C

**Option 5.8 - Auxiliary modulation input function (0 - 2)\***

The auxiliary modulation input (terminals PE 13, 14, 15) may be configured to perform a remote setpoint function. See Derivation of Modulation rate for information on how this function is performed.

0	No function. The input is ignored.
1	Remote setpoint. The input determines the control value for the PID loop when setpoint 1 is selected, providing the loop current is within the range of 3.5-21mA. If the loop current is outside this range, the unit reverts to using the setpoint 1 control value (option parameter 6.3). Option parameters 6.7 & 6.8 give the zero and span for this input.
2	Remote tracking input. The input determines the modulation rate, providing the loop current is within the range of 3.5-21mA. If the loop current is outside this range, the unit reverts to using the normal modulation rate (depending on current modulation mode). This is different from using 'track modulation input' (option 6.0 = 0, or 8.0 = 1) because an out of range signal will cause those options to hold low fire. This function will override both setpoints 1 and 2. 4mA = low fire, 20mA = high fire.

**Option 5.9 - Modulation rate relay trigger point (0-100)\***

This option specifies the modulation rate at which an output relay will be set ON. The relay is programmed in Option 11.

**Option 6.0 - Setpoint 1 input type (0 - 3)\***

The setpoint 1 input type must be selected as follows:

0	Track modulation input. (Where minimum input signal = low fire, maximum input signal = high fire).
1	Measured value input, PID control, values displayed with no decimal place.
2	Measured value input, PID control, values displayed with 1 decimal place.
3	Measured value input, PID control, values displayed with 2 decimal places.

**Option 6.1 - Setpoint 1 zero value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)\***

When setpoint 1 is selected, this is the measured value which is displayed when the minimum signal level (0V or 4mA) appears at the modulation input. This parameter is not used when a track modulation is selected.

**Option 6.2 - Setpoint 1 span value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)\***

When setpoint 1 is selected, this is the measured value which is displayed when the maximum signal level (5V or 20mA) appears at the pressure input. This parameter is not used when a track modulation input type is selected.

**Option 6.3 - Setpoint 1 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

This is the control value which is used in the PID control loop for setpoint 1. When the unit is in auto mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as this parameter.

**Option 6.4 - Setpoint 1 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

This is the width of the proportional band that is used by the PID control loop for setpoint 1. If the setpoint was 5.00 bar, and this term was set to 1.00, then the proportional band would be from 4.00 to 5.00 bar. A value of 0 means no proportional band.

**Option 6.5 - Setpoint 1 integral term (0 - 100)**

This is the integral term which is used in the PID control loop for setpoint 1. It may be set to any value from 0 to 100, where 0 means no integral term.

**Option 6.6 - Setpoint 1 derivative term (0 - 100)**

This is the derivative term which is used in the PID control loop for setpoint 1. It may be set to any value from 0 to 100, where 0 means no derivative term.

**Option 6.7 - Setpoint 1 remote zero value (0 - 999)\***

When setpoint 1 is selected and the remote setpoint function is enabled (see Option 5.8), this is the PID control value displayed when a 4mA signal is present on the auxiliary modulation input. See Derivation of Modulation Rate.

There is no such function for setpoint 2.

This parameter is not used when a track modulation input type is selected.

**Option 6.8 - Setpoint 1 remote span value (0 -999)\***

When setpoint 1 is selected and the remote setpoint function is enabled (see option parameter 05.8), this is the PID control value displayed when a 20mA signal is present on auxiliary modulation input. See Derivation of Modulation Rate.

There is no such function for setpoint 2.

This parameter is not used when a track modulation input type is selected.

**Option 7.0 - Setpoint 1 control limit type (0 - 2)\***

This option parameter defines the control limit type for setpoint 1, where:

0	No limits.
1	Absolute limit. The values entered in the option parameters 7.1 and 7.2 are the actual limit values.
2	Deviation limit. The values entered in option parameters 7.1 and 7.2 represent a deviation from the setpoint 1 control value. This means that if the setpoint control value is changed, the limits are automatically changed correspondingly.

**Option 7.1 -Setpoint 1 low limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

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 7.2 - Setpoint 1 high limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99).**

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 7.5 - Setpoint 1 warming limit (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

If the boiler’s measured value is below the value of this parameter and the unit is in auto or sequencing mode, the burner will be held at low fire.

*Note: the warming limit is only applied to the first start-up after the “Burner On” signal (Terminal PB7) has been detected. Re-starts after a Controlled Shutdown will not use the warming limit if PB7 is maintained on.*

**Option 7.6 - Setpoint 1 warming time (0 - 360)**

If the boiler’s measured value remains below the warming limit set in option 07.5 for longer than the warming time set here in minutes, the boiler will be allowed to modulate normally.

**Option 8.0 - Setpoint 2 input type (0 - 4)\***

The setpoint 2 input type must be selected as follows:

0	Setpoint 2 not available.
1	Track modulation input. (Where minimum input signal = low fire, maximum input signal = high fire).
2	Measured value input, PID control, values displayed with no decimal place
3	Measured value input, PID control, values displayed with 1 decimal place.
4	Measured value input, PID control, values displayed with 2 decimal places.

*Note: the remote setpoint input is ignored when Setpoint 2 is selected, refer to Option Parameter 5.8.*

**Option 8.1 - Setpoint 2 zero value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)\***

When setpoint 2 is selected, this is the measured value which is displayed when the minimum signal level (0V or 4mA) appears at the modulation input. This parameter is not used when a track modulation input type is selected.

**Option 8.2 - Setpoint 2 span value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)\***

When setpoint 2 is selected, this is the measured value which is displayed when the maximum signal level (5V or 20mA) appears at the pressure input. This parameter is not used when a track modulation input type is selected.

**Option 8.3 - Setpoint 2 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

This is the control value which is used in the PID control loop for setpoint 2. When the unit is in auto mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as this parameter.

**Option 8.4 - Setpoint 2 proportional term (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

This is the width of the proportional band that is used by the PID control loop for setpoint 2. If the setpoint was 5.00 bar, and this term was set to 1.00, then the proportional band would be from 4.00 to 5.00 bar. A value of 0 means no proportional band.

**Option 8.5 - Setpoint 2 integral term (0 - 100)**

This is the integral term which is used in the PID control loop for setpoint 2. It may be set to any value from 0 to 100, where 0 means no integral term.

**Option 8.6 - Setpoint 2 derivative term (0 - 100)**

This is the derivative term which is used in the PID control loop for setpoint 2. It may be set to any value from 0 to 100, where 0 means no derivative term.

**Option 9.0 - Setpoint 2 control limit type (0 - 2)\***

This option parameter defines the control limit type for setpoint 2, where:

0	No limits.
1	Absolute limit. The values entered in option parameters 9.1 and 9.2 are the actual limit values.
2	Deviation limit. The values entered in option parameters 9.1 and 9.2 represent a deviation from the setpoint 1 control value. This means that if the setpoint control value is changed, the limits are automatically changed correspondingly.

**Option 9.1 - Setpoint 2 low limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

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 9.2 - Setpoint 2 high limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

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 9.5 - Setpoint 2 warming limit (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

If the boiler's measured value is below the value of this parameter and the unit is in auto or sequencing mode, the burner will be held at low fire.

*Note: the warming limit is only applied to the first start-up after the "Burner On" signal (Terminal PB7) has been detected. Re-starts after a Controlled Shutdown will not use the warming limit if PB7 is maintained on.*



### Option 9.6 - Setpoint 2 warming time (0 - 999)

If the boiler's measured value remains below the warming limit set in option 09.5 for longer than the warming time set here in minutes, the boiler will be allowed to modulate normally.

### Options 10.0 to 10.9 - Auxiliary input functions

Option parameters 10.1 to 10.9 determine the functions of the 10 auxiliary inputs.

Please note, only auxiliary inputs A to E may be set and used for safety critical functions

[14 to 20]. Refer to Aux. A to E inputs in wiring section for terminal designations. If more than one input is selected to have the same function, the "lower number" input is used. Refer to following page for details.

Option Parameter	Input Channel	Default Function
10.0	1 (PF1 - PF2)	Fault mute
10.1	A (PF11 - PF12)	None (must be selected)
10.2	B (PF13 - PF14)	None (must be selected)
10.3	C (PF15 - PF16)	None (must be selected)
10.4	D (PF17 - PF18)	None (must be selected)
10.5	E (PF19 - PF20))	None (must be selected)
10.6	2 (PF1 - PF3)	Gas select
10.7	3 (PF1 - PF4)	Oil select
10.8	4 (PF5 - PF6)	Air pressure switch 2 FLOW
10.9	5 (PF5 - PF7)	Air pressure switch 2 NO FLOW



<b>Auxiliary Input Switch Functions</b>	
0	No function or default function as listed above.
1	Auto/manual selection. A high level on the input forces the unit into manual modulation mode.
2	Manual up. A high level on this input will force the unit to modulate up if manual is selected via one of the other auxiliary inputs.
3	Manual down. A high level on this input will force the unit to modulate down if manual is selected via one of the other auxiliary inputs.
4	Setpoint select. The level of the input determines whether setpoint 1 or setpoint 2 is used. A low level selects setpoint 1. Refer to option parameters 6.0 and 8.0.
5	Release to ignite. Once the system has purged, the drives will move to their ignition positions. A high level on the input will start the ignition sequence
6	Release to modulate. Once the burner has ignited and the ignition time has elapsed, the drives will move to their low fire positions. After the low fire hold time has elapsed, a high level on the input will permit the drives to modulate.
7	Lead boiler select. If boiler sequencing is enabled, a high level on the input selects the unit as the lead boiler.
8	Profile select. The input will select between firing profile 1 or 2 for the selected fuel.
9	Purge Hold. A closed contact will hold the pre-purge (sequence status 8).
10	Oil valve proof of closure. A high level on this input confirms the closure of the main oil valve. This function may only be used in circumstances where the relevant approvals for the specific application allows a proof of closure switch to be used. Option 2.9 must also be enabled.
11	Gas valve proof of closure. A high level on this input confirms the closure of the main gas valve. This function may only be used in circumstances where the relevant approvals for the specific application allows a proof of closure switch to be used. Option 2.9 must also be enabled.
12	Trim Enable. A high level on this input will enable oxygen trim.
13	Spare. Input is ignored.
14	Forced lockout. A high level on the input (switch closed) prevents the unit from going into safety shutdown condition (burner lockout). If the high level is removed, the display will show F17 and the fault relay will operate. (This is the function required by the extra low water alarm).
15	Forced shutdown. A high level on the input (switch closed) prevents the unit from going into a controlled shutdown condition (burner off). If the high level is removed, the display will show LIMIT 42 and the limit relay will operate. (This is the function required by the low water alarm).
16	Forced alarm. A high level on the input (switch closed) prevents the unit from going into a limit condition. If the high level on the input is removed, the display will show L 43 and the limit relay will operate. (This is the function required by the high water alarm).
17	Forced Lockout Oil only. This function is only active when firing on oil. A high level on the input (switch closed) prevents the unit from going into safety shutdown condition (burner lockout). If the high level is removed, the display will show F23 and the fault relay will operate. (This is the function required by the low oil pressure alarm).
18	Forced Shutdown Oil only. This function is only active when firing on oil. A high level on the input (switch closed) prevents the unit from going into a controlled safety shutdown condition (burner lockout). If the high level is removed, the display will show LIMIT 45 and the limit relay will operate. (This is the function required by the low oil temperature alarm).
19	Forced Lockout Gas only. This function is only active when firing on gas. A high level on the input (switch closed) prevents the unit from going into safety shutdown condition (burner lockout). If the high level is removed, the display will show F22 and the fault relay will operate. (This is the function required by the low gas pressure alarm).
20	Forced Lockout Gas (during modulation) only. This function is only active when firing on gas and after the unit moves away from the ignition. A high level on the input (switch closed) prevents the unit from going into safety shutdown condition (burner lockout). If the high level is removed, the display will show F24 and the fault relay will operate. (This is the function required by the high gas pressure alarm).
21	Fan Interlock. This function is a normally open contact or switch, that closes after the blower output(PB12) is energized
22	Fuel Pump Interlock. This function is only active when firing on oil. This function is a normally open contact or switch, that closes after the auxiliary relay output (PB14) is energized (refer to option parameter 1.4 for timing).
23	Purge Hold Off. Configures a second airflow function. The purge timer is not started until this switch is made. For example, 70% purge airflow requirement for NFPA. The input is then ignored after purge.





**Option 11.0 - Relay Output Enable (0 -1)\***

Option parameter 11.0 enables the Alarm 2 output for selected indication as listed in Option 11.9.

0	Relay outputs disabled
1	Relay output enabled. The control outputs data as set in Option 11.9 to control the relay.

**Option 11.9 - Alarm Output (0 -20)\***

This option parameter allows the control to output via volt-free relay contacts, various fault or status conditions. The relay output may be used for high voltage and/or low voltage (<50v)n signaling. The relay output will energize if the selected condition is present, therefore if the power to the control fails, then the output will be off.

*Note: The output must not be used for any safety related function.*

1	Motor related fault. The output will be on if any servo-motor fault occurs. (Fault 1 to 8 inclusive).
2	Fault causing non-volatile lockout. The output will be on if any fault occurs which forces the control into a non-volatile lockout condition.
3	External shutdown condition. The output will be on if any digital input into the control is forcing a shutdown or lockout condition (for example: low water). The alarm relays will also indicate this condition. Please note since several external signals can cause a lockout condition, it will only be possible to identify which condition caused the relay to operate by using the Engineer's Key Function. (Fault 17 or Limit 42).
4	External alarm condition. The output will be on if any digital input into the control is forcing an alarm condition (for example: high water). The alarm relays will also indicate this condition. Please note since several external signals can cause a lockout condition, it will only be possible to identify which condition caused the relay to operate by using the Engineer's Key Function. (Limit L43).
5	Flame failure. The output will be on if the flame check is incorrect in either the false flame or flame not detected conditions. (Fault 9 or 10).
6	Valve proving. The output will be on if any fault related to the valve leakage tests occur. (Fault 15).
7	Air pressure. The output will be on if flow checking is incorrect for either flow or no-flow checking for both the secondary air and if the selected, the primary air sensors. (Faults 11 to 14 inclusive).
8	Burner modulating. The output will be on if the burner is modulating. (Burner status 16).
9	Burner control valve exceeded. The output will be on if the burner will not fire because the temperature or pressure measured valve exceeds the high control value, option parameter 7.2 or 9.2. (Engineer's Key 18).
10	Safety limit exceeded. The output will be on if the temperature or pressure safety limit has been exceeded. Please note this limit is only available when using the NX1030 or NX1040 fail safe sensors. Option parameter 5.6 (Fault 41).
11	Burner at low fire hold. The output will be on if the burner is held at low fire by either the keyboard low fire hold or the warming limits.
12	Burner in manual control. The output will be on if the burner modulation rate is being controlled manually via ComFire, keyboard or digital input.
13	Burner in PID or tracking modulation control. The output will be on if either the an external "track "modulation signal or the internal PID control is controlling the burner.
14	Fuel 1 selected. The output will be on if fuel 1 is selected.
15	Fuel 2 selected. The output will be on if fuel 2 is selected.
16	Burner under sequence control. The output will be on if the burner is under sequence control.
17	Burner is selected as lead under sequence control. The output will be on if the burner is under sequence control and is also selected as the lead burner.
18	Gas pressure. The output will be on if any fault related to the gas pressure occurs. (Fault 16).
20	Modulation rate. The relay is energized when the Modulation Rate equals or exceeds the value set in Option 5.9.



**Option 12.0 - Boiler sequencing enable (0 - 1)**

This option parameter enables boiler sequencing control via the RS485 serial communications interface.

0	Sequence control disabled. The unit operates in a stand-alone mode.
1	Sequence control enabled. The unit will modulate and sequence its boiler according to instructions received from the lead boiler. If communication with the lead boiler is lost, the unit operates in stand-alone mode.

**Option 12.1 - Boiler priority (0 - 9)**

This option parameter determines the order in which the boiler will be fired when operating under sequence control. After the lead boiler, the next boiler to be fired is the boiler with the next highest priority. The examples below show how the priorities are chosen for a ten boiler sequencing system.

e.g. 1: If the lead boiler priority is 0, the sequence is: LEAD, 1, 2, 3, 4, 5, 6, 7, 8, 9.

e.g. 2: If the lead boiler priority is 5, the sequence is: LEAD, 6, 7, 8, 9, 0, 1, 2, 3, 4.

**Option 12.2 - Low fire burner power output (0.0 - 99.9MW)\***

This option parameter must be set to the power output from the burner when operating at low fire. It is used when boiler sequencing is enabled to determine the switching points for the boiler.

**Option 12.3 - High fire burner power output (0.0 - 99.9MW)\***

This option parameter must be set to the power output from the burner when operating at high fire. It is used when boiler sequencing is enabled to determine the switching points for the boiler.

**Option 12.4 - Lead boiler select (0 - 1)**

When the unit is under sequence control, setting this option parameter to 1 will force the unit to assert itself as the lead boiler.

If this option parameter is set to 1 AND/OR an auxiliary input is high (assuming the auxiliary input has been configured for lead boiler select - see option parameters 10.1 and 10.2), the unit will assert itself as the lead boiler.

If two or more units have been set as lead, sequencing is disabled.

**Option 12.5 - Standby low limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

If the unit is placed in standby mode by boiler sequence control, the boiler's pressure is maintained between two limit values.

This option parameter determines the pressure at which the boiler will be turned on when in standby mode.

**Option 12.6 - Standby high limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99)**

If the unit is placed in standby mode by boiler sequence control, the boiler's pressure is maintained between two limit values.

This option parameter determines the pressure at which the boiler will be turned off when in standby mode.

**Option 12.7 - Sequencing ON delay (5 - 15 minutes)**

When the unit is under sequence control, this parameter determines the minimum amount of time between one slave coming ON and the next slave coming ON. This parameter is not used on a two boiler system because there is only one slave to turn on or off.

**Option 12.8 - Sequencing OFF delay (1 - 15 minutes)**

When the control is under sequence control, this parameter determines the minimum amount of time between one slave coming OFF and the next slave coming OFF. This parameter is not used on a two boiler system because there is only one slave to turn on or off.

**Option 13.1 - Sustained modulation time before OFF/ON transition**

This parameter is an optional time delay, which is applied when the normal modulation limit for a slave to be activated is reached. Once the time limits specified in option parameters 12.7 & 12.8 have passed (or always, in the case of a two boiler system), the modulation from the PID control is monitored. Providing the modulation stays above the “ON” threshold for greater than the time set by option 13.1 the slave will come on.

**Option 13.2 - Sustained modulation time before ON/OFF transition**

This parameter is an optional time delay, which is applied when the normal modulation limit for a slave to be de-activated is reached. Once the time limits specified in option parameters 12.7 & 12.8 have passed (or always, in the case of a two boiler system), the modulation from the PID control is monitored. Providing the modulation stays below the “OFF” threshold for greater than the time set by option 13.2, the slave will go “OFF”.

**Options 14 thru 43 refer to Expansion Module functions. Refer to bulletin NEX-1002 for explanations/Details regarding these option parameters.**

**Option 50.0 - Erase enable (0 - 1)\***



**CAUTION: If this value is displayed as a “2” the option parameter data has been up-loaded into the unit, ensure all option parameters are set to match the requirements of the burner it is connected to. Failure to do so could cause a hazardous condition to occur. After all option parameters have been checked to match the requirements of the burner it is connected to, reset this option parameter to zero to allow the system to operate. If an attempt is made to operate the system, with this option parameter set to “2” a fault will be generated and the unit will perform a safety shutdown, preventing the burner from firing.**

In order to erase information in memory for a specific profile selection, this option must be set to “1”. Once the unit has left setup mode, this parameter will automatically be reset to “0”.

If this option parameter is set to “2” see caution message above.

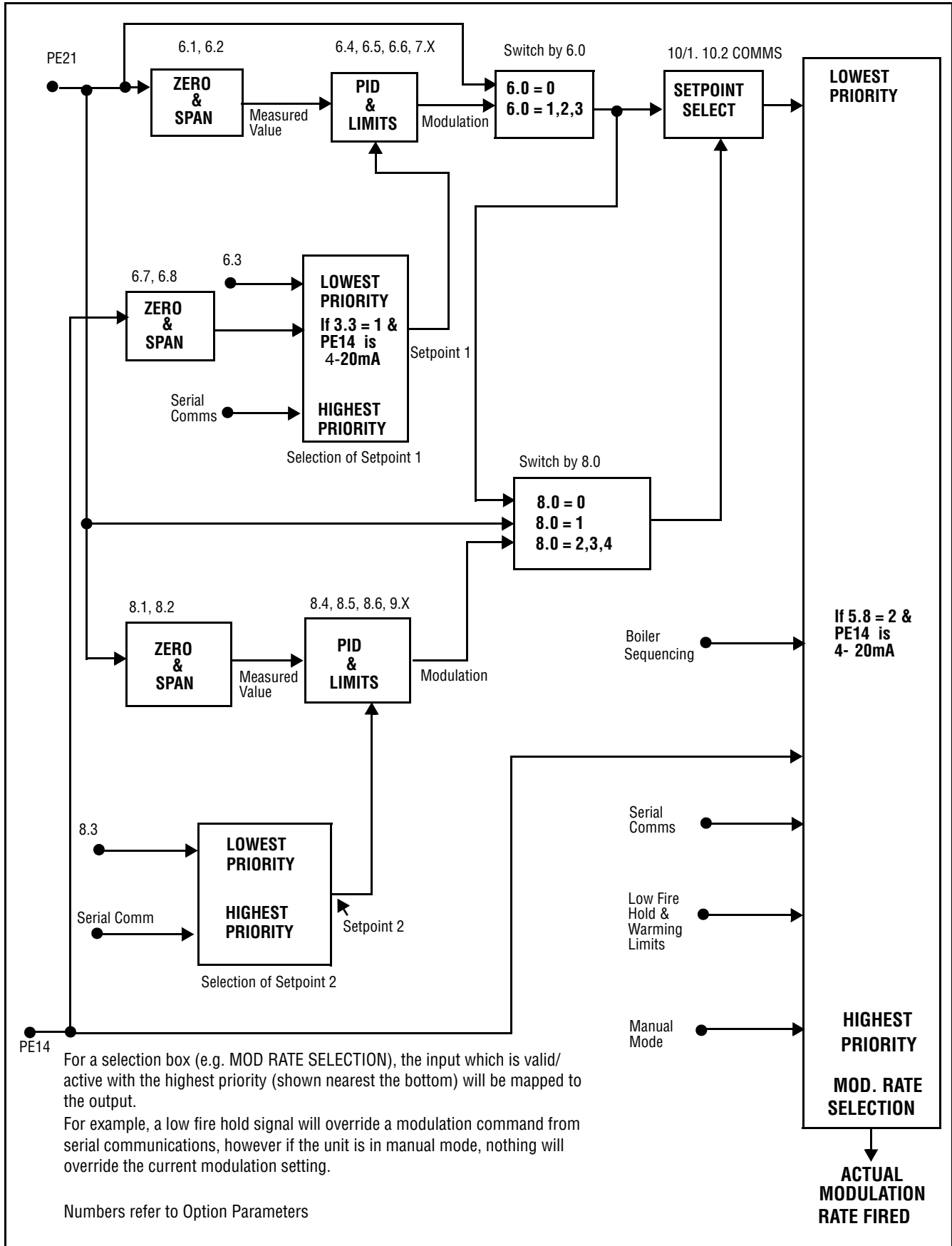
**Option 50.1 - Erase command (0 - 5)\***

When erase enable (option 15.0) is set to “1”, this option parameter determines which information will be erased when the unit leaves option set mode.

0	No erase
1	Erase gas profile 1 (profile 1)
2	Erase oil profile 1 (profile 2)
3	Erase gas profile 2 (profile 3)
4	Erase oil profile 2 (profile 4)
5	Erase all setpoints and initialize all option parameters

**If 5 is selected, all profile setpoints will be erased and all option parameters will be set to default values.** The unit will be initialized to the same state as when it was shipped.

**FIGURE 10. DERIVATION OF MODULATION RATE**



## FAULTS AND FAULT FINDING

### The Fault Display

The unit carries out a number of internal and external checks during operation. If a fault is found, a fault number is used to identify the type of problem. A list of fault numbers may be found later in this section.

Depending on the type of fault, the unit may perform a safety shutdown of the burner and activate the alarm relay.

For details of how to restart the burner after a fault has occurred, refer to “When a Fault Occurs”.

### Description

Many of the faults detected and displayed by the unit will cause a safety shutdown of the burner. Other faults will be displayed as a warning but operation of the burner will not be affected.

Each fault number is prefixed on the commissioning display by a letter. This letter describes the status of the fault:

F	This means that a fault has occurred and is still present. The fault may be internal or external to the unit.
C	This means that a fault did occur but has now cleared.

For example:


F60	Means fault 60 has occurred and still exists.
C73	Means fault or alarm limit 73 has occurred but has subsequently been rectified. This is known as a cleared fault.

### When A Fault Occurs

To cancel the alarm relay, briefly press the **FAULT MUTE** (reset) key on the user display. A separate **FAULT MUTE** (reset) switch will be **REQUIRED** if no display is connected.

### Using the NX550 display:



Use the Engineer's select key  to view the **FAULT NUMBER** and look up the fault number(s) shown, to discover why the fault occurred.

If all faults which caused a safety shutdown have cleared, hold down the **FAULT MUTE** key for approximately three seconds to remove the faults and re-start the burner.

The function of the **FAULT MUTE** key may also be achieved using the **FAULT MUTE** (reset) input.

### Using the LED Display:

If a fault is present, the red fault lamp will be illuminated and the fault 'number' will be displayed as a code by the 7 green lamps on the control unit. Refer to Fault Listing to determine Fault Code.

If all faults which caused a safety shutdown have cleared, hold down the **FAULT MUTE** (reset) key for approximately three seconds to remove the faults and restart the burner.

The function of the **FAULT MUTE** (reset) key may also be achieved using the **FAULT MUTE** (reset) input.

### Non-Volatile Lockout

If power is removed from the unit while a fault is still present, the fault will be stored in non-volatile memory. When power is restored to the unit, the fault number will still be present and it will be necessary to remove the fault before restarting the burner.

### Fault Subsets

As an aid to fault finding, most faults also have a fault subset which gives additional information about the type of fault or what the burner was doing when the fault occurred, these are only available using the commissioning display or via Comfire. Where applicable, the subsets are given in the fault listing.

To view a fault subset press the engineer's key



## Fault Listing

● = LED ON    ○ = LED OFF

NO	LED							NAME	DESCRIPTION
	A	B	C	D	E	F	G		
F1	●	○	○	○	○	○	○	Fuel 1 servo-motor incorrect position	A drive positioning fault has occurred, which will cause a safety shutdown of the burner. This fault has occurred for one of the following reasons:
F2	○	●	○	○	○	○	○	Fuel 2 incorrect position	1. During close position prove, when a drive stops at a position which is outside the close set position by more than five degrees.
F3	●	●	○	○	○	○	○	Air damper 1 incorrect position	2. During purge position prove, when a drive stops at a position which is outside the purge set position by more than five degrees.
F4	○	○	●	○	○	○	○	Air damper 2 incorrect position	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 setpoint as defined by the commissioned fuel/air ratio for the selected profile. A drive is defined as having moved from its setpoint 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. Note: Only the selected fuel servo-motor and the air damper servo-motor are checked. The other fuel servo-motor is ignored. Subset: burner status
F5	●	○	●	○	○	○	○	Fuel 1 servo-motor illegal speed	1. Before the pre-purge starts, all required drives are moved from their lowest positions (closed setpoints) to their highest positions (purge setpoints).
F6	○	●	●	○	○	○	○	Fuel 2 illegal speed	2. During this time, a speed measurement is made for each drive.
F7	●	●	●	○	○	○	○	Air damper 1 illegal speed	These faults will occur if a drive is outside the allowable speed range of 10s/90° to 60s/90°. Is the POT SUPPLY link set for the correct voltage?
F8	○	○	○	●	○	○	○	Air damper 2 illegal speed	<i>Subset: measured speed (s/90°).</i>
F9	●	○	○	●	○	○	○	Flame not detected	The flame detector did not register the presence of a flame when it should be present.
F10	○	●	○	●	○	○	○	Flame detected	The flame detector registered the presence of a flame when it should not be present or when the shutter (if selected) was closed. Subset: burner status
F11	●	●	○	●	○	○	○	Air pressure not detected	The air pressure switch (SW#1) failed to register air pressure when it should be present, or both the "flow" and "no flow" inputs are at the same state. Subset: burner status
F12	○	○	●	●	○	○	○	Air pressure detected	The air pressure switch (SW#1) 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 ( <i>subset: 2</i> ).
F13	●	○	●	●	○	○	○	Air pressure not detected	The air pressure switch (SW#2) failed to register air pressure when it should be present, or both the "flow" and "no flow" inputs are at the same state. Subset: burner status
F14	○	●	●	●	○	○	○	Air pressure detected	The air pressure switch (SW#2) 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 ( <i>subset 2</i> ).
F15	●	●	●	●	○	○	○	Valve proving fault	The measured gas pressure was not correct during the gas valve proving test. Subset: value prove status



● = LED ON    ○ = LED OFF

NO	LED							NAME	DESCRIPTION
	A	B	C	D	E	F	G		
F16	○	○	○	○	●	○	○	Gas pressure limit	The measured gas pressure is outside the operating limits (subset: valve prove status), or the gas pressure sensor is not responding correctly Subset: 10. See option parameter 2.0 for details on changing the operating limits.
F17	●	○	○	○	○	○	○	Forced lockout	A high level on an auxiliary input has forced a lockout.
F18	○	●	○	○	○	○	○	Not enough setpoints entered	A fuel/air ratio profile has been selected which does not have at least four setpoints commissioned. Use commission ratio mode to enter more setpoints. Subset: fuel code
F19	●	●	○	○	○	○	○	CPU board voltage reference	The CPU board has an incorrect on-board reference level. <i>Subset: measured reference, where 512 = 2.5V</i>
F20	○	○	○	●	○	○	○	Potentiometer supply incorrect	The unit has detected that the supply voltage to the potentiometers is too high or too low. Is the potentiometer supply voltage selection link installed? Are the potentiometers wired correctly? Subset: expected potentiometer voltage (5/15)
F21	●	○	○	○	○	○	○	Burner input	The burner inputs (FUEL 1 SEL, FUEL 2 SEL, FAULT MUTE, AUX 1 to AUX 5, FLOW or NO FLOW [for either airflow sensor]) are not responding correctly. Subset: faulty input (1-512)
F22	○	○	○	○	○	○	○	Forced lockout gas firing	A forced lockout has occurred due to the removal of the high level on auxiliary input configured to provide this function, when the unit is firing on gas.
F23	●	○	○	○	○	○	○	Forced lockout oil firing	A forced lockout has occurred due to the removal of the high level on auxiliary input configured to provide this function, when the unit is firing on oil.
F24	○	○	○	○	○	○	○	Forced lockout gas during modulation	A forced lockout has occurred due to the removal of the high level on auxiliary input configured to provide this function, when the unit is modulating on gas.
F25	●	○	○	○	○	○	○	Shutdown relay	The safety shutdown relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F26	○	○	○	○	○	○	○	Gas valve 1 relay	The main gas valve 1 relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F27	●	○	○	○	○	○	○	Gas valve 2 relay	The main gas valve 2 relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F28	○	○	○	○	○	○	○	Pilot valve relay	The pilot valve relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F29	●	○	○	○	○	○	○	Vent valve relay	The vent valve relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F30	○	○	○	○	○	○	○	Ignition transformer relay	The ignition transformer relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F31	●	○	○	○	○	○	○	Oil valve relay	The oil valve relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F32	○	○	○	○	○	○	○	Auxiliary relay	The auxiliary relay is not responding correctly. Subset: required state (0 - off, 1 - on)
F33	●	○	○	○	○	○	○	Gas Proof of Closure	The gas (main 2) valve proof of closure signal is not responding correctly.



● = LED ON ○ = LED OFF

NO	LED							NAME	DESCRIPTION
	A	B	C	D	E	F	G		
F34	○	●	○	○	○	○	○	Oil Proof of Closure	The oil valve proof of closure signal is not responding correctly.
F35	●	●	○	○	○	○	○	Calibration	The calibration data could not be read. The unit will not perform a safety shut-down but instead will use default calibration values. This means that potentiometer and sensor inputs may be inaccurate. Subset: +1 - zero data, +2 - checksum incorrect
F36	○	○	●	○	○	○	○	Commissioning data checksum	The commissioning data memory on the CPU board has been corrupted. • Erase all option parameters and fuel/air ratio setpoints. • Contact supplier. Subset: page number
F37	●	○	●	○	○	○	○	RAM test	The main memory on the CPU board has malfunctioned. • Interrupt power to the unit.
F38	○	●	●	○	○	○	○	Program memory checksum	The program memory on the CPU board has been corrupted. • Interrupt power to the unit.
F39	●	●	●	○	○	○	○	Microprocessor clock	The timing reference on the CPU board is incorrect. • Is option parameter 1.1 set for the correct frequency? • Is the on-site frequency incorrect? • Use a filtered uninterruptable power supply if the voltage supply is excessively noisy. Subset: expected frequency (50/60Hz)
F40	○	○	○	●	○	○	○	Three channel only	An attempt has been made to select a second air damper on a 3 channel control, using option 1.3. • Erase all setpoints and option parameters
F41	●	○	○	●	○	○	○	Boiler safety limit exceeded	The boiler's measured value has exceeded the pressure/temperature safety limit, or the Fireye pressure/temperature sensor is not responding correctly. Subset: 1 - sensor feedback < 1V, 2 - sensor feedback > 5V, 3 - sensor failed during test, 4 - safety limit exceeded
L42	○	●	○	○	○	○	○	Forced shutdown from digital input	The burner has been forced into a shutdown situation from the digital inputs, (operates alarm relay 2).
L43	●	●	○	○	○	○	○	Forced limit alarm from digital input	The burner has been forced into a limit alarm situation from the digital inputs, (operates alarm relay 2).
F44	○	○	●	●	○	○	○	Auxiliary digital input	A digital input is faulty. Look for a short between two inputs.
F50	○	●	○	○	○	○	○	Oxygen probe heater fault	The probe heater has not heated to the correct temperature within 15 minutes of system power up. • Is the probe heater wiring correct? • Is the probe cell thermocouple wiring correct? Subset: O2 probe status
F51	●	●	○	○	○	○	○	Probe calibration fault	The probe calibration data is invalid. • Enter the calibration data supplied with the probe. • Calibrate the probe using air and reference gas.
L52	○	○	●	○	○	○	○	Oxygen low limit alarm	The oxygen level measured value is below the oxygen setpoint low alarm value for the current profile.
L53	●	○	○	○	○	○	○	Oxygen high limit alarm	The oxygen level measured value has exceeded the oxygen setpoint high alarm value for the current profile.
L55	●	●	●	○	○	○	○	Trim limit alarm	The trim drive has reached the allowed maximum deviation limit.





● = LED ON    ○ = LED OFF

NO	LED							NAME	DESCRIPTION
	A	B	C	D	E	F	G		
F56	○	○	○	●	●	●	○	Oxygen probe purge check	The measured value from the oxygen probe was less than 18.0% at the end of pre-purge. Trim is disabled. Subset: Oxygen level x 10
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 setpoint
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.
L59	●	●	○	●	●	●	○	Flue temperature high alarm value exceeded	The measured flue temperature has exceeded the high alarm value for the current profile.
L/ F60	○	○	●	●	●	●	○	Remove unit fault	The communication from the remote unit is faulty. <ul style="list-style-type: none"> <li>• Check wiring between units</li> <li>• Check supply to remote unit</li> <li>• Check fuse in remote unit</li> <li>• Check IC11 (CU 221616) is correct with all pins inserted into the socket</li> </ul> Subset: 1 = ESP not responding, >1 = contact supplier
F61	●	○	●	●	●	●	○	Var. speed incorrect position	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: <ul style="list-style-type: none"> <li>• During close position prove, when a drive stops at a position which is outside the close set position by more than five degrees.</li> <li>• During purge position prove, when a drive stops at a position which is outside the purge set position by more than five degrees.</li> <li>• During pre-purge, ignition or post-purge, when a drive moves from its setpoint.</li> <li>• During modulation, when a drive is not at its correct setpoint as defined by the commissioned fuel/air ratio for the selected profile.</li> <li>• Reference error on expansion unit or communications error (L60) between units.</li> </ul> A drive is defined as having moved from its setpoint 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 error tolerance during modulation is defined by option parameter 14.6. Frequent positioning faults are usually caused by one of the following problems: <ul style="list-style-type: none"> <li>• Worn, dirty or unsuitable (e.g. wire-wound) potentiometers used for servomotors feedback.</li> <li>• Unsuitable lead drive selection - two adjacent profile points having a small change in lead drive position and a large change by a non-lead drive.</li> </ul> Note: Only the selected fuel motor and the aux damper motor are checked. The other fuel motor is ignored. Subset: Burner status
F62	○	●	●	●	●	●	○	Aux. damper position fault	
F63	●	●	●	●	●	●	○	Var. speed drive illegal speed	The specified drive is outside the allowable speed range of 10s/90° to 60s/90°. If the drive is an inverted, adjust the acceleration and deceleration times accordingly. Before the pre-purge starts, all required drives are moved from their lowest positions (closed set points) to their highest positions (purge setpoints).
F64	○	○	○	○	○	○	●	Aux. damper drive illegal speed	During this time, a speed measurement is made for each drive. These faults will occur if a drive is outside the allowable speed range of 10s/90° to 60s/90°. <ul style="list-style-type: none"> <li>• Is the POT SUPPLY link set for the correct voltage.</li> <li>• Is the wiring correct?</li> <li>• Has the triac output failed?</li> </ul> Subset: measured speed (s/90°).
F65	●	○	○	○	○	○	●	Inverter generated fault	Fault generated from auxiliary input on expansion unit (PL4), no non-volatile lockout.

NO	LED							NAME	DESCRIPTION
	A	B	C	D	E	F	G		
F66	○	●	○	○	○	○	○	●	Drive selection fault Selected profile requires drive which is not available, check option parameters 1.3, 14.x .
L67	●	●	○	○	○	○	○	●	Aux 1 Limit The 4-20mA auxiliary input signal is above the limit set by the corresponding option parameter. Its value is displayed on EK 87.
L68	○	○	●	○	○	○	○	●	Aux 2 Limit The 4-20mA auxiliary input signal is above the limit set by the corresponding option parameter. Its value is displayed on EK 88.
L69	●	○	●	○	○	○	○	●	Aux 3 Limit The 4-20mA auxiliary input signal is above the limit set by the corresponding option parameter. Its value is displayed on EK 89.
L70	○	●	●	○	○	○	○	●	Aux 4 Limit The 4-20mA auxiliary input signal is above the limit set by the corresponding option parameter. Its value is displayed on EK 90.
F76	○	○	●	●	○	○	○	●	Secondary flame sensor input fault The flame sensor input is not responding correctly. If the fault persists for 23 hours, the burner will be shutdown.
F77	●	○	●	●	○	○	○	●	Secondary non-volatile lock-out relay fault A secondary fault has occurred with the main 1, main 2, pilot, vent or non-volatile lock-out relays. If the fault persists for 23 hours, the burner will shutdown. Subset: +1 - non-volatile lockout, =2 - main1, =4 - main2, =8 -pilot, =16 -vent.
F78	○	●	●	●	○	○	○	●	Secondary program memory checksum fault A fault has occurred with the program memory on the CPU board. If the fault persists for 23 hours, the burner will shutdown. • Contact supplier.
F79	●	●	●	○	○	○	○	●	Secondary watchdog fault A fault has occurred with the CPU watchdog. If the fault persists for 23 hours, the burner will shutdown. • Contact supplier.



## THE ENGINEER'S KEY

The engineer's key is a hidden key under the Fireye logo on the display. With the use of the engineer's key it is possible to read the values of internal system variables and external input and output states. It is also possible to see the values of fault subsets (refer to Fault Listing for details), in order to obtain more detailed information about a fault which has occurred.

When using the engineer's key it is not possible to change any parameters. Therefore, it is not possible to affect the operation of the burner.

ENGINEER'S KEY PARAMETER LIST		
NO	NAME	DESCRIPTION
EK1	Digital Input 3 (oil select)	Shows the state of each input. Where: 0 = OFF 1 = ON
EK2	Digital Input 2 (gas select)	
EK3	Safety Input C	
EK4	Safety Input D	
EK5	Safety Input E	
EK6	Fault Mute	
EK7	Safety Input A	
EK8	Safety Input B	
EK9	Air Flow Input	
EK10	Air NO Flow Input	
EK11	Burner Select Input	
EK 12	Primary Air Flow	
EK 13	Primary Air NO Flow	
EK 14	Undefined	
EK15	Track Input 2	0 - Not tracking PE21 input 1 - Tracking PE21 input
EK16	Warming Limit Active	0 - Measured value above warming limit, burner free to modulate 1 - Measured value below warming limit, burner held at low fire if the unit is in auto or sequencing mode.
EK17	PID SP Selected 1/2	Indicates which setpoint the unit is currently operating from.
EK18	Boiler Status	0 - Burner will not fire because the temperature/pressure measured value has exceeded the high control value. 1 - Burner will fire because the temperature/pressure measured value has fallen below the low control value.
EK19	Confirm to Adjust	0 - Unit not in commission mode or unit is in commission mode and drives moving to setpoints. 1 - Unit in commission mode and drives may be adjusted using the UP/DOWN keys.
EK20	Drive Moved	0 - Unit not in commission mode or unit is in commission mode and drives have not been moved using the UP/DOWN keys. 1 - Unit in commission mode and drives have been moved using the UP/DOWN keys.
EK21	Positions Proved	0 - Drives have stopped moving, ready for position prove test. 1 - Ready for position prove test but drives still moving.
EK22	Fault Alarm Relay	0 - Fault alarm relay off. 1 - Fault alarm relay on.
EK23	Serial Communications Status	+1 - Toggles on message received +2 - Serial communications passcode correct, or in commission ratio mode +4 - Boiler sequencing passcode correct



### ENGINEER'S KEY PARAMETER LIST

NO	NAME	DESCRIPTION
EK24	Lead Lag Status	0 - Boiler sequencing inactive 1 - Boiler held off via sequence control 2 - Boiler in standby via sequence control. 3 - Boiler modulating via sequence control. 4 - Boiler is lead via sequence control
EK25	Burner status	Status of the start-up sequence. Refer to Gas safety valve proving sequence for details.
EK26	Valve Prove Status	Status of the valve proving sequence. Refer to Gas safety valve proving sequence for details.
EK27	Selected Profile	0 - No profile selected. 1 - Gas profile 1. 2 - Oil profile 1. 3 - Gas profile 2. 4 - Oil profile 2.
EK28	Setpoints Entered	The number of fuel/air setpoints entered for the current profile, where: 0 - No setpoints entered. 1 - Close setpoint only. 2 - Close and purge setpoints. 3 - Close, purge and ignition. 4 - Close, purge, ignition and low fire. 5 thru 24 -etc.
EK29	Commission Status	Current commissioning mode, where: 0 - Normal run mode. 1 - Adjust ratio mode. 2 - Commission ratio mode.
EK30	Commission Profile	The expected commission ratio profile, where: 1 - Gas profile 1. 2 - Oil profile 1. 3 - Gas profile 2. 4 - Oil profile 2.
EK31	Commission Setpoint	The current commission ratio setpoints: 0 - Closed setpoint. 1 - Purge setpoint. 2 - Ignition setpoint. 3 - Low fire setpoint. 4 thru 24 - profile setpoints
EK32	Number of Commission Setpoints	The number of setpoints entered in the current commission ratio session: 0 - No setpoints entered. 1 - Close setpoint only. 2 - Close and purge setpoints. 3 - Close, purge and ignition. 4 thru 24 - profile setpoints.
EK33	Modulation Mode	The current modulation mode: 0 - Auto mode. 1 - Manual from external limit. 2 - Manual from keyboard. 3 - Boiler sequencing control. 4 - Low fire hold.
EK34	Undefined	
EK35	Shutdown profile setpoint	When the unit performs a safety shutdown, this shows the number of the profile setpoint nearest to the last modulation position.
EK36	Flame Sensor Signal Value	Signal value received from the flame sensor input. A steady signal of 10 or greater is required for reliable operation.
EK37	Measured Gas Pressure (mBar)	Measured pressure from gas pressure sensor (sensor must be enabled and gas must be selected).



### ENGINEER'S KEY PARAMETER LIST

NO	NAME	DESCRIPTION
EK38	Valve Close Time $t_{test}$ (s)	Time for which each half of the valve prove test will be conducted (refer to Gas safety valve proving sequence for details). This time counts down to zero during stages 2 and 4 of the valve prove test.
EK39	Gas Pressure Change ( $P_{test}$ )	Maximum pressure drop/rise allowed during the valve prove test (refer to Gas safety valve proving sequence for details).
EK40	Modulation Rate	Current percentage modulation rate (based on lead drive position), where: 0 - Low fire (or burner off) 100 - High fire.
EK 41	Nearest Profile Setpoint	The number of the profile setpoint which is nearest to the current lead drive position.
EK42	Drives a At Setpoint	Represents which drives are currently at their setpoints, where: 0 - All drives are at their setpoints and not moving. NON-ZERO - One or more drives are not at their setpoints.
EK43	Potentiometer Supply Voltage (V)	The measured potentiometer supply voltage.
EK44	Voltage Reference Error (V)	The error between the measured voltage reference and the calibrated value.
EK45	Gas Servo-Motor Setpoint (°)	Setpoint for each servo-motor, in angular degrees
EK46	Oil Servo-Motor Setpoint (°)	
EK47	Air Damper 1 Servo-Motor Setpoint (°)	
EK48	Air Damper 2 Servo-Motor Setpoint (°)	
EK49	Gas Servo-Motor Error (°)	
EK50	Oil Servo-Motor Error (°)	
EK51	Air Damper 1 Servo-Motor Error (°)	
EK52	Air Damper 2 Servo-Motor Error (°)	
EK53	Gas Servo-Motor Response Speed (s/90°)	The measured time taken (in secs.) for each servo-motor to move over 90°.
EK54	Oil Servo-Motor Response Speed (s/90°)	
EK55	Air Damper Response Speed (s/90°)	
EK56	Air Damper 2 Response Speed (s/90°)	
EK57	Message GAP	
EK58	Undefined	
EK59	Undefined	
EK60	Manufacture Day	Date of manufacture/test of CPU board.
EK61	Manufacture Month	
EK62	Manufacture Year	
EK63	Software Issue	Currently installed software issue.
EK64	CPU Board Hardware Issue	
EK65	CPU Board Serial No. (low 3 digits)	The 6-digit CPU board serial number. This serial number is required to obtain the boiler sequencing and/or serial data communications passcodes.
EK66	CPU Board Serial No. (high 3 digits)	
EK68	Adjust Ratio Times	The number of times adjust ratio mode has been used.
EK69	Commission Ratio Counter	The number of times commission ratio mode has been used.
EK70	Number of Tries	The number of times the burner was reset.
EK71	Oxygen Level (%) * optional NX280HW expansion unit must be installed	Power output to the probe heater (0-100%)

### ENGINEER'S KEY PARAMETER LIST

NO	NAME	DESCRIPTION
EK72	O2 Probe Status * optional NX280HW expansion unit must be installed	+1 - Offset fault +2 - Gain fault +4 - Heater fault +8 - Cell mv too high +16 - Oxygen level <18% during pre-purge
EK73	O2 Trim Status * optional NX280HW expansion unit must be installed	0 - O2 trim working, or +1 - no expansion unit installed +2 - Option 20.0 not 1 or 2, or option 20.5 not 1, or option 20.8 not 0 or trim not selected via aux input or trim not selected via serial comms +4 - O2 setpoints or flow values incorrect +8 - Option 20.6 not 0 +16- Not modulating +32- In commission mode +64- Probe faulty (see EK72) +128-Passcode for trim incorrect
EK74	O2 trim Enable * optional NX280HW expansion unit must be installed	0 - O2 trim disabled or inoperative 1 - O2 trim enabled and operative
EK75	Oxygen Probe Cell Temperature (°C) * optional NX280HW expansion unit must be installed	Temperature of oxygen cell, nominal 650°C. F50 will be generated if outside the window 600°C (after 15 minutes of power on) to 700°C
EK76	Oxygen Error (%)	Error between O2 measured value and O2 setpoint
EK77	Trim Deviation (%) flow)	Deviation in air flow imposed by trim (-25 to +25%)
EK78	Excess Air (%)	Excess combustion air at the current firing position
EK79	Oxygen Setpoint (%)	Current oxygen setpoint. This is only available if trim is enabled and working.
EK80	Fuel Flow	Calculated fuel flow for currently selected profile. This is only available on single fuel profiles which have all flow values entered.
EK81	Inverter Setpoint	Inverter speed setpoint (0 – 999)
EK82	Auxiliary Damper Motor Setpoint (°)	Setpoint, in angular degrees
EK83	Inverter Error	Inverter speed error (0 – 999)
EK84	Auxiliary Damper Motor Error (°)	How far motor is from its setpoint, in angular degrees
EK85	Inverter Drive Response Speed	The measured time taken in seconds for the inverter to move from zero speed to 50/60Hz.
EK86	Auxiliary Damper Motor Response Speed (s/90°)	The measured time taken (in secs.) for drive to move over 90°.
EK87	Auxiliary Analogue Input 1	Auxiliary analogue input range as selected by option parameter 40.x.
EK88	Auxiliary Analogue Input 2	Auxiliary analogue input range as selected by option parameter 41.x.
EK89	Auxiliary Analogue Input 3	Auxiliary analogue input range as selected by option parameter 42.x.
EK90	Auxiliary Analogue Input 4	Auxiliary analogue input range as selected by option parameter 43.x.



## TROUBLESHOOTING

### Display Problem

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Display will not light. Display shows garbage. Keys do not work.	Display wired incorrectly.	Check wiring to connector PE.
Display will not light.	Fuse blown on backplane board.	Check fuse. If blown, investigate all external wiring and replace fuse with a new one of the correct type and rating.
Drive positions incorrect.	Wrong potentiometer voltage Incorrect potentiometer wiring.	Check POT SUPP link (refer to POT supply, page 21). Check wiring to terminals PD11-17.
Measured value incorrect.	Wrong sensor voltage. Wrong sensor input type. Incorrect sensor wiring. Wrong zero or span. Setpoint 1 or 2 incorrectly selected	Check SENS SUPP link (see option link section). Check SENS IN link (see option link section). Check wiring to terminals PE 20 -23 Check option parameters 6.1, 6.2, 8.1, 8.2. Check EK17 and select other setpoint.
Setpoint incorrect.	Setpoint 1 or 2 incorrectly selected Option params 6.3/8.3 incorrect. Value updated via serial comms	Check EK17 and select other setpoint. Enter option set mode and change values. Change setpoint using ComFire software.
Hours run shows '---'. Hours run keeps toggling.	No profile selected. Hours run > 999 hours.	Select oil or gas profile. 1st digits show thousands, 2nd show units.
Modulation rate is 0.	Burner not modulating.	Wait for burner to finish start-up sequence.
Burner status is flashing.	Unit in safety shutdown mode.	Burner status before shutdown displayed.
Gas pressure not shown.	Gas sensor not selected.	Select sensor using option parameter 02.0.
Gas pressure incorrect.	Wrong zero or span.	Check option parameters 2.1 and 2.2.

### Start-up Problem

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Burner will not start.	Unit in safety shutdown. Air pressure switch still made. No fuel selected. Burner not selected. High control limit exceeded. Unit in commission ratio mode. Burner off via serial comms.	Hold FAULT MUTE key when faults clear. Wait for burner fan to stop. Check EK1 (oil input) and EK2 (gas input). Check EK11 (burner select input). Check EK18 and wait for press/temp to drop. Press NEXT to advance to next setpoint. Turn burner on using ComFire software.
Drive positioning fault occurs before drives move to purge.	Stored close positions do not match actual close positions.	Check feedback potentiometers and servo-motor micro-switches. Reset close positions using commission ratio
Drive positioning fault occurs when drives reach purge.	Stored purge positions do not match actual purge positions.	Check feedback potentiometers and servo-motor micro-switches. Reset purge positions using commission ratio
Pilot, main 1 and main 2 valves will not open.	No feed on BURNER SEL.	Check terminal PB7.
Ignition transformer does not energize.	No output on IGN.	Check terminal PB6.
Drives stuck at ignition and burner has not fired.	Drives cannot reach ignition pos. Valve proving in progress.	Check servo-motor micro-switches and linkages. Wait for proving sequence to finish.
Drives stuck at ignition and burner has fired.	Ignition time has not elapsed.	Wait for ignition time to elapse. Reduce ignition time (option parameter 4.1).



## Commissioning Problem

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Cannot get past P0.	Unit in safety shutdown. Air pressure switch still made. No fuel selected. Burner not selected. High control limit exceeded. Unit in commission ratio mode. Burner off via serial comms.	Hold FAULT MUTE key when faults clear. Wait for burner fan to stop. Check EK1 (oil input) and EK2 (gas input). Check EK11 (burner select input). Check EK18 and wait for press/temp to drop. Press NEXT to advance to next setpoint. Turn burner on using ComFire software.
'Px' or 'Ax' display flashes constantly and servo-motor positions cannot be altered.	Drives moving to position. Valve proving test in progress. Burner off in adjust ratio mode. A0, A1, A2 displayed.	Wait for drives to reach position. Wait for valve proving test to finish. Fire burner to alter points in adj. ratio mode. Use commission ratio mode to alter these.
'Px' or 'Ax' display does not flash and servo-motor positions cannot be altered.	Incorrect servo-motor selected. No feed on SERVO-MOTOR COM. servo-motor microswitch open.	Use the top left/right arrow to select a servo-motor. Check for feed on terminal PA1. Adjust servo-motor microswitch.
Servo-motors appear to move too quickly.	+15V potentiometer supply incorrectly selected.	Change the link on the backplane board to select a +5V potentiometer supply.
Servo-motor feedback will only go up to approx.... 35°.	+5V potentiometer supply incorrectly selected.	Change the link on the backplane board to select a +15V potentiometer supply.
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 params. in group.
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.	Enter correct passcode. Turn burner off.
Not possible to enter adjust ratio mode.	Supplier passcode or adjust ratio passcode incorrect.	Enter supplier passcode with the burner on OR adjust ratio passcode with the burner off.

## Gas Valve Proving Problem

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Proving sequence takes a long time.	Nominal gas pressure, test volume or leakage rate incorrect.	Check option parameters 02.3, 02.6 and 02.7 Expected time shown on EK38.
Main valve 2 does not open.	Vent valve has been selected.	Check option parameter 02.8.
Vent valve does not open.	Vent valve not selected.	Check option parameter 02.8.
Main valve 1 and/or main valve 2 do not open.	Valve proving not selected. No feed on BURNER SEL.	Check option parameter 02.0. Check for feed on terminal PB7.





## Modulation Problem

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Sensor or modulation rate inaccurate.	V/I input setting incorrect. 5/24V supply setting incorrect.	Check option parameter 05.5. Check SENSOR IN and SUPPLY links.
Intermittent positioning faults.	Lead drive setting incorrect. Profile not suitable. Profile too close to micro-switch. Poor Earth or screening. Feedback potentiometer faulty.	Change lead drive (option param. 05.1/05.2). Increase servo-motor range (by adjusting linkages). Move end points further away from high/low. Check wiring. Move servo-motor across range and check f/back.
Modulation rate sticks at a profile setpoint.	Lead drive position similar or same as adjacent setpoint.	Enter commission ratio mode and change the lead drive setpoints or change lead drive.
Unit stuck at low fire.	Meas. value exceeds setpoint. Low fire hold time not expired. Warming limit active (EK16 =1). Unit in manual. External low fire hold. Sequencing low fire hold.	No fault. Wait for low fire hold time to expire. Wait for boiler to warm up. Press the AUTO key to change to auto mode Check auxiliary input functions (Option Parameter 10.0 -10.9) Increase the mod. rate in manual mode.
Unit stuck at mod. rate.	Serial communications. Unit in commission mode.	Disable or change mod. slider in ComFire. Press RUN then ENTER to enter run mode.



COMMISSIONING SHEET			
Site:			Engineer:
			Comments:
Serial No:	Boiler No:		
Fuel:	Date:		
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
0.1	Site Passcode		0-999
0.5	Serial Communication Passcode 1		0-999
0.6	Serial Communication Passcode 2		0-999
0.7	Expansion Module Passcode 1		0-999
0.8	Expansion Module Passcode 1		0-999
1.1	Main Supply Frequency		50/60
1.2	Unit Communication Address		0-15
1.3	Air Damper 2		0- Deselect, no second air damper 1- Second Air Damper selected as Primary air for Oil Firing 2- Second Air Damper Selected as Flue Gas Recirculation for Gas Firing 3- Second Air (Sleeve) Damper available for both Fuels. 4- 2nd Damper
1.4	Auxiliary Relay		0- Deselected, Auxiliary relay output not used 1- Auxiliary relay output used to control the Oil Pump-off unless firing on oil and burner status between sequence 10 and 16 (Table 1, Start-up sequence) 2- Auxiliary relay output used to control a Steam Atomizing Valve-off unless firing on oil and burner status between sequence 6 and 16 (Table 1, Start-up sequence) 3- Auxiliary relay output used to control a Steam Purge Valve-on when firing oil during sequence 17 or 18. 4- Auxiliary relay output used to control Boiler-Sequencing Valve; relay off unless the boiler is selected as sequencing slave, in standby and the measured value is below setpoint. 5- Flame detector
1.5	Reset Hours		0- Not Used 1- Reset Now
1.6	Motor Display		0- xx.x° Open Angular degrees to 1 decimal place. 1- xx° Open Angular degrees, no decimal place. 2- xx.x% Open Percentage to 1 decimal place. 3- xx% Open Percentage, no decimal place.



COMMISSIONING SHEET			
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
2.0	Gas Pressure Select		0- Gas pressure input not used. The gas valve leak test is not performed and the gas pressure limit values are ignored. 1- NX1020 gas pressure sensor used. The unit Monitors the gas pressure (including gas pressure limits) if gas profile is selected but does not perform gas valve proving. 2- NX1020 gas pressure sensor used. The unit monitors the gas pressure (including gas pressure limits) and performs Gas Valve Proving if a gas profile is selected.
2.1	Gas Pressure Zero		0-999 mBar
2.2	Gas Pressure Span		0-999 mBar
2.3	Gas Pressure Nominal		0-999 mBar
2.4	Gas Pressure Low Limit		0-999 mBar
2.5	Gas Pressure High Limit		0-999 mBar
2.6	Test Volume		0.0-99.9 liters
2.7	Maximum Leak Rate		0.0-99.9 liters/hour
2.8	Vent Valve Select		0- Not used 1- Type NC valve Output energized to open valve (Used for V.P.S.) 2- Type NO valve Output energized to close valve, powered at sequence 5.
2.9	Fuel Valve Proof of Closure		0- Deselected, no proof of closure function selected. 1- Gas Valve Main 2 Only checked. 2- Oil Valve Only checked. 3- Both Gas main 2 and oil valve checked.
3.0	Flame Detection Device		0- IR detector 1- Ultraviolet (UV) detector, non self-check. 2- Ultraviolet Self-Check (UVSC) with shutter.
3.1	False Flame Detection Time		0- False flame detection time < 3 seconds 1- False Flame detection time < 30 seconds
3.2	Flame Failure Response Time		0- Flame Failure response time < 1 second (compatibility with CE products). 1- Flame failure response time < 1 second. 2- Flame failure response time < 2 seconds. 3- Flame failure response time < 3 seconds
3.5	Fan on Early		0-120 seconds
4.0	Safety Time Configuration		0-10 see Table 3, pg. 77
4.1	Ignition Time		0-999 sec
4.2	Low Fire Hold Time		0-999 sec
4.3	Post Purge Time		0-999 sec
4.4	Extended Oil Pilot		0-20 sec
4.5	Permanent Gas Pilot		0- Disabled 1- Enabled Permanent pilot operation, when firing on gas. (Intermittent pilot)



COMMISSIONING SHEET			
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
4.6	Pilot Open		0- Pilot only operates without the main gas valve when firing on gas. 1- Pilot operates with the main gas valve (#1) when firing on gas.
4.7	Limit Modulation Range (Expansion Module Only)		0- No Limit 1- Limited
4.9	Direct Ignition on Oil		0 = OFF, 1 = ON
5.1	Lead Drive for Gas		0- Lead drive is air register 1- Lead drive is currently selected fuel.
5.2	Lead Drive for Oil		0- Lead drive is air register 1- Lead drive is currently selected fuel.
5.3	Bumpless Transfer Operation		0- None, If the burner is fired up in MANUAL mode, the drives remain at low fire until modulated manually. If the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives remain at their current positions. 1- If the burner is fired up in MANUAL mode, the drives are modulated to the last positions used in MANUAL mode. If the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives are modulated to the last positions used in MANUAL mode. 2- The unit powers up in the last selected modulation mode. If the burner is fired up in MANUAL mode, or the modulation mode is changed from AUTO to MANUAL while the burner is firing, the drives are modulated to the position used last time in MANUAL mode.
5.4	Modulation Speed		25-100% (Default = 100%)
5.5	Modulation Sensor Input Type		0- 0-5V operation. Set the SENSOR IN link to "V". Set the SENSOR SUPPLY link as required. 1- 4-20 mA operation. Set the SENSOR IN link to "I". Set the SENSOR SUPPLY link as required. 2- NX1040 fail safe boiler temperature sensor. Set the SENSOR IN link to "V" and the SENSOR SUPPLY link to +24V. 3- NX1030 fail safe boiler pressure sensor. Set the SENSOR IN Link to "V" and the SENSOR SUPPLY link to +24V
5.6	Boiler High Safety Limit		0-999
5.7	Control Units		0- PSI 1- Bar 2- °F 3- °C
5.8	Auxiliary Modulation Input Function		0- Not used. The input is ignore 1- Remote setpoint. The input determines the control value of the PID loop when setpoint 1 is selected, providing the loop current is within the range of 3.5-21 mA. If the loop current is outside this range, the unit reverts to using the setpoint 1 control value (Option parameter 6.3). Option parameters 6.7 and 6.8 give zero and span for this input. 2- Remote tracking input. The input determines the modulation rate, providing the loop current is within the range 3.5-21 mA. If the loop current is outside this range, the units revert to using normal modulation rate (depending on current modulation mode). This is different from using 'track modulation input' (option 6.0=0, or 8.0=1) because an out of range signal will cause those options to hold on low fire. This function will override both setpoints 1 and 2. 4 mA= low fire, 20 mA= high fire.



COMMISSIONING SHEET			
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
5.9	Modulation Switch		0-99%
6.0	Setpoint 1 Input Type		0- Track modulation input. (Where minimum input signal= low fire, Maximum input signal= high fire) 1- Measure value input, PID XXX control, values displayed with no decimal place 2- Measure value input, PID XX.X control, values displayed with 1 decimal place. 3- Measure value input, PID X.XX control, values displayed with 2 decimal places.
6.1	Setpoint Zero Value		0-999
6.2	Setpoint 1 Span Value		0-999
6.3	Setpoint control Value		0-999
6.4	Setpoint 1 Proportional Band		0-999
6.5	Setpoint 1 Integral Term		0-999
6.6	Setpoint 1 Derivative Term		0-999
6.7	Setpoint 1 Remote Zero Value		0-999
6.8	Setpoint 1 Remote Span Value		0-999
7.0	Setpoint 1 Control Limit Type		0- No limits 1- Absolute limit. The values entered in the option parameters 7.1 and 7.2 are the actual limit values. 2- Deviation limit. The values entered in option parameters 7.1 and 7.2 represent a deviation from the setpoint 1 control value. This means that if the setpoint control value is changed, the limits are automatically changed correspondingly.
7.1	Setpoint 1 Low Limit Control Value		0-999
7.2	Setpoint 1 High Limit Control Valve		0-999
7.5	Setpoint 1 Warming Limit		0-999
7.6	Setpoint 1 Warming Time		0-360
8.0	Setpoint 2 Input Type		0- Not used. 1- Track modulation input. (Where minimum input signal = low fire, maximum input signal = high fire. 2- Measure value input, PID XXX control, values displayed with no decimal place. 3- Measure value input, PID XX.X control, values displayed with 1 decimal place. 4- Measure value input, PID X.XX control, values displayed with 2 decimal places.
8.1	Setpoint 2 Zero Value		0-999
8.2	Setpoint 2 Span Value		0-999
8.3	Setpoint 2 Control Valve		0-999
8.4	Setpoint Proportional Band		0-999
8.5	Setpoint 2 Integral Term		0-100
8.6	Setpoint 2 Derivative Term		0-100



**COMMISSIONING SHEET**

OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
9.0	Setpoint 2 Control Limit Type		0- No limits. 1- Absolute limit. The values entered in option parameters 9.1 and 9.2 are the actual limit values. 2- Deviation limit. The value entered is option parameters 9.1 and 9.2 represent a deviation from the setpoint 1 control value. This mean that if the setpoint control value is changed, the limits are automatically changed correspondingly.
9.1	Setpoint 2 Low Limit Control Value		0-999
9.2	Setpoint 2 High Limit Control Value		0-999
9.5	Setpoint 2 Warming Limit		0-999
9.6	Setpoint 2 Warming Time		0-360
10.0	Fault Mute		0- Fault Mute 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable
10.1	I/P A Function		0- No selection, 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable 13- Spare 14- Force lockout Low Water) 15- Forced shutdown.(Low Water) 16- Force alarm.(High Water) 17- Forced lockout Oil only.(Low Oil Pressure) 18- Forced shutdown Oil only.(Low Oil Temperature) 19- Forced lockout Gas only.(Low Gas Pressure) 20- Forced lockout Gas (during modulation) only.(High Gas Pressure) 21- Fan Interlock 22- Fuel Pump Interlock 23- Purge Hold Off
10.2	I/P B Function		Same as 10.1



**COMMISSIONING SHEET**

<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
10.3	I/P C Function		Same as 10.1
10.4	I/P D Function		Same as 10.1
10.5	I/P F Function		Same as 10.1
10.6	I/P 2 Function	Gas Select	0- Gas Selected 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable
<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
10.7	I/P 3 Function	Oil Select	0- Oil Selected 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable
10.8	I/P 4 function	Air Pressure Switch 2 Flow	0- Air Pressure Switch 2 FLOW 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable



**COMMISSIONING SHEET**

<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
10.9	I/P 5 function	Air Pressure Switch 2 Flow	0- Air Pressure Switch 2 NO FLOW 1- Auto/Manual selection 2- Manual Up 3- Manual Down 4- Setpoint select 5- Release to ignite 6- Release to modulate. 7- Lead boiler select. 8- Profile select 9- Purge Hold (Switch close hold purge). 10- Oil valve proof of closure. 11- Gas valve proof of closure. 12- Trim Enable
11.0	Relay Output Enable		0 - Disabled 1 - Relay Output Enabled
<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
11.9	Alarm 2 Output		0 -No Selection 1- Motor Related Fault 2- FAult Causing Non-Volitale Lockout 3- External Shutdown Condition 4- External Alarm Condition 5- Flame Failure 6- Valve Proving. 7- Air Pressure 8- Burner Modulating 9- Burner Control Value Exceeded 10- Safety Limit Exceeded 11- Burner at Low Fire Hold 12- Burner in Manual Control 13 - Burner in PID or Tracking Modulation Control 14 - Fuel 1 Selected 15 - Fuel 2 Selected 16 - Burner Under Sequence Control 17 - Burner is selected as lead under sequence control 18 - Gas Pressure 20 -Modulation Rate
12.0	Lead Lag Enable		0- Disabled. The unit operates in a stand-alone mode. 1- Enabled. The unit will modulate and sequence its boiler according to instructions received from the lead boiler. If communication with the lead boiler is lost, the unit operates in stand-alone mode.
12.1	LL Priority	0-9	Lead, 1, 2, 3, 4, 5, 6, 7, 8, 9, Lead, 6, 7, 8, 9, 0, 1, 2, 3, 4,
12.2	Low Fire Burner Output		0.0-99.9 MW
12.3	High Fire Burner Output		0.0-99.9 MW
12.4	Lead Boiler Select		0- Not Lead 1- Lead boiler
12.5	Standby Low Limit Control Value		0-999
12.6	Standby High Limit Control Value		0-999





COMMISSIONING SHEET			
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
12.7	Sequencing Up Delay		1-15 minutes
12.8	Sequencing Down Delay		1-15 minutes
13.1	Sustain Mod Hi		0-15 minutes
13.2	Sustain Mod Low		0-15 minutes
14.0	Inverter/ Auxiliary Damper enable		0- Disabled 1- Enabled
14.1	Inverter/ Auxiliary Damper enable Profile 1		0- Inverter speed control disabled 1- Inverter speed control enabled for relevant fuel/profile. 2- Auxiliary damper control enabled for relevant fuel/profile. 3- Inverter and auxiliary damper enabled for relevant fuel/profile.
14.2	Inverter/ Auxiliary Damper enable. Profile 2		0- Inverter speed control disabled. 1- Inverter speed control enabled for relevant fuel/profile. 0- Auxiliary damper control enabled for relevant fuel/profile. 1- Inverter and auxiliary damper enabled for relevant fuel/profile.
14.3	Inverter/ Auxiliary Damper enable. Profile 3		0- Inverter speed control disabled. 1- Inverter speed control enabled for relevant fuel/profile. 2- Auxiliary damper control enabled for relevant fuel/profile. 3- Inverter and auxiliary damper enabled for relevant fuel/profile.
14.4	Inverter/ Auxiliary Damper enable. Profile 4		0- Inverter speed control disabled. 1- Inverter speed control enabled for relevant fuel/profile. 2- Auxiliary damper control enabled for relevant fuel/profile. 3- Inverter and auxiliary damper enabled for relevant fuel/profile.
14.5	Inverter Control Accuracy		0- Low accuracy (normal setting). 1- High accuracy (not recommend)
14.6	Inverter Error Tolerance		0- Small Tolerance (normal setting). 1- Large Tolerance
14.7	Inverter closed loop Gain		15-125%
14.8	Inverter speed stop time		0-100 seconds
20.0	Oxygen Probe select		0- No probe selected 1- Fireye Oxygen probe w/o pre-purge test. 2- Fireye Oxygen probe w/ pre-purge test
20.1	Oxygen probe calibration offset value		0-999
20.1	Oxygen probe calibration offset value		0-999
20.2	Oxygen probe calibration gain value		0-999
20.3	Oxygen probe calibration gas concentration		0-9.99%
20.4	Temperature Unit		0- °C 1- °F



**COMMISSIONING SHEET**

<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
20.5	Oxygen Input function		0- Monitor only 1- Closed loop trim
20.6	Oxygen probe calibrate enable		0- Not selected 1- Calibrate in air 2- Calibrate in reference gas
20.7	Boiler transport delay		5-60 seconds
20.8	Reset oxygen trim profile		0- No Reset 1- Reset learned trim profile
20.9	Automatic trim commissioning		0- Not selected 1- Automatic trim commissioning
23.0	Trim Limit default		0- Not selected (trim limit fixed at $\pm 5\%$ ) 1- Selected (trim limit adjustable $\pm 25\%$ )
23.1	Trim limits Profile 1		0.0-25.0
23.2	Trim limits Profile 2		0.0-25.0
23.3	Trim limits Profile 3		0.0-25.0
23.4	Trim limits Profile 4		0.0-25.0
24.1	Trim Integral Gain Profile 1		0.0-99.9%
24.2	Trim Integral Gain Profile 2		0.0-99.9%
24.3	Trim Integral Gain Profile 3		0.0-99.9%
24.4	Trim Integral Gain Profile 4		0.0-99.9%
25.0	Trim Proportional Gain default		0- Not selected. 1- Selected (Proportional Gain available for each profile)
25.1	Trim Proportional Gain Profile 1		0.0-99.9%
25.2	Trim Proportional Gain Profile 2		0.0-99.9%
25.3	Trim Proportional Gain Profile 3		0.0-99.9%
25.4	Trim Proportional Gain Profile 4		0.0-99.9%
26.0	Inlet Temperature Sensor		0- Not Fitted 1- For calculated burner GROSS efficiency. 2- For calculated burner NET efficiency.
26.1	Calorific Values of fuels/profiles 1		0.0-99.9%
26.2	Calorific Values of fuels/profiles 2		0.0-99.9%
26.3	Calorific Values of fuels/profiles 3		0.0-99.9%
26.4	Calorific Values of fuels/profiles 4		0.0-99.9%
26.5	Hydrocarbon ratios of fuel for Profile 1		0-9.99%
26.6	Hydrocarbon ratios of fuel for Profile 2		0-9.99%
26.7	Hydrocarbon ratios of fuel for Profile 3		0-9.99%
26.8	Hydrocarbon ratios of fuel for Profile 4		0-9.99%
26.9	Boiler Radiated Heat Loss		0-9.99%



COMMISSIONING SHEET			
OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
27.0	Flue Temperature Alarm Select		0- Disabled 1- Enable
27.1	Flue Temperature Low Alarm Values for Profile 1		0-999
27.2	Flue Temperature Low Alarm Values for Profile 2		0-999
27.3	Flue Temperature Low Alarm Values for Profile 3		0-999
27.4	Flue Temperature Low Alarm Values for Profile 4		0-999
28.1	Flue Temperature High Alarm Values for Profile 1		0-999
28.2	Flue Temperature High Alarm Values for Profile 2		0-999
28.3	Flue Temperature High Alarm Values for Profile 3		0-999
28.4	Flue Temperature High Alarm Values for Profile 4		0-999
29.0	Oxygen Alarm Select		0- Alarms Disabled 1- Alarms Enabled, NO non-volatile lockout. 2- Alarms Enabled, WITH non-volatile lockout
29.1	Oxygen Low Alarm values at Low Fire for Profile 1		0-99.9%
29.2	Oxygen Low Alarm values at Low Fire for Profile 2		0-99.9%
29.3	Oxygen Low Alarm values at Low Fire for Profile 3		0-99.9%
29.4	Oxygen Low Alarm values at Low Fire for Profile 4		0-99.9%
30.1	Oxygen Low Alarm values at High Fire for Profile 1		0-99.9%
30.2	Oxygen Low Alarm values at High Fire for Profile 2		0-99.9%
30.3	Oxygen Low Alarm values at High Fire for Profile 3		0-99.9%
30.3	Oxygen Low Alarm values at High Fire for Profile 4		0-99.9%
31.1	Oxygen High Alarm Values at Low Fire for Profile 1		0-99.9%
31.2	Oxygen High Alarm Values at Low Fire for Profile 2		0-99.9%
31.3	Oxygen High Alarm Values at Low Fire for Profile 3		0-99.9%
31.4	Oxygen High Alarm Values at Low Fire for Profile 4		0-99.9%



**COMMISSIONING SHEET**

OPTION	DESCRIPTION	VALUES	ALLOWABLE VALUES
32.1	Oxygen High Alarm Values at High Fire for Profile 1		0-99.9%
32.2	Oxygen High Alarm Values at High Fire for Profile 2		0-99.9%
32.3	Oxygen High Alarm Values at High Fire for Profile 3		0-99.9%
32.4	Oxygen High Alarm Values at High Fire for Profile 4		0-99.9%
33.0	Fuel Flow Select		0- No calculation 1- Flow XXX 2- Flow XX.X
33.1	Maximum Fuel Flow 1		0-999
33.2	Maximum Fuel Flow 2		0-999
33.3	Maximum Fuel Flow 3		0-999
33.4	Maximum Fuel Flow 4		0-999
36.0	4-20 mA output Function for Auxiliary Output		0- Not used. The output will transmit 0 mA 1- Modulation rate (4 mA when not modulating) 2- Boiler pressure/Temperature measured value. 3- Boiler pressure/Temperature setpoint. 4- Calculated efficiency. 5- Inlet temperature. 6- Flue temperature. 7- Oxygen level. 8- CO2 level. 9- Gas pressure. 10- Modulation rate master signal for twin burner slaving. 11- Com Rate. Note: When 2 to 9 option are used, The Zero & Span values must be entered.
36.1	Zero value for Output 1		0-999
36.2	Span value for Output 1		0-999
37.0	4-20 mA output Function for Output 2		Same as 36.0
37.1	Zero value for Output 2		0-999
37.2	Span value for Output 2		0-999
38.0	4-20 mA output Function for Output 3		Same as 36.0
38.1	Zero value for Output 3		0-999
38.2	Span value for Output 3		0-999
39.0	4-20 mA output Function for Output 4		Same as 36.0
39.1	Zero value for Output 4		0-999
39.2	Span value for Output 4		0-999



**COMMISSIONING SHEET**

<b>OPTION</b>	<b>DESCRIPTION</b>	<b>VALUES</b>	<b>ALLOWABLE VALUES</b>
40.0	4-20 mA Input function AUX 1		0- Input not used. 1- XXX, Auxiliary input values displayed with no decimal place. 2- XX.X Auxiliary input values displayed with 1 decimal place. 3- X.XX Auxiliary input values displayed with 2 decimal places.
40.1	Zero values for AUX 1 input		0-999
40.2	Span values for AUX 1 input		0-999
40.3	High Limit values for AUX 1 input		0-999
41.0	4-20 mA Input function AUX 2		Same as 40.0
41.1	Zero values for AUX 2 input		0-999
41.2	Span values for AUX 2 input		0-999
41.3	High Limit values for AUX 2 input		0-999
42.0	4-20 mA Input function AUX 3		Same as 40.0
42.1	Zero values for AUX 3 input		0-999
42.2	Span values for AUX 3 input		0-999
42.3	High Limit values for AUX 3 input		0-999
43.0	4-20 mA Input function AUX 4		Same as 40.0
43.1	Zero values for AUX 4 input		0-999
43.2	Span values for AUX 4 input		0-999
43.3	High Limit values for AUX 4 input		0-999
50.0	Erase Enable		0- Disabled 1- Enabled.
50.1	Erase Command		0- No Erase 1- Erase profile 1 Gas 1 2- Erase profile 2 Oil 1 3- Erase profile 3 Gas 2 4- Erase profile 4 Oil 2 5- Erase all setpoints and initialize all option parameters.

**Table 3: SAFETY TIME CONFIGURATION (OPTION 4.0)**

CONFIGURATION	PROVE AIR PRESSURE	SUPERVISED PURGE	PRE-IGNITION	PILOT TRIAL FOR IGNITION	PILOT IGNITION INTERVAL	MAIN TRAIL** FOR IGNITION	WAIT FOR FLAME ESTABLISH
	T1	T2	T3	T4*	T5	T6	T7
<b>0</b>	6	15	4	2	4	2	2
<b>1(EP113)</b>	8	36	4	2	8	2	8
<b>2</b>	10	37.5	5	2.5	10	5	7.5
<b>3(EP113)</b>	8	66	4	2	8	2	8
<b>4</b>	10	67.5	5	2.5	10	5	7.5
<b>5</b>	15	30	4	5	8	5	2
<b>6</b>	15	60	4	5	8	5	2
<b>7(EP170)</b>	10	30	0	5	5***	10	2
<b>8(EP160)</b>	10	30	0	5	5	10	2
<b>9****</b>	10	30	0	5	5***	10	2
<b>10****</b>	10	60	0	5	5	10	2

\* If an oil profile is selected, T4 will always be 5 seconds regardless of the time chosen.

\*\* See option 4.4 for extended MTFI.

\*\*\* Using configuration 7 or 9 the ignition transformer is off during T5.

\*\*\*\* Option 9 and 10 allow an additional 30 seconds purge allowing the FGR damper to fully close.

A 30 second purge with the FGR damper closed is achieved.



**COMMISSIONING SHEET -GAS SELECT**

<b>Profile 1</b>		<b>Fuel 1 (°)</b>	<b>Air 1 (°)</b>	<b>Air 2 (°)</b>
Close	P0			
Purge	P1			
Ignition	P2			
Low Fire	P3			
	P4			
	P5			
	P6			
	P7			
	P8			
	P9			
	P10			
	P11			
	P12			
	P13			
	P14			
	P15			
	P16			
	P17			
	P18			
	P19			
	P20			
	P21			
	P22			
	P23			

<b>Profile 3</b>		<b>Fuel 1(°)</b>	<b>Air 1 (°)</b>	<b>Air 2(°)</b>
Close	P0			
Purge	P1			
Ignition	P2			
Low Fire	P3			
	P4			
	P5			
	P6			
	P7			
	P8			
	P9			
	P10			
	P11			
	P12			
	P13			
	P14			
	P15			
	P16			
	P17			
	P18			
	P19			
	P20			
	P21			
	P22			
	P23			



**COMMISSIONING SHEET - OIL SELECT**

Profile 2		Fuel 2(°)	Air 1 (°)	Air 2 (°)
Close	P0			
Purge	P1			
Ignition	P2			
Low Fire	P3			
	P4			
	P5			
	P6			
	P7			
	P8			
	P9			
	P10			
	P11			
	P12			
	P13			
	P14			
	P15			
	P16			
	P17			
	P18			
	P19			
	P20			
	P21			
	P22			
	P23			

Profile 4		Fuel 2(°)	Air 1 (°)	Air 2 (°)
Close	P0			
Purge	P1			
Ignition	P2			
Low Fire	P3			
	P4			
	P5			
	P6			
	P7			
	P8			
	P9			
	P10			
	P11			
	P12			
	P13			
	P14			
	P15			
	P16			
	P17			
	P18			
	P19			
	P20			
	P21			
	P22			
	P23			





## ORDERING INFORMATION

### Main Components

Part Number	Description
NX3000	EC approved Controller (3 channel) for up to 3 independent servo-motors (2 fuel, 1 air). Selectable purge, PTFI and MTFI timings.
NX3100	UL, ULC approved Controller (3 channel) for up to 3 independent servo-motors (2 fuel, 1 air). Selectable purge, PTFI and MTFI timings.
NX4000	EC approved Controller (4 channel) for up to 4 independent servo-motors (2 fuel, 2 air). Selectable purge, PTFI and MTFI timings.
NX4100	UL approved Controller (4 channel) for up to 4 independent servo-motors (2 fuel, 2 air). Selectable purge, PTFI and MTFI timings.
NX1386-1	Closed wiring base, surface mounting, UL listed (links and fuse set for 120V).
NX1466-1	Open wiring base, cabinet mounting, UL recognized (links and fuse set for 120V).
NX1386-2	Closed wiring base, surface mounting, UL listed (links and fuse set for 230V).
NX1466-2	Open wiring base, cabinet mounting, UL recognized (links and fuse set for 230V).

### Display

Part Number	Description
NX550	Panel mount, 2 line by 20 character vacuum fluorescent display with eight multi-function key pad.
NX551	Hand held, 2 line by 20 character vacuum fluorescent display with eight multi-function key pad. (Commissioning tool).

### Sensors

Part Number	Description
NX1020-1	Gas Pressure Sensor: 0 - 8.5 PSI 0 - 600 millibar, 1/2" NPT
NX1020-2	Gas Pressure Sensor: 0 - 8.5 PSI, 0 - 600 millibar, 1/2" BSP
NX1025-1	Steam Pressure Sensor: 0 -58 PSI, 0 - 4 bar, 1/2" NPT.
NX1025-2	Steam Pressure Sensor: 0 -58 PSI, 0 - 4 bar, 1/2" BSP.
NX1030-1	Steam Pressure Sensor: 0 -375 PSI, 0 - 20 bar, 1/2" NPT.
NX1030-2	Steam Pressure Sensor: 0 -375 PSI, 0 - 20 bar, 1/2" BSP.
NX1040-1	Boiler Temperature Sensor: 32° - 662°F, 0° -150°C, 1/2" NPT.
NX1040-2	Boiler Temperature Sensor: 32° - 662°F, 0° - 150°C, 1/2" BSP.

### Servo-Motors

Part Number	Description
NX04-1	Servo-Motor, 3 ft. lbs, 120V.
NX04-2	Servo-Motor, 4Nm, 230V.
NX20-1	Servo-Motor, 15 ft. lbs, 120V.
NX20-2	Servo-Motor, 20Nm, 230V.
NX50-1	Servo-Motor, 37 ft. lbs, 120V.
NX50-2	Servo-Motor, 20Nm, 230V.
NX98-1	Servo-Motor, 72 ft. lbs, 120V.

## Expansion Interface

Part Number	Description
NX280HW	Expansion Interface Hardware: 4 AI, 4 AO, additional channel. Includes variable speed drive Interface and Trim and Analyzer Interface.
NX280PK	Zirconia exhaust O <sub>2</sub> probe kit.

## Software

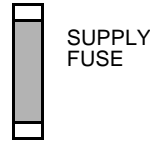
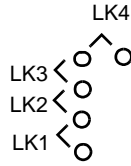
Part Number	Description
NXAM	Passcodes to enable ComFire software for communications with Nexus or PPC controllers in all operating modes. Note: Passcodes are based on the serial number of the Nexus or PPC5000 controller. Only one part number needs to be ordered per site.
NXAMS	Passcodes to enable ComFire software for communications with Nexus or PPC controllers in all operating modes and boiler lead/lag sequencing. Note: Passcodes are based on the serial number of the Nexus or PPC500 controller. Only one part number needs to be ordered per site.
NXSO	Passcodes to enable ComFire software for Nexus or PPC controllers for boiler lead/lag sequencing. Note: Passcodes are based on the serial number of the Nexus or PPC5000 controller. Only one part number needs to be ordered per site.

## Additional Options for O<sub>2</sub> Analyzers

Part Number	Description
NXA-CAB10	Interconnecting cable from O <sub>2</sub> probe to NX280HW, 33 feet (10m.)
NXA-CAB20	Interconnecting cable from O <sub>2</sub> probe to controller, 66 feet (20m.)
NXA-CAB30	Interconnecting cable from O <sub>2</sub> probe to controller, 99 feet (30m.)
NXA-PWS	Weather shield for O <sub>2</sub> probe.
NXA-PS500	Angled gas sampling tube (500mm) for NX280PK for flues 600mm to 2000mm.
NXA-PS1000	Angled gas sampling tube (1000mm) for NX280PK for flues 1200mm to 4000mm.
NXMBI	“MODBUS” RTU interface, standard DIN rail mount. Networks up to 15 Fireye Nexus Systems. 7-35 VDC supply required.
NXPBI	“PROFIBUS” interface, standard DIN rail mount. Networks up to 15 Fireye Nexus Systems. 7-35 VDC supply required.

## WIRING BASE LAYOUT -NX1466/1386

PA	
Servo-Motor Supply (L1)	PA1
Fuel 1 up	PA2
Fuel 1 down	PA3
Fuel 2 up	PA4
Fuel 2 down	PAS
Damper 1 up	PA6
Damper 1 down	PA7
Damper 2 up	PA8
Damper 2 down	PA9



PF	
PF1	I/P 1, 2, 3 common
PF2	I/P 1 + fault/mute
PF3	I/P 2 + gas
PF4	I/P 3 + oil
PF5	I/P 4, 5 flow common (Air pressure sw 2)
PF6	I/P 4 flow (Air pressure sw 2)
PF7	I/P 5 no flow (Air pressure sw 2)
PF8	Flow common (Air pressure sw 1)
PF9	Flow (Air pressure sw 1)
PF10	No flow (Air pressure sw 1)
PF11	I/P A-
PF12	I/P A +
PF13	I/P B-
PF14	I/P B +
PF15	I/P C -
PF16	I/PC+
PF17	I/P D-
PF18	I/P D +
PF19	I/P E -
PF20	I/P E +
PF21	IR scanner
PF22	IR scanner

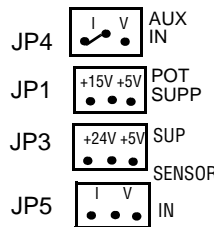
PB	
UV scanner	PB1
UV scanner	PB2
Unused	PB3
Neutral	PB4
Hot (L1)	PB5
Ignition	PB6
Burner select (on/off)	PB7
Pilot valve	PB8
Gas valve 1	PB9
Gas valve 2	PB10
Oil valve	PB11
Burner fan	PB12
Vent valve	PB13
Auxiliary relay	PB14



PC	
Alarm 1 N.0	PC1
Alarm 1 N.C	PC2
Alarm 1 common	PC3
Alarm 2 N.0	PC4
Alarm 2 N.C	PC5
Alarm 2 common	PC6

PE	
PE1	Fuel 1 pot supply +
PE2	Fuel 1 feedback in
PE3	Fuel 1 pot ground Ov
PE4	Fuel 2 pot supply +
PE5	Fuel 2 feedback in
PE6	Fuel 2 pot ground Ov
PE7	Damper 1 pot supply +
PE8	Damper 1 feedback in
PE9	Damper 1 pot ground Ov
PE10	Damper 2 pot supply +
PE11	Damper 2 feedback in
PE12	Damper 2 pot ground Ov
PE13	Aux. modulation input (supply) +24V
PE14	Aux. modulation input (in) I/P
PE15	Aux. modulation input (ground) Ov
PE16	Gas pressure sensor (supply)+
PE17	Gas pressure sensor (in)
PE18	Gas pressure sensor (ground) Ov
PE19	Gas pressure sensor (test)
PE20	Stm press/water temp. sensor (supply)
PE21	Stm press/water temp. sensor (in)
PE22	Stm press/water temp. sensor (ground)
PE23	Stm press/water temp. (test)

PD	
Display (+5v)	PD1
Display (key return)	PD2
Display (data)	PD3
Display (clock)	PD4
Display (serial)	PD5
Display (Ov)	PD6
RS485 (Ov)	PD7
RS485 A+	PD8
RS485 B-	PD9
RS485 ISOL GND	PD10
RS485 isol A+	PD11
RS485 iso B-	PD12









---

## NOTICE

When Fireeye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

---

## WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.



The content on or accessible through CombustionDepot.com, (including, but not limited to) text, graphics and other materials, are provided by CombustionDepot.com, for informational purposes only. CombustionDepot.com does not claim ownership to any of the photos, images, or pictures of products on the site. These depictions are solely for information purposes and may not be an exact replication of the related product available for sale. All PDF and specification pages are gathered from the OEM web sites or publicly available information. CombustionDepot.com does not claim responsibility for any of the information found on these bulletins, documents, literature, specification charts, etc. and such information is subject to change without notice.