Section 7: Appendix

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1. Option Parameters in detail

WARNING

- Be **extremely careful** when entering or changing option parameters. Incorrect data entry could cause a hazardous situation to occur.
- **Parameter Adjustment Security:** For reasons related to application safety, option parameters may not be adjustable under some circumstances. The security level for each option parameter is shown in the brackets **[ ]** next to each option title and classified as follows:

  Level 0 – Adjustment can be performed at any time using the site passcode.
  Level 1 – Adjustment can be made at any time but only after access using the Commission passcode.
  Level 2 – Adjustment may only be made when the burner is OFF and after access using the Commission passcode.

ALL PARAMETERS DEFAULT TO ZERO UNLESS OTHERWISE SPECIFIED.

Option 00.1 - Site passcode (0 - 999) [1]

This is a three-digit passcode that will allow the site engineer or end-user to go into the **Option Set mode**, where you can adjust a limited range of option parameters (those not marked with '*' in this section). This passcode can be zero, in which case you only need to press the **COM / ENTER** key twice to enter **Option Set mode** with limited access.

Option 00.2 - Serial communications controller address (0 - 15) [2]

If the controller is to be connected to other equipment via the serial communications interface, it must be given a unique address using this option parameter. Additionally, if more than one controller is connected on the CANbus (for example to share a display), the controllers must all have unique addresses BEFORE THEY ARE CONNECTED TO THE SAME CANBUS.

Option 00.3 - Reset hours run (0 - 1) [1]

This option parameter allows the HOURS RUN display for all fuels to be reset to zero. To perform a reset, set this option parameter to **1** and leave Option Set mode. When the burner begins to modulate, the HOURS RUN display will be reset and the option parameter automatically returns to **0**. Additionally, the counters of burner cycles and burner lockouts will be cleared (see Engineer's Key Data numbers 90 and 91).

Option 00.7 – Modbus device address (0 – 250) [2]

DEFAULT: 0
A value of zero in this option sets the RS485 protocol to ComFire2 at 9600 baud.

A value greater than zero in this option sets the protocol to Modbus RTU protocol and sets the device address for the controller.

Option 00.8 – Modbus Data Communications (0 – 15) [2]

DEFAULT: 0
This option sets the data speed and parity for Modbus RTU communications at terminals TB4-1 and TB4-2 as follows:

Option 00.8 value	Speed and Parity		Option 00.8 value	Speed and Parity
0	9600 None		8	9600 Even
1	4800 None		9	4800 Even
2	9600 None		10	9600 Even
3	19200 None		11	19200 Even
4	38400 None		12	38400 Even
5	57600 None		13	57600 Even
6	115200 None		14	115200 Even
7	Reserved		15	Reserved

Important

- When you have changed Option 00.7 or 00.8 you ***must*** power down the controller to commit and enable the changes.
  Do this before executing any digital communications functions.

Option 01.0 – Power Up Option (0 - 30) [2]

This option can be used to modify the behavior of the controller at power-up.

Option 01.0 value	Meaning
0	Normal power-up. If no faults and fuel / burner selected, the burner will start.
1	Lockout. The burner will always lock out after a power-up. An F75 will be generated which will require manual intervention to clear.
2 – 30	The controller will power-up as normal but wait for 2 to 30 seconds before checking the digital inputs for fault conditions. This may be useful to prevent nuisance lockouts at power-up due to water levels and plant interlocks. The controller will remain in safety shutdown (but not locked out) for this time.

Option 01.1 – Keyboard Auto/Manual enable (0 - 1) [1]

DEFAULT: 1
You can enable/disable the auto/man facility from the keyboard. Selecting a 0 will disable the operation of the ‘auto/man’ function from the keyboard. Selecting a 1 will enable the operation of the ‘auto/man’ function from the keyboard.

Option 01.2 – Fault Mute Input enable (0 - 6) [2]

The Fault Mute function is available via serial communications, and from the DISPLAY. It can also be selected to be from a digital input. Selecting a non-zero value will enable the operation of the ‘Fault Mute’ function from the corresponding digital input. Make sure that the digital input selected is not used for any other function (option parameters 1.x, 18.x and 20.x).

Note: any key/button that provides a Fault Mute function must be mounted near the burner.

Number entered in parameter 01.2	Fault mute from:
0	Keyboard / comms only.
1	Input 1, TB5-7 to TB5-11/12 Low Voltage
2	Input 2, TB5-8 to TB5-11/12 Low Voltage
3	Input 3, TB5-9 to TB5-11/12 Low Voltage
4	Input 4, TB5-10 to TB5-11/12 Low Voltage
5	Input 5, TB1-2 Line Voltage
6	Input 6, TB1-3 Line Voltage

Option 01.3 – External profile select enable (0 - 6) [2]

This option parameter specifies how the fuel profile is selected by the user. The profile selection is available via serial communications, and from the DISPLAY. It can also be selected to be from a digital input. Selecting a non-zero value will enable the function from the corresponding digital input. Make sure that the digital input selected is not used for any other function (option parameters 1.x, 18.x and 20.x).

If the input is open circuit, then the profile selection is profile 1, and if the input is a closed connection, then the profile selection is profile 2.

Number entered in parameter 01.3	Profile selected from:
0	Keyboard / comms only.
1	Input 1, TB5-7 to TB5-11/12 Low Voltage
2	Input 2, TB5-8 to TB5-11/12 Low Voltage
3	Input 3, TB5-9 to TB5-11/12 Low Voltage
4	Input 4, TB5-10 to TB5-11/12 Low Voltage
5	Input 5, TB1-2 Line Voltage
6	Input 6, TB1-3 Line Voltage

Option 01.4 – Main Valve Proof of Closure (POC) select (0 - 6) [2]

This option parameter is used to enable proof of closure switches to be monitored for the main fuel valves. When enabled, POC uses a digital input as specified by the number entered (1 – 6). If any digital input is used for this function, make sure the same input is not selected for any other function (option parameters 1.x, 18.x and 20.x).

Number entered in parameter 01.4	Digital Input used for POC function.
0	NONE.
1	Input 1, TB5-7 to TB5-11/12 Low Voltage
2	Input 2, TB5-8 to TB5-11/12 Low Voltage
3	Input 3, TB5-9 to TB5-11/12 Low Voltage
4	Input 4, TB5-10 to TB5-11/12 Low Voltage
5	Input 5, TB1-2 Line Voltage
6	Input 6, TB1-3 Line Voltage

Option 01.7 – Safety time configuration set (0 - 1) [2]

DEFAULT: 1

This parameter allows the selection of a set of values to be forced for the burner start-up safety times. Specifically, option parameters 7.4, 7.5, 7.6 and 14.6 will be forced.

If this option parameter is set to zero, the above option parameters become independently adjustable. The controller is shipped with set 1 selected.

Number entered in parameter 01.7	Option 7.4 (T4 Pilot ignition) forced to:	Option 7.5 (T5 Pilot hold) forced to:	Option 7.6 (T6 Main ignition) forced to:	Option 14.6 (spark termination) forced to:
0	Adjustable	Adjustable	Adjustable	Adjustable
1	10	5	10	1
2	10	5	10	2
3	5	5	10	0
4	2	8	2	1
5	5	8	5	1

Safety Time Configuration Table

Fireye EP and YP Series Programmer Equivalents	Air Proving Time (t1)	Pre-Purge Time (t2)	Pre-Ignition Time (t3)	Pilot Ignition Time (t4)	Pilot Hold Time (t5)	Main Ignition Time (t6)	Ignition Spark Output Check	Flame Failure Response Time (t9)
Option Parameter	Opt. 07.1	Opt. 07.2	Opt. 07.3	Opt. 07.4	Opt. 07.5	Opt. 07.6	Opt. 08.0	Opt. . 08.1
NX6300 Default	**30**	**30**	**0**	**10**	**5**	**10**	NA	**1**
EP113 Cfg1	8	36	4	2	8	2	NA	**1**
EP113 Cfg3	8	66	4	2	8	2	NA	**1**
EP160	**30**	**30**	**0**	**10**	**10**	**10/15**	NA	3
EP161	**30**	**30**	**0**	**10**	**5**	10/301	NA	3
EP163	NA	40	**0**	5	5	5	NA	3
EP165	NA	**30**	**0**	**10**	**10**	10	NA	2
EP166	NA	**30**	**0**	**10**	**5**	15	NA	2
EP170	NA	**30**		5	10	10	Required	3
YP100	NA	**30**	**0**	**10**	**5**	15	NA	4
YP102	NA	**30**	**0**	**10**	**5**	15	NA	2
YP138	NA	**30**	**0**	**10**	**5**	15	NA	4
YP113	NA	**30**	**0**	5	**5**	5	NA	1

Option 02.x – Drive Name [2]

Each Drive connected to the system must be assigned a name which will then be shown on the display. There are 4 drives (0 – 3), which can be connected, the names are set by option parameter 02.0 to 02.3.

The drives are displayed with the drive number first, then a three-character label, such as ‘1GAS’, ‘2AIR’, ‘3AIR’ Fireye.

The permitted drive names are:

Number entered in parameter 02.0 to 02.4	Drive Label	Considered as:	Trim if selected:	Meaning
0	N/A	Not used	N/A	This drive will not be used.
1	FUE	Fuel drive	YES	Generic fuel drive
2	GAS	Fuel drive	YES	A gas drive
3	OIL	Fuel drive	YES	An oil drive
4	CUP	Fuel drive	YES	Cup speed for rotary cup burners
5	FGR	Fuel drive	NO	Flue Gas Recirculation damper
6	PUM	Fuel drive	YES	VSD controlled oil pump. Can be used for oil warming – see option parameter 9.8
7	WAS	Fuel drive	YES	Waste fuel (combined fuel firing)
8	PRI	Fuel drive	YES	Primary (flame shaping) air or atomizing medium
9	FUE	Fuel drive	NO	Generic fuel, but not trimmed.
10	AIR	Air drive	YES	Main combustion air damper
11	FAN	Air drive	YES	Main combustion air fan
12	SEC	Air drive	YES	Secondary air (same as 10 apart from name)
13	AIR	Air drive	NO	Generic Air, but not trimmed.
14	SLE	Air drive	YES	Burner Sleeve

Primary air is considered a fuel drive since it is used for flame shaping and should normally track the fuel valve. Two drives may be assigned the same name.

The number entered also tells the controller information about the drive. If the number entered here is less than 10, then the drive controlled as a fuel. If the number is 10 or more, then it is controlled as an air drive. This is important when oxygen trim is enabled because it determines the trim direction. Selection of fuel trim or air trim is made with option parameters 31.1 to 31.4.

Option 03.x – Drive Serial Number [2]

Each servomotor connected to controller has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to identify each drive uniquely.

When the system is in Commission mode, the serial number of all the connected drives is read by the controller and displayed as a 'list' to allow the selection of the relevant servomotor for each drive (0 – 4) to be made.

Scrolling the list in an upward direction will scroll through all drive options available until '0, No Drive' is displayed. Enter this value to disconnect the specified drive from any hardware.

Scrolling the list in a downward direction will stop when the currently selected item is displayed, and the value will stop flashing.

The display will show type information for each drive present (such as the torque rating of a servo). Before setting these parameters, the commissioning engineer should be aware of each servo type and serial number that is connected to the burner.

If a variable speed drive (VSD) is configured into the system, then the options for the feedback type are shown in the drive list as:

Displayed Option	Meaning
-a,VSD1:mA	VSD channel 1 is used with a 4-20mA feedback
-b,VSD1:Hz	VSD channel 1 is used with an encoder pulse (frequency) feedback

If a drive serial number is changed, then any profiles using that drive number will require re-validating.
A 'profile invalid' fault (see FAULT 64) will lock the burner out if you try to fire a profile that has had a previously commissioned drive removed.
The profile can be re-validated by using the NEXT / ENTER keys in Commission Ratio mode to verify the combustion at all points on the curve.

See Section 3 Commissioning. Also see option 45.2

Option 04.x – Drive Usage Information [2]

The system will allow two fuel / air profiles to be entered. Each drive (servo or VSD) can be selected to operate for any, all, or none of these profiles.

Number entered in parameter 4.X	Drive X used for profile(s)
0	NONE
1	1
2	2
3	2+1

Example of use:

Option parameter 4.2 = 1 means that drive 2 is used for profile 1 only.
Option parameter 4.0 = 3 means that drive 0 is used for both profiles.

If these parameters are changed after the burner has been commissioned, then any profiles affected will need to be re-validated. A 'profile invalid' fault (see FAULT 64) will 'Lock out' the controller on an attempt to fire a profile that has had a previously commissioned drive removed.

If a drive has been added or removed from a profile, then it is recommended that the specified profile is erased (using option parameter 45.X) before an attempt is made to re-commission the profile.

Option 05.x – Drive Options [2]

This parameter is used to specify direction for each servo drive. This parameter has no effect for variable speed drives (VSD). If this parameter is changed after a profile has been commissioned, then the effected profile(s) must be re-commissioned by a suitably qualified person. A 'profile invalid' fault (see FAULT 64) will lock the burner out until this is completed.

Number entered in parameter 5.X	Drive Options
0	Drive moves anti-clockwise
1	Drive moves clockwise.

Option 06.0 – Fuel Options [2]

Option parameter 6.0 defines whether the burner is Gas or Oil firing.

Number entered in parameter 6.0	Fuel type
0	NONE
1	GAS burner
2	Oil burner

Option 07.0 – Fan ON Early, time (0 to 120 seconds) [2]

DEFAULT: 0
During the burner start-up, it is possible to start the fan before starting to open the main damper. This reduces the load on the F.D. fan motor. The value entered will be the time in seconds from powering the 'FAN' relay output to starting to move the selected 'drives' to their relevant pre-purge positions. If zero is entered, the FAN relay will be energized at the same time as the drives start to open.

Option 07.1 – Air Proving Time (t1) (5 to 120 seconds) [2]

DEFAULT: 15
Here, "proving" is confirming that an air pressure switch has changed state, indicating that there is air pressure in the burner.
You can set the time for air pressure to be 'proved' by the air pressure switch, using this option parameter. It is the time interval allowed for the air pressure switch to change state starting from when the FAN output is energized.
If the air pressure switch doesn't register air pressure after this time, the burner will perform a safety shutdown.
If the air pressure is proved during this time, and the drives have moved successfully to their pre-purge (P1) positions, then the pre-purge time will start.

Air pressure must be present when the air proving time t1 has elapsed until the end of any selected post-purge. All selected 'drives' must be in their correct positions, or a safety shutdown will occur. See section 1, "Description of Operation", for the status diagram.

Option 07.2 – Pre-Purge Time (t2) (5 to 300 seconds) [2]

DEFAULT: 30
The pre-purge time is set using this option parameter. This is the time in seconds that the burner will remain at the pre-purge position, air pressure must be present throughout the pre-purge time, or a safety shutdown will occur, the value entered should allow sufficient time for any un-burnt 'fuel' to be cleared from the boiler. **If in any doubt about the time being used, please consult with the burner or boiler supplier, as incorrect setting could result in a hazardous condition.**
The pre-purge time will not start until the air pressure switch has 'proved' and the selected drives have reached their relevant pre-purge positions.

Option 07.3 – Pre-Ignition Time (t3) (0 to 10 seconds) [2]

DEFAULT: 3
The pre-ignition time can be set using this option parameter. **If in any doubt about the time being used, please consult with the burner or boiler supplier, because incorrect setting could result in a hazardous condition**.

t3 is the time in seconds that the ignition transformer will be 'ON' with the selected 'drives' at their relevant ignition positions before the pilot valve(s) are opened.

The pre-ignition time will not start until the pre-purge time has elapsed, the selected drives have reached their relevant ignition positions and the valve leak test has completed (if selected).

A flame **must not** be detected during the pre-ignition time **t3**, otherwise a controller lockout will occur. If there is a risk that the flame scanner will detect a flame during this period, then set option 08.0 = 1 to allow monitoring of the ignition relay output terminals - an additional wire is also required, see section 2, "How to Install and Wire the System", which will signal to ignore a flame detected during this pre-ignition time.

Option 07.4 Pilot Ignition Time (t4) (1 to 10 seconds) [2]

DEFAULT: 5 and may only be changed if option 01.7=0.

The Pilot Ignition Time is set using this option parameter, the time should be set to allow sufficient time for the Pilot flame to stabilize before the flame must be detected. **If in any doubt about the time being used, please consult with the burner or boiler supplier, as incorrect setting could result in a hazardous condition**.

This is the time, in seconds, that the Pilot Valve will be open with the ignition transformer 'ON', with the selected drives at their relevant ignition positions before a flame is required to be detected. Depending on the setting of other option parameters, the 'Pilot' or 'Pilot and First Main Gas Valve' or the 'Pilot and Main Oil Valve' may be open during this time. The Pilot Ignition Time will not start until the pre-ignition time has elapsed.
The controller does not monitor if a flame is present during the pilot ignition time **t4**.

Also see option 10.9.

Option 07.5 – Pilot Hold Time (t5) (1 to 30 seconds) [2]

DEFAULT: 8, and *may only be changed if option 01.7=0*

You can set the Pilot Hold Time using this option parameter. Set the time to allow sufficient time for the pilot flame to stabilize. This is the time in seconds that the Pilot Valve will be open with the selected 'drives' at their relevant ignition positions and a flame detected before the main valve is opened. The ignition transformer output may be ON or OFF, depending on option parameter 14.6.

The Pilot Hold Time will not start until the pilot ignition time has elapsed and a flame must be detected throughout the interval. Dependent on the setting of other option parameters, the 'Pilot' or 'Pilot and First Main Gas Valve' or the 'Pilot and Main Oil Valve' may be open during this time.

Early spark termination will cause the ignition transformer to be OFF during the pilot hold time **t5**.

Option 07.6 – Main Ignition Time (t6) (1 to 10 seconds) [2]

DEFAULT: 5 and may only be changed if option 01.7=0.

The Main Ignition Time is be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize before removing the pilot flame. **If in any doubt about the time being used, please consult with the equipment supplier**.

The Main Ignition Time is the time in seconds that the pilot valve and the main fuel valve(s) are open together, with the selected 'drives' at their relevant ignition positions and a flame detected. The Main Ignition Time will not start until the pilot hold time has elapsed. At the end of the Main Ignition Time, the pilot valve will be de-energized, unless permanent pilot has been selected,

Extended Oil Pilot time (see option parameter 14.8) will cause an extension of the Main Ignition Time.

Late or returning spark termination will cause the ignition transformer to be ON during the main ignition time **t6**. See option parameter 14.6.

Option 07.7 – Ignition Hold Time t7 (1 to 30 seconds) [2]

DEFAULT: 1

The ignition position hold time can be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize after removing the Pilot flame and before allowing the burner to modulate, **if in any doubt about the time being used, please consult with the burner or boiler supplier**.

This is the time in seconds that the burner will remain at the ignition position, with only the Main Fuel Valve(s) open (unless permanent pilot has been selected) with the selected drives at their relevant ignition positions and a flame detected. At the end of the ignition hold time, the burner will move to Low Fire. The ignition hold time will not start until the main ignition time has elapsed. A flame must be detected, or a safety shutdown will occur.

Option 07.8 – Low Fire Hold Time t8 (0 to 999 seconds) [2]

DEFAULT: 0
The Low Fire Hold Time can be set using this option parameter, the time should be set to allow sufficient time for the main flame to stabilize after moving away from the ignition positions before allowing the burner to modulate as required, **if in any doubt about the time being used please consult with the equipment supplier**.

The Low Fire Hold Time is the time in seconds that the burner will remain at the Low Fire position after a start-up before modulating as required with the selected 'drives' at their relevant Low Fire positions and a flame detected. At the end of the Low Fire hold time the burner will modulate as required. The Low Fire hold time will not start until the ignition hold time has elapsed. A flame must be detected, or a safety shutdown will occur.

Option 07.9 – Post Purge Time (t9) (-999 to 999 seconds) [2]

DEFAULT: 0
The Post Purge Time can be set using this option parameter if a post purge is required by the application. The time should be set to allow sufficient time for any un-burnt fuel to be removed from the boiler or sufficient cooling to occur (as required). All selected drives will move to their relevant post-purge positions before the post purge time starts, **if in any doubt about the time being used, please consult with the equipment supplier**.

The Post Purge Time is the time in seconds that the selected 'drives' will remain at their relative post-purge positions following a burner shut-down or lock-out (product dependent). The presence of a flame is not checked in post purge. After the post purge time is complete the burner will move all drives to their relative closed positions ready for another start-up, unless the post-purge followed a 'Lockout', in which case the controller will remain in 'Lockout' with the drives at the positions at the time of 'Lockout'.

Option 08.0 – Ignition Spark Output Check (0 - 1) [2]

CAUTION

- If the **Ignition Spark Output Check** function is selected (because the spark can be seen as a flame), we recommend you use early or returning spark termination (option parameter 14.6). Early spark termination will allow the pilot flame to be validated.
- Make sure that the setting of this option does not allow an unsafe condition to occur and is acceptable for the application being controlled.

If the ignition spark is visible as a flame, then it is necessary to ensure that the controller monitors the ignition transformer output. Digital input 6 is pre-defined for this function. If this check is not made and the ignition spark is seen as a flame, a hazardous condition could occur.

Set this option parameter to a value of '1' to enable the check and wire a connection between the ignition output terminal TB3-2 and TB1-3 (input 6). Make sure that input 6 is not selected for any other function in options 01.x, and 18.x and 20.x.

Number entered in parameter 08.0	Ignition Output Monitored	Digital inputs used
0	no	NONE
1	yes	Input 5, TB1-2

Option 08.1 – Flame Failure Response Time (0 – 3) [2]

DEFAULT: 0
The Photocell FFRT can be set between 0 and 3 seconds as permitted by local burner codes. The value entered will be the time in seconds after the loss of flame (when a flame should be present) for a 'Lockout' to occur (all safety valves closed Fireye). This option setting is only valid when option 12.0=1.

You can connect an external flame amplifier to the photocell input if required. The flame amplifier must have a volt-free relay output when connected to photocell input. For this configuration, this option parameter must be set to zero, which will result in a flame failure response time of approximately 250ms. This ensures that an excessive safety time is not applied.

Option 08.2 – False Flame Response Time [2]

The False Flame Response Time should be set to the shortest time possible to minimize the risk of a hazard, but, in any case, within the maximum time allowable for the particular application being controlled. The value entered will be 0 or 1, corresponding to 3 or 30 seconds after the detection of a flame (when a flame should not be present) for a 'Lockout' to occur (all fuel valves closed Fireye).

Number entered in parameter 08.2	False flame lockout time (seconds)
0	3 seconds
1	30 seconds

WARNING

- If in any doubt about the time being used in options 08.1 and 08.2, please consult with the burner or boiler supplier, as an excessive time will increase the possibility of a hazardous condition.
- Make sure the time set is acceptable for the application to which the product is being applied.

Option 08.3 – Recycling on Pilot flame failure (0 – 2) [2]

Set this option to allow a re-cycle of the burner start sequence and re-try of pilot ignition if the pilot flame does not ignite during status 11 and 12.
The number entered is the number of re-tries (maximum of 2), before a flame failure will 'Lockout' the burner.

CAUTION

- Make sure that the setting of this option does not allow an unsafe condition to occur and is acceptable for the application being controlled.

Option 09.0 - Inverter control accuracy (0 / 1) [2]

This parameter is fixed at 0.

Option 09.1 - Inverter error tolerance (0 / 1) [2]

This parameter is fixed at 1.

Option 09.2 - Inverter closed loop gain (10 – 125%) [2]

DEFAULT: 50
This option parameter affects all inverters connected to the controller. For normal operation, a value of 50%. If the inverter control is slow or unstable, then tune this value to improve the control accuracy. Reducing the value has the effect of damping the inverter's speed change as it approaches its set point.

Option 09.4 - Inverter acceleration time (1 – 100 seconds) [2]

DEFAULT 30
The value entered for this parameter must be set to the time in seconds that the inverter takes to move from zero to maximum speed.

The inverter should also be able to move from maximum to zero speed in the same time. If this is not the case, adjust the time settings in the inverter to ensure the times to accelerate and decelerate are the same.

If this option parameter does not match the true inverter acceleration / deceleration times, drive positioning will be compromised, and position faults will be likely.

Note: The manufacturer of the NX6300 recommend a maximum time of 60 s. However, this parameter can be set to values higher than 60 (up to 100), but this should only be considered as a last resort.

Note: If a very slow inverter is used, take extra care during commissioning to make sure that the UP / DOWN keys are not pressed for more than a few seconds at a time. This is essential, to ensure that the controller does not get out of step with the inverter and cause a position fault during the commission process. This controller is not designed to work with inverters that take more than 60 seconds to drive from zero to maximum speed.

Option 09.5 – Motor Speed Encoder Scaler (255 – 999 recommended) [2]

When using encoder feedback for motor speed, program this option to make sure that the feedback signal gives between 950 and 995 when the motor is at maximum speed (drive signal at 20 mA). The value for the parameter can be calculated using the following formula:

$$\frac{\text{(Motor Max RPM x No of teeth on encoder)}}{60} = \text{Scaler}$$

The value may need adjustment after the device has been tested. Specifically, it must be ensured that the feedback received never exceeds this value. In practice, this may mean adding 2% to 5% to this value. See section 4 for more details.

Option 10.0 - Gas pressure sensor select (0 - 4) [2]

If an gas pressure sensor is connected to the system, its type and units must be entered here.

Option parameter 10.0 value	Meaning
0	Gas pressure input not used.
1	NX6043 gas pressure sensor fitted (low pressure range, **mbar**). The span of the gas pressure sensor is 600**mbar**. **Note: The test volume and leakage rates will be entered in liters and liters per hour.**
2	NX6044 gas pressure sensor fitted (high pressure range, **bar**). The span of the gas pressure sensor is 4**bar**. **Note: The test volume and leakage rates will be entered in liters and liters per hour.**
3	NX6043 gas pressure sensor fitted (low pressure range, **inches of water column**). The span of the gas pressure sensor is 241**inches of water**. **Note: The test volume and leakage rates will be entered in cubic inches and cubic inches per hour.**
4	NX6044 gas pressure sensor fitted (high pressure range, **PSI**). The span of the gas pressure sensor is 58**PSI**. **Note: The test volume and leakage rates will be entered in cubic inches and cubic inches per hour.**

The controller monitors the gas pressure (including the gas pressure limits) and performs gas valve leak testing (VPS) during start-up if parameter 10.8 is non-zero.

Option 10.1 – CAN Gas pressure sensor serial number [2]

DEFAULT: 0
If Option 10.0 is greater than 0 then a CANBus gas pressure sensor is used for the VPS and operating limits. Select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 10.x set the span and VPS test characteristics.

Option 10.2 - Gas pressure nominal (mbar, bar, inches of water, PSI) [2]

This is the nominal, governed line pressure of the gas supply delivered to the burner. The units and number of decimal places depend on option parameter 10.0.

Option 10.3 – Low Gas pressure limit (mbar, bar, inches of water, PSI) [2]

Set this option to the Low-pressure limit, at which the burner must set off. The units and number of decimal places depend on option parameter 10.0.

Option 10.2 – High Gas pressure limit (mbar, bar, inches of water, PSI) [2]

Set this option to the High-pressure limit, at which the burner must set the off. The units and number of decimal places depend on option parameter 10.0.

Option 10.5 - Test volume (0.1 - 99.9 liters or cubic inches) [2]

This must be set to the volume of the test pipe section between the two safety valves, including the volume in each valve on the test section side. The units and number of decimal places depend on the value set in option parameter 10.0.

Option 10.6 - Maximum permissible leakage rate (0.1 - 99.9 liters or cubic inch/hr) [2]

This is the maximum permissible leakage rate allowed during the valve leak test. This value must be set according to the installation and local regulations. The units and number of decimal places depend on the value set in option parameter 10.0.

Option 10.8 – Valve leak test selection (0 - 360) [2]

Option parameter 10.8 value	Meaning
0	No valve leak test is performed.
1	When firing on Gas, the gas valve prove (leak) test will be performed each time the burner starts up, mostly during pre-purge.
2 to 360	If the burner control system includes the NX6043 CANBus gas pressure sensor, then the gas valve prove (leak) test will be performed after the burner is turned OFF. In this instance no pre-purge or valve leak test (at restart) will be performed if the burner restarts within the time entered in this parameter (in minutes). If the burner does not restart within the time limit, normal valve leak test and pre-purge will happen on the next start-up.

Option 10.9 – VPS valve energize time (0 – 6 seconds) [2]

During the valve leakage tests for the valve prove (leak) test system (VPS), Gas Valve output 1 or Gas Valve output 2 is energized for just under three seconds, depending upon the phase of the test. It is an approvals and safety requirement that the valve never opens (lets gas pass) for more than three seconds, during this test.

Some gas valves require power for a few seconds to open enough to allow gas to pass through – this is often the case for hydraulically actuated valves. When three seconds of energizing is not enough time to allow gas to flow, then this parameter can be set to increase the valve energize time for up to six seconds.
This parameter must be set to the minimum value that allows the VPS system to function correctly. In addition, for this function to operate correctly, option 7.4 must be set equal to, or greater than, the value set for this option.

WARNING

- **This option parameter must only be adjusted above three seconds if a valve energize time of three seconds is not sufficient to allow the valve to open and allow gas to pass.**
- **Under no circumstances must it be used to allow gas through a valve for more than three seconds.**

Option parameter 10.9 value	Meaning
0, 1, 2 or 3	The gas valves will be energized for just under 3 seconds.
4	The gas valves will be energized for just under 4 seconds.
5	The gas valves will be energized for just under 5 seconds.
6	The gas valves will be energized for just under 6 seconds.

Option 12.0 – Flame1 detection device (0 – 2) [2]

This option parameter sets the flame sensor device for Flame1.

Option parameter 12.0 value	Meaning
0	Flame detection is by way of Line voltage input to terminal TB1-2. This mode is **not permitted for continuous operation** (>24 hours) depending on the appliance standards.
1	Flame detection is by conductive Photocell or volt-free flame switch connected to terminals TB4-11 and TB4-12. The UV Photocell is typically a photo resistive device where the flame signal level is determined by the amount of light falling on the sensor. This mode is **not permitted for continuous operation** (>24 hours) depending on the appliance standards. Use this setting for the NXUV24UL flame detector. Use TB4-4, TB4-7 and TB4-11 for the UV sensor.
2	Flame detection is by conductive Photocell where flame flicker is present in the monitoring signal. This setting is typically used for an infrared (IR) flame scanner. The flame signal level is determined by the amount of 'flicker' detected by the sensor. This type of flame monitoring is suitable for continuous operation (>24 hours) when a suitable flame-sensing device is used.

Note: Flame monitoring may be performed simultaneously on both the Flame1 and Flame2 channels. In this configuration, the controller **must not** see a flame on either device when the flame should be OFF. When the flame should be ON, a flame **must** be seen on BOTH devices.
Alternatively, when both flame channels are set active, you can set a pilot or main flame threshold of zero for either, to set that device to ignore the flame. In this instance a flame must be detected by the other device.

Option 12.1 – Pilot Flame Threshold Photocell or I.R. (1 -100%) [1]

DEFAULT: 20
If option parameter 12.0 has been set to select a photocell or I.R. flame sensor, this option parameter must be set to a value for the flame threshold to validate the pilot flame. After a value is set, the flame signal detected during pilot ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.

Option 12.2 – Main Flame Threshold Photocell or I.R.(0 – 100%) [1]

DEFAULT: 20
In a similar manner to option 12.1 when option parameter 12.0 has been set to select a photocell or I.R. flame sensor this option parameter must be set to a value for the flame threshold to validate the main flame. After a value is set, the flame signal detected during main ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set, please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 12.4 – Flame1 CAN detector serial number. [2]

DEFAULT: 0
Where a CANBus flame detector is used for Flame1 select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x.
Note: Setting a value in 12.4 will automatically set 12.0 to a value of 5.

Option 13.0 – Flame2 detection type (0 - 2) [2]

This option parameter sets the selection of the Flame 2 sensor device type.

Option parameter 13.0 value	Meaning
0	Flame 2 unused.
1	Flame detection is by way of Line voltage input to terminal TB1-2. This mode is **not permitted for continuous operation** (>24 hours) depending on the appliance standards.
5	Auto set value if CANBus device selected in Opt.13.4.

Note: Flame monitoring may be performed simultaneously on both the Flame1 and Flame2 channels. In this configuration, the controller **must not** see a flame on either device when the flame should be OFF. When the flame should be ON, a flame **must** be seen on BOTH devices.
Alternatively, when both flame channels are set active, you can set a pilot or main flame threshold of zero for either, to set that device to ignore the flame, provided a flame is seen on the other device.

Option 13.1 – Pilot Flame Threshold U.V. or Shuttered U.V. (0 – 100%) [2]

DEFAULT: 20
If option parameter 13.0 has been set to select a U.V. or shuttered U.V. flame sensor, this option parameter must be set to a value for the flame threshold to validate the pilot flame. After a value is set, the flame signal detected during pilot ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set, please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 13.2 – Main Flame Threshold U.V. or Shuttered U.V. (0 – 100%) [2]

DEFAULT: 20
If option parameter 13.0 has been set to select a U.V. or shuttered U.V. flame sensor this option parameter must be set to a value for the flame threshold to validate the main flame. After a value is set, the flame signal detected during main ignition should be monitored and the level adjusted, if necessary, to ensure safe and reliable operation.
If in any doubt about the flame threshold being set, please consult with the burner supplier, as a very low threshold may increase the possibility of a hazardous condition.

Option 13.4 – Flame2 CAN detector serial number. [2]

DEFAULT: 0
Where a CANBus flame detector is used for Flame2, select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x.
Note: Setting a value in 13.4 will automatically set 13.0 to a value of 5.

Option 14.0 – Primary Fault Relay (0 - 4) [2]

This option parameter assigns the primary faults to a specific relay. Relays 2 & 3 may share a common connection.

Option parameter 14.0 value	Meaning	Connection Details
0	Primary faults not assigned to any relay.	N/A
1	Primary faults assigned to relay 1	**Display**, Low voltage, or line voltage.
2	Primary faults assigned to relay 2	**Display**, Low voltage, or line voltage.
3	Primary faults assigned to relay 3	**Display**, Low voltage, or line voltage.
4	Primary faults assigned to relay 4	**Main Controller**, line voltage output TB3-5.

These relays MUST NOT be used to provide a safety function.

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2, which means that one relay could be used for all faults. When used for an alarm function, relays 1, 2 and 3 will de-energize when in the fault condition, so you need to wire an alarm bell in series with the normally closed contacts.

Option 14.1 – Limit Relay (0 - 4) [2]

This option parameter assigns the limits to a specific relay. Relays 2 & 3 may share a common connection.

Option parameter 14.1 value	Meaning	Connection Details
0	Limits not assigned to any relay.	N/A
1	Limits assigned to relay 1	**Display**, Low voltage, or line voltage.
2	Limits assigned to relay 2	**Display**, Low voltage, or line voltage.
3	Limits assigned to relay 3	**Display**, Low voltage, or line voltage.
4	Limits assigned to relay 4	**Main Controller**, line voltage output TB3-5.

These relays MUST NOT be used to provide a safety function.

Option 14.2 – Oxygen and Flue Temperature Limit Relay (0 - 4) [2]

This option parameter assigns the limits to a specific relay. Relays 2 & 3 may share a common connection.

Option parameter 14.2 value	Meaning	Connection Details
0	Flue Limits not assigned to any relay.	N/A
1	Flue Limits assigned to relay 1	**Display**, Low voltage, or line voltage.
2	Flue Limits assigned to relay 2	**Display**, Low voltage, or line voltage.
3	Flue Limits assigned to relay 3	**Display**, Low voltage, or line voltage.
4	Flue Limits assigned to relay 4	**Main Controller**, line voltage output TB3-5.

These relays MUST NOT be used to provide a safety function.

Option 14.3 – Permanent gas pilot select (0 - 1) [2]

Set this option to select a permanent pilot operation when the burner is firing on gas. When firing on oil this option parameter is ignored,

Option parameter 14.3 value	Meaning
0	Non-permanent pilot
1	Permanent pilot operation, when firing on gas.

Option 14.4 – Ignition for Gas profiles (0 – 2) [2]

This option parameter sets the selection of pilot operation with or without the main gas valves when the burner is firing on gas. When firing on oil, this option parameter is not valid.

Option parameter 14.4 value	Meaning
0	Energize pilot valve without main gas valve 1. Pilot operates without main gas valve, when firing on gas
1	Energize main gas valve 1 on when pilot comes on. Pilot operates with main gas valve, when firing on gas.
2	Energize main gas valve 1 and 2 on when pilot comes on. *Use this setting for Direct ignition without pilot.*

Direct ignition on Gas burners.

The use of a direct ignition on gas burners is restricted by the burner application standards, for example EN746. Typically, the restriction refers to the burner size and a maximum ignition flame heat rate, as a percentage of Maximum burner output.
It is the responsibility of the equipment supplier to state these constraints, and of the commissioning person to implement the function within the stated constraints.

Option 14.5 – Ignition for Oil profiles (0 - 1) [2]

This option parameter sets the selection of direct ignition when firing Oil. This allows the main oil valve(s) to open at the same time as the pilot valve opens. When firing on gas, this parameter is not valid.

Option parameter 14.5 value	Meaning
0	Ignition on pilot only.
1	Energize on pilot and main oil valves together. **Direct ignition**.

Option 14.6 – Spark Termination (0-3) [2]

DEFAULT = 1 and can only be changed if option 01.7=0.

CAUTION

- This parameter affects all profiles.
- If the late spark termination function is selected, it is **not** recommended to use a flame scanner that detects the ignition spark as a flame (option 08.0).
- Make sure setting of this option does not allow an unsafe condition to occur.

This option parameter allows the operation of the ignition transformer to be changed from the default behavior.

Normally, the ignition transformer will switch OFF at the same time the main fuel valve(s) open. If required, the ignition spark can be terminated early, so it is OFF during the pilot hold time **t5**, OR, to hold it on right through the main ignition time **t6**.

Option parameter 14.6 value	Meaning
0	Early spark termination. The spark turns OFF at the end of **t4**, leaving the pilot to stabilize without a spark present.
1	Normal spark termination. Spark turns OFF at the end of **t5** when the main valve opens.
2	Late spark termination. The spark stays ON through main ignition, turning OFF at the end of **t6**.
3	Returning Spark. The spark turns OFF at the end of **t4**, as for selection 0, but it comes back ON when the main valve opens, for **t6**.

Option 14.7 – Aux Relay Function. (0 - 8) [2]

Setting this parameter as shown in the table below configures the function of output TB3-4.

Option parameter 14.7 value	Meaning
0	The oil pump relay is not used for one of the functions listed below.
1	This is an auxiliary relay output used to control the oil pump for oil profiles. This output is valid for burner status between 10 and 16.
2	This is an auxiliary relay output used to control a steam atomizing valve for oil profiles. This output is valid for burner status between 6 and 16.
3	This is an auxiliary relay output used to control a steam purge valve for oil profiles. This output is valid for burner status 17 or 18. See option 16.7 also.
4	This is an auxiliary relay used to switch power to a cup motor, an oil pump or primary air motor, which comes ON at status 6 and remains ON during a post purge when firing oil only.
5	Flame ON – The relay comes ON when a flame is detected.
6	Gas Booster – On when firing GAS between burner status 5 and 16.
7	Vent Valve output – energized to open the valve.
8	Vent Valve output – energized to close the valve.

Option 15.0 - Modulation sensor input type (0 - 4) [2]

You can configure the modulation sensor input in several modes as detailed below.

Option parameter 15.0 value	Meaning
0	4 - 20 mA Tracking operation - The burner modulation will track the current applied to **TB4-9**, going to High Fire for 20 mA and Low Fire for 4 mA. If the current measured is out of range, then the burner will go to Low Fire. There is no 'measured value', just a tracking set point. Option parameters 15.1 to 15.5 are unavailable.
1	PT1000 type connected between terminals **TB4-9 and TB4-10**. Option parameters 15.1 to 15.5 are applicable for this mode and the internal PID will be available in option 21.x and 22.x.
2	4 - 20 mA Sensor operation. This configures the **TB4-9** input for a 4-20 mA measured value input device such as a pressure or temperature sensor. Option parameters 15.1 to 15.5 are applicable for this mode and the internal PID will be available in option 21.x and 22.x.
3	CAN temperature sensor. This value will automatically set if the serial number of a CAN device has been programmed.
4	CAN Pressure sensor. This value will automatically set if the serial number of a CAN device has been programmed.

Note:
For option 15.0 values of zero or two and where FGR Hold-off by temperature measurement is required (set by Opt. 44.4), then the PT1000 input terminals TB4-9 and TB4-10 are allocated to this measurement. In this case the NX6300 will look to TB4-8 to determine the modulation rate from a 4-20mA signal.

Where VFD speed feedback is a 4-20mA signal then the use of TB4-8 is not available as an alternative input for the modulation measurement. In this configuration you should consider using a CAN sensor for modulation measurement or hold-off FGR by timer only.

Option 15.1 – Modulation input decimal places (0 to 2) [2]

This parameter specifies the number of decimal places to which the measured value and set point are displayed. It also affects the scaling of the zero and span – so it is vital that this parameter is set before parameters 15.2 and 15.3.

Option parameter 15.1 value	Meaning
0	Measure value and set point displayed with no decimal places. Range of values is from 000 to 999.
1	Measure value and set point displayed with one decimal place. Range of values is from 00.0 to 99.9.
2	Measure value and set point displayed with two decimal places. Range of values is from 0.00 to 9.99.

Option 15.2 – Modulation input zero value (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) [2]

This value will normally be left at zero. It is the measured value to be displayed when the sensor connected is at its minimum value. For CANBus fail-safe sensors, this value must be left at zero.

If a 4-20 mA sensor is used, this parameter must be set to the 4mA value (usually zero).

Option 15.3 – Modulation input span value (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) [2]

This value is the measured value to be displayed when the sensor connected is at its maximum value. For CANBus fail-safe sensors, this value must be set to the specified range of the sensor.

If a 4-20 mA sensor is used, this parameter must be set to the 20mA value.

Option 15.4 – Set point display units (0 – 5) [2]

This option selects the displayed units for measured value and set point, detailed in option(s) 21.x.

Option parameter 15.4 value	Meaning
0	Show measured value as **PSI**.
1	Show measured value as **bar**.
2	Show measured value as **°F**.
3	Show measured value as **°C**.
4	Show measured value as **%**.
5	Show measured value as blank – i.e. no units.

Option 15.5 - Boiler high safety limit (0 - 9999 / 0.0 - 99.99 / 0.00 – 9.999) [2]

When an CANBus fail- safe boiler sensor model is used in the burner configuration, the controller can monitor the boiler high safety limit and perform a shutdown and lockout if the limit is exceeded. ***If a high safety limit is not required and a fail-safe sensor is still to be used, set this option parameter to 999.***

If a 4-20 mA sensor is used, you can configure this parameter to give a lockout when a high limit is reached. In this case, enter a value other than zero. ***Note: When a 4-20 mA sensor is used, external limits must be in place to protect the boiler in case of sensor failure.***

Option 15.6 – Modulation Time (0 – 120 seconds) [1]

This parameter sets the minimum time for the burner to modulate from low to High Fire and in reverse. Note - The modulation speed in AUTO mode is set. The burner may modulate slower than this setting if the drive speeds dictate this at any point in the range.

Option 15.7 – CAN Boiler sensor serial number [2]

DEFAULT: 0
When a CANBus sensor is used to measure the boiler or process measured value select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 15.x set the span and limits for the burner operation.

Option 15.8 – Low before Off (0 or 1) [1]

When set to 1, this parameter will change the way a normal controlled shutdown works.

Option parameter 15.7 value	Meaning
0	The burner will turn OFF immediately when it is expected / required to.
1	The burner will modulate down for up to 30 seconds (or until Low Fire is reached) and then turn OFF.

Note: This function works for shutdowns caused by control limits set by Opt. 21.5 and 22.5, and for shutdowns caused by option parameter 20.1 (aux shutdown) only. Lockouts / shutdowns caused by the alarm inputs in parameters 18.X will always work immediately.

Option 16.7 – Gun Blowout time (0 - 30 s) [1]

This option defines the length of time that the TB3-4 terminal is ON when Option 14.7 = 3 - Steam purge valve for Oil gun.

Option 16.9 – Second oil stage point (0 - 23) [2]

DEFAULT:0
This option parameter sets the profile set-point (P3 to P23) at which the MV2 output (TB2-5) will energize when the controller is configured for an Oil burner.
If this option is set to a value less than 4, then the TB2-5 output will energize with TB2-6, which is the default setting.

Option 17.1 to 17.4 – Relay Output Functions (0 – 250) [1]

This option parameter assigns ‘events’ to the relay outputs on a FIREYE6066/7 display or 6076 touch screen. Set option parameter 17.1 to select the function for relay output 1, option 17.2 to select the function for relay 2 Fireye.

Option parameter 17.x value	Meaning
0	No function set from this option parameter
1	Mirror the Digital Input 1
2	Mirror the Digital Input 2
3	Mirror the Digital Input 3
4	Mirror the Digital Input 4
5	Mirror the Digital Input 5
6	Mirror the Digital Input 6
7	N/A
8	N/A
9	N/A
10	N/A
11	N/A
12	N/A
13	N/A
14	Mirror the Burner Select Input
15	Mirror the Airflow Input
16	Warming limit exceeded
17	Flame Detected
18	Boiler Below Control Limit
19	Gas Profile Selected
20	Oil Profile Selected
21	Controller in Lockout
22	Burner is Shutdown from a Limit or Input event
23	Burner in Loc1/Loc2/OFF from the keypad
24	Profile uses second fuel train
25	Burner modulating
26	Profile with Variable Speed Drive (VSD) selected, and Fan output is ON
27	Copy Fan relay output
28	Gas Booster o/p for gas profiles, status 6-16
29	Burner OFF from Shutdown or Lockout
30	Burner is status 15 through to 18

Option parameter 17.x value	Meaning
31	Profile 1 selected
32	Profile 2 selected
33	Profile 3 selected
34	Profile 4 selected
35	No function
36	No function
37	No function
38	The burner is available. The relay is ON if there are no faults causing the burner to switch OFF, and the burner is not turned OFF from the keypad or the burner select input.
39	Purge in progress. The relay is ON if the burner status is 8.
40	Purge completed. The relay is ON if the burner status is 9.
41	The relay is ON if the burner is not turned OFF from the keypad.
42	Shutter drive for UV check. Used when option parameter 13.0 is set to 2. Relay comes ON when shutter operation is required.
43	ON if controller is in 'Normal/Remote' mode, OFF when in 'Local' or 'Off' mode. OFF when controller loses power.
44	The Relay is ON if the controller is powered up.
45	Draft/Ventilation control – ON if controller status value is 3 through to 18.
46	Burner available to fire – ON if controller status value is 3 through to 16.
47	At Low Fire position.
48	At High Fire position.
49 – 100	No function
101 – 199	Fault numbers 1 – 99 control the relay
200	No functions
201 – 250	Engineer's Key Data numbers 101 – 150 mirrored (On/Off)

The following table shows details of the output relay connections for the text display:

Option Parameter	Relay Output	Connection Detail
17.1	Relay 1, NX*6220 or NX6330 DISPLAY.*	Display - Low or Line voltage.
17.2	Relay 2, NX*6220 or NX6330 DISPLAY.*	Display - Low or Line voltage.
17.3	Relay 3, NX*6220 or NX6330 DISPLAY.*	Display - Low or Line voltage.
17.4	Relay.4, Controller	Controller – TB3-5 (NO) Line voltage output.

Option 18.x – Fail-safe Digital Inputs (0 – 468) [2]

The fail-safe digital inputs can be used to lock out or shutdown the burner, by the opening of a contact across the input terminals. This event will generate a fault or limit number that relates directly to the input that caused the event (changing to open circuit). As an example, F2 comes from input 2 and F4 comes from input 4.

The shutdown or lockout functions are configured by setting a number into option parameters 18.1 to 18.6 for inputs 1 to 6. The number is a one-, two- or three-digit number defined as follows - zero gives no function.

HUNDREDS (Fault type)	TENS (Fuel type)	UNITS (Burner status type)
0 – This alarm will lock out the burner and shows on the display as 'FXX'. Manual intervention (Mute/Reset) is required to restart the burner after the fault condition has cleared. The burner will lock out within **one** second.	**0 or 1** – Fault will be active for any fuel selection (including no fuel selected at all).	**0 or 1** – Fault will be active regardless of the current burner status (i.e., all the time).
1 – This alarm will shut down the burner and show on the display as 'Lxx'. When the event condition clears, this code will change to 'CXX' and the burner will restart without manual intervention. The burner will shut down within **three** seconds.	**2** – Fault will be active only when the currently selected profile fires GAS.	**2** – Fault will be active after the fan has started, the air pressure switch has made, and the drives have made their purge positions (i.e. after pre-purge starts). Not active during post purge.
2 – This alarm is for indication only. It will appear on the display as 'LXX' but will not stop the burner operating. The limit will operate within **three** seconds.	**3** – Fault will be active only when the currently selected profile fires OIL.	**3** – Fault will be active after pre-purge has finished (i.e., drives moving to the ignition position). Not active during post purge.
3 – This operates the same as selection 1 in this column, but the fault will be generated when the input closes. **This mode of operation must not be used for any safety function because if the wire breaks, it cannot be detected.**	**4** – Fault will be active only when there is a fuel profile currently selected (either firing GAS or OIL).	**4** – Fault will be active after pilot ignition has started (status 11 onwards). Not active during post purge.
4 This alarm will lock out the burner and shows on the display as 'FXX'. Manual intervention (Mute/Reset) is required to restart the burner after the fault condition has cleared. The burner will lock out within **three** seconds.	**5** - Input will be considered when Profile 1 is active.	**5** – Fault will be active after main ignition has started (status 13 onwards). Not active during post purge.

HUNDREDS (Fault type)	TENS (Fuel type)	UNITS (Burner status type)
5 to 9 are spare and cannot be selected.	**6** - Input will be considered when Profile 2 is active.	**6** – Fault will be active after the drives have reached their Low Fire positions and the burner is ready to modulate (status 16). Not active during post purge.
	All other values will work like selection 1 (including zero). 7 to 9 are spare so that new functions can be added later. – No function	**7** – Fault will be active at IGNITION only (burner status 10 to 14 inclusive)
		8 – Fault will be active at pre-purge only.
		All other values will work like selection 1 (including zero). 7 to 9 are spare so new functions can be added later.

Option parameter no.	Digital Input Number / Terminals	Fault number
18.1	Input 1 – TB5-7 to TB5-11/12, 24Vac	F1 or L1
18.2	Input 2 – TB5-8 to TB5-11/12, 24Vac	F2 or L2
18.3	Input 3 – TB5-9 to TB5-11/12, 24Vac	F3 or L3
18.4	Input 4 – TB5-10 to TB5-11/12, 24Vac	F4 or L4
18.5	Input 5 – TB1-2 to live, HIGH VOLTAGE	F5 or L5
18.6	Input 6 – TB1-3 to live, HIGH VOLTAGE	F6 or L6

Examples:
To set input 2 to give a ‘high gas pressure lockout’ you might enter 25 (025) into option parameter 18.2. This will give a lockout if gas is selected, the main valve is open and circuit to terminal TB5-8 is open.

Option 19.x –Alarm / Lockout Display Messages [2]

These option parameters assign messages to the shutdown or lockout functions defined in options 18.1 to 18.6. The messages are chosen from a list of 48 possible items using option parameters 19.1 to 19.6 (for inputs 1 to 6). The list below details the pre-set messages.

19.x value	Message
0	Alarm Input Open
1	Low Water
2	Extra Low Water
3	High Water
4	High Gas Pressure
5	Low Gas Pressure
6	High Oil Pressure
7	Low Oil Pressure
8	High Oil Temp.
9	Low Oil Temp.
0	Low Atom. Media
11	High Temperature
12	Low Temperature
13	High Pressure
14	Low Pressure
15	Panel Switch Open
16	High Stack Temp.
17	Fan Interlock
18	End Switch Open
19	Oil Interlock
20	Gas Interlock
21	Forced Lockout
22	Extra High Water
23	Oil Gun Interlock
24	Low Draft
25	Burner Door Switch
26	Emergency Stop
27	Exit Damper Closed
28	Low Water Flow
29	Low System Press
30	Excess Temp
31	PM5 Shutdown
32	Feed Tank Low

19.x value	Message
33	Phase Failure
34	Soft Start Fault
35	Feed Pump1 O/L
36	Feed Pump2 O/L
37	Blower Motor O/L
38	Dunk Failed Sink
39	Dunk Failed Rise
40	W/D Timer Fault
41	Low Pilot Press
42	High Pilot Press
43	Fan VSD Tripped
44	Pmp1 VSD Tripped
45	Pmp2 VSD Tripped
46	High BioGas Press
47	Low BioGas Press
48	BioGas Bster Tripped

CAUTION

- The 6300 controller allows for customization of various non-safety-critical functions, including the modulation control.
- Option parameters 20.0 to 29.9, which follow, relate to the default 'supplier control function' programmed in the control at the factory.
- To verify this has not been replaced by an application specific function, check with the equipment supplier and / or check option parameter 00.4, if available.

Option 20.0 – Set point Select input (0 – 6 and 21 to 26) [1]

This option parameter allows for a digital input to be used to select between modulation set point sets 1 and 2 (see option parameters 21.0 and 22.0 onwards). Select 0 to always give set point 1. A value of 16 will permanently select set point 2.
Values 21 to 26 invert the function.

Digital Input Numbers	Digital input used:
0	None. Always reads OFF.
1	Input 1, TB5-7 to TB5-11/12 Low Voltage
2	Input 2, TB5-8 to TB5-11/12 Low Voltage
3	Input 3, TB5-9 to TB5-11/12 Low Voltage
4	Input 4, TB5-10 to TB5-11/12 Low Voltage
5	Input 5, TB1-2 Line Voltage
6	Input 6, TB1-3 Line Voltage
16	Always set-point 2

Option 20.1 – Boiler Shutdown input (0 – 6 and 21 to 26) [1]

A closed contact or high level on the input specified here will cause the boiler to go OFF and stay OFF until it is removed. No fault / alarm is generated. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 26 invert the function.

Option 20.2 – Low Fire Hold input (0 – 6 and 21 to 26) [1]

A closed contact or high level on the input specified here will cause the boiler to go to Low Fire and stay there until it is removed. The input numbers are as specified in option parameter 20.0 above.
Values 21 to 26 invert the function.

Option 21.0 – Set point 1 enable (0 - 1) [1]

Use this option parameter to select set point 1.

Option 21.1 – Set point 1 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the control value used in the PID control loop for set point 1. When the controller is in AUTO mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as set by this parameter.

Option 21.2 – Set point 1 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

This is the span of the proportional band that the PID control loop uses for set point 1. If the set point 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 measured value of 4.00 bar would give High Fire, and 5.00 would give Low Fire, assuming no integral or derivative terms were entered.

A value of 0 means no proportional band – the burner would stay at High Fire until the set point is reached, then drop to Low Fire. Proportional control is therefore needed to prevent the measured value from overshooting the set point.

Option 21.3 – Set point 1 integral time (0 – 999 seconds) [1]

This is the integral time used in the PID control loop for set point 1. It can be set to any value from 0 to 999, seconds. If a time value of 0 is entered, the integral function is disabled. If >0 then the time entered is the number of seconds the PID system will take to give an additional modulation change equal to that currently given by the proportional term. Integral control is required for the burner to accurately reach its set point. The lower the number (apart from zero), the more effect the integral function has. A large number will cause the integral term to act very slowly.

Option 21.4 – Set point 1 derivative time (0 – 999 seconds) [1]

This is the derivative time used in the PID control loop for set point 1. It can be set to any value from 0 to 999. A value of zero will disable the derivative function. A non-zero value will have the effect of ‘advancing’ the modulation rate change caused by a constantly changing measured value by the number of seconds given. A low value will have little effect; a large value will cause a large effect.

Derivative control is seldom needed for fire-tube boilers, but can improve the response of the modulation system to sudden load changes, characteristic of water-tube boilers.

Option 21.5 - Set point 1 control limit type (0 - 2) [1]

This option parameter defines the control limit type for set point 1. The control limits are used to automatically turn the burner OFF when it is not needed and bring it back ON when it is needed.

Option parameter 21.5 value	Meaning
0	**No limits.** The burner will run until another method is used to switch it OFF.
1	**Absolute limit.** The values entered in option parameters 21.6 and 21.7 are the fixed limit values.
2	**Deviation limit.** The values entered in option parameters 21.6 and 21.7 represent a deviation (i.e., offset) from the set point 1 control value. This means that if the set point control value is changed, the limits are automatically changed correspondingly.

Option 21.6 - Set point 1 low limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

If the boiler is OFF due to a controlled shutdown, this parameter defines the measured value at which the boiler will be turned ON again.

Option 21.7 - Set point 1 high limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

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 22.0 – Set point 2 enable (0 - 1) [1]

Use this option parameter to select set point 2.

Option 22.1 – Set point 2 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [0]

This is the control value used in the PID control loop for set point 2. When the controller is in AUTO mode, the PID control loop will modulate the boiler to maintain the measured value at the same level as set by this parameter.

Option 22.2 – Set point 2 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

This is the span of the proportional band that the PID control loop uses for set point 2. If the set point 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 measured value of 4.00 bar would give High Fire, and 5.00 would give Low Fire, assuming no integral or derivative terms were entered.
A value of 0 means no proportional band.

Option 22.3 – Set point 2 integral time (0 – 999 seconds) [1]

This is the integral time used in the PID control loop for set point 2. It can be set to any value from 0 to 999, seconds. If a time value of 0 is entered, the integral function is disabled; otherwise, the time entered is the number of seconds the PID system will take to give an additional modulation change equal to that currently given by the proportional term. Integral control is required for the burner to accurately reach its set point. The lower the number (apart from zero), the more affect the integral function has. A large number will cause the integral term to act very slowly.

Option 22.4 – Set point 2 derivative time (0 – 999 seconds) [1]

This is the derivative time used in the PID control loop for set point 2. It can be set to any value from 0 to 999. A time value of zero will disable the derivative function. A non-zero value will have the effect of ‘advancing’ the modulation rate change caused by a constantly changing measured value by the number of seconds given. A low value will have little effect; a large value will cause a large effect.

Option 22.5 - Set point 2 control limit type (0 - 2) [1]

This option parameter defines the control limit type for set point 2. The control limits are used to automatically turn the burner OFF when it is not needed and bring it back ON when it is needed.

Option parameter 22.5 value	Meaning
0	**No limits.** The burner will run until another method is used to switch it OFF.
1	**Absolute limit.** The values entered in option parameters 22.6 and 22.7 are the actual limit values.
2	**Deviation limit.** The values entered in option parameters 22.6 and 22.7 represent a deviation (i.e., offset) from the set point 1 control value. This means that if the set point control value is changed, the limits are automatically changed correspondingly.

Option 22.6 - Set point 2 low limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

If the boiler is OFF due to a controlled shutdown, then this parameter defines the measured value at which the boiler will be turned ON again.

Option 22.7 - Set point 2 high limit value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

If the boiler is ON and firing, this parameter defines the measured value at which the boiler will be turned OFF by means of a controlled shutdown.

Option 23.0 – Warming Enable (0 or 1) [1]

This parameter allows a warming function to be applied to the boiler and enables option parameters 23.1 and 23.2. If the value is zero, then no warming limit is applied.

Option 23.1 – Warming Limit (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) [1]

During the start-up phase for the burner, if the measured boiler pressure or temperature value is lower than that specified in this option, the controller will hold the burner at Low Fire until the value specified is reached. The controller will hold the burner at Low Fire (in status 15) indefinitely unless a non-zero time has been entered in option parameter 23.2.

Note: If during normal modulation, the measured value falls below this limit after having been above it, the warming function will not be re-applied. The warming function is only applied when there is a burner start-up.

Option 23.2 – Warming Time (0 to 999 minutes) [1]

This parameter specifies a maximum time to hold the burner at Low Fire, before ignoring the warming limit and allowing normal modulation.

Note: If the burner goes OFF (for any reason other than power interruption), and the measured value falls below the warming limit, the warming function will not be activated again until this time has passed.

Option 30.0 – Oxygen probe interface serial number [2]

Each CANbus device connected to the system has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to uniquely identify each device.

When the system is in Commission mode the serial numbers of all CANbus devices that are connected are collated by the controller and displayed as a 'list' to allow the selection of the relevant serial number against a specific function.
Scrolling the list in an upward direction will scroll through all oxygen probe interface options available until '0, nothing' is displayed. Enter this value to disconnect the specified device from any hardware.
Scrolling the list downwards will stop when the currently selected item is displayed, and the value will stop flashing.

The display will show type information for each device present (such as 'O2 probe'), but the commissioning engineer should be aware of which serial number device is being used for which function.

Option 30.1 - Oxygen probe calibration offset value (0 – 999) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be set to the calibration offset value that is specified with the probe supplied.

Option 30.2 - Oxygen probe calibration gain value (0 – 999) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be set to the calibration gain value that is specified with the probe supplied.

Option 30.3 - Oxygen probe calibration gas concentration (0.00 – 9.99%) [1]

This option parameter is only available if option 30.0 is non-zero.
This option parameter must be set to the percentage oxygen concentration of the calibration gas used if the probe is to be calibrated using a reference gas (see option parameter 30.6).
The range of this parameter is 0.00 - 9.99%.

Option 30.4 – Flue and inlet sensor temperature units (0 – 1) [1]

This option parameter is only available if option 30.0 is not zero.
Set this option parameter to select the units for display of both temperatures on either °C or °F.

Option parameter 30.4 value	Meaning
0	**°C.** The temperature value will be displayed in °C.
1	**°F.** The temperature value will be displayed in °F.

Please note that temperature limits MUST be set in the correct units.

Option 30.5 - Oxygen input function (0/1) [1]

This option parameter can only be set above 1 if option 30.0 is not zero.

Use this option parameter to configure the oxygen input for a monitoring function or trim function. The two functions are explained below:

Option parameter 30.5 value	Meaning
0	**Monitor only.** The oxygen value is only used to display the measured oxygen level.
1	**Closed loop trim.** The oxygen value provides both a display of the measured oxygen level and a feedback signal for closed loop trim control function of the FIREYE6000 series controller.
2	**Closed loop trim with feed forward.** This option may not be available. **This is an advanced mode of operation and is beyond the scope of this manual.**

Option 30.6 - Oxygen probe calibration enable (0 – 2) [1]

This option parameter is only available if option 30.0 is non-zero.

This option parameter must be used when calibrating the FIREYE oxygen probe. There are three possible values:

Option parameter 30.6 value	Meaning
0	**Calibration OFF.** This is the normal operating condition, where the probe measures the oxygen concentration in the flue.
1	**Calibrate in air.** The probe 'offset' will be calibrated at the normal atmospheric oxygen concentration.
2	**Calibrate in reference gas.** The probe 'gain' will be calibrated in a reference gas with a nominal oxygen concentration (typically 3.0%), the level specified in option parameter 30.3.

After this calibration has been successfully completed, the values in 30.1 and 30.2 will be updated automatically.

Option 30.7 - Boiler transport delay (5 – 60 seconds) [1]

The Boiler transport delay is the time taken for 'gas' to travel from the burner to the oxygen probe. This delay varies with burner fire rate.

In order for the oxygen trim control loop to be stable, this parameter must be set accurately to the transport delay of the boiler **when at Low Fire**. This option can be set between **5** and **60** seconds inclusive.

- To measure the transport delay, ignite the burner and enter Adjust Ratio mode. Select the Low Fire set point and allow time for the flue oxygen reading to settle. After the oxygen reading is steady, make a step change to the fuel: air ratio and start a timer. As soon as the measured oxygen reading **begins** to change, stop the timer. Set the option parameter to the recorded timer value in seconds.

- Automatic Trim commissioning (option 30.9) will attempt to set this automatically. However, the engineer must check the value.

Option 30.8 - Reset oxygen trim profile (0/1) [1]

This option parameter allows the learned trim profile to be reset. If the option is set to 1, any learned profile currently held in memory will be reset, and the trim drives will return to their commissioned positions for the corresponding modulation position. After the profile has been reset, this option parameter will automatically reset to 0.

Option 30.9 – Automatic Trim commissioning (0 / 1) [1]

Option parameter 30.9 value	Meaning
0	**Not selected.**
1	**Perform automatic trim characterization.** The controller will attempt to characterize the burner profile by calculating flow values and selecting oxygen set points to match the currently commissioned points. Automatic Trim commissioning will be performed under the following conditions: • An oxygen probe is fitted and fully operational. • The controller is in Adjust Ratio mode. • A hydrocarbon ratio has been entered for the current fuel profile (see option parameters 35.1 – 35.4).

Option 31.0 - Limit Modulation Range (0 to 1) [2]

By default, the controller modulates the burner between the set points P_3 (Low Fire) and P_h (High Fire), where P_h is the last set point entered in Commission Ratio mode. If oxygen trim is fitted, it is not possible for any drive position to be trimmed lower than point P_3 (Low Fire) or higher than point P_h (High Fire). This means that, you cannot take fuel or air OFF at Low Fire, and you cannot add fuel or air at High Fire.

Setting this option parameter to a value of 1 will limit the modulation range of the burner such that the modulate range will be between points P_4 (one set point above Low Fire) and P_{h-1} (one set point below High Fire). Since oxygen trim is not affected by this limitation, each drive can be trimmed between the points P_3 and P_h. This means that it is not possible to over-fire or under-fire the burner, but a degree of trim may still be achieved at high and Low Fire. Note that this option may reduce the turn down ratio of the boiler.

Option parameter 31.0 value	Meaning
0	Modulation not limited. Burner modulates from P_3 to P_h. Oxygen trim works over full range from P_3 to P_h but may not be able to apply trim at High Fire, or Low Fire – depending on trim direction. The burner always modulates to the desired modulation rate, which may limit the system's ability to maintain the desired oxygen value.

1	Normal modulation range limited to P_4 to P_{h-1} always. Oxygen trim works over full range from P_3 to P_h, and can apply extra trim at low and High Fire – limited by P_3 and P_h.

Options 31.1 to 31.2 - Trim Type for profiles 1 to 2 (0 to 2) [2]

These option parameters determine the type of oxygen trim applied to profiles 1 to 4. These parameters are used together with the parameters entered in option parameters 2.0 to 2.9 to determine which drives are trimmed, and in which direction.

Parameter	Meaning
31.1	Trim Type for profile 1.
31.2	Trim Type for profile 2.

Parameter value in 31.X	Meaning
0	No Trim. Do not apply oxygen trim when running on this profile.
1	Air Trim. Trim 'Air' drives when running on this profile (see option parameters 2.0 to 2.9.)
2	Fuel Trim. Trim 'Fuel' drives when running on this profile (see option parameters 2.0 to 2.9.)

Option 32.0 - Trim limit default (0/1) [1]
Options 32.1 to 32.2 - Trim limits (0.0 – 25.0) [1]

Option 32.0 is only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

It is possible for the system to apply trim to the air or fuel drives up to a maximum deviation of ±25.0% of the air or fuel flow, for the chosen trim drives, at each profile set point.

If option 32.0 is set to 0, the default trim limit will be ±5.0% for all profile selections. Option parameters 32.1 to 32.2 will not be available.

If option 32.0 is set to 1, you can individually adjust the trim limit for each profile selection using option parameters 32.1 to 32.2. The trim limit can be adjusted from 0.0% (no trim) up to a maximum of ±25.0% (maximum allowable trim).

It is the responsibility of the commissioning engineer to make sure the trim limit set will not allow a hazardous combustion condition to occur in the event of an oxygen probe failure. Where oxygen is to be considered safety critical, use option parameters 42.X to set up a second oxygen monitor. When a second oxygen monitoring system is used, the oxygen can be considered fail-safe, and the trim limits can be set up to 50% instead of 25%, provided the maximum time between probe calibrations does not exceed six months.

Options 33.1 to 33.2 - Trim integral term (0.0 – 99.9%) [1]

Options 33.1 to 33.2 are only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

In order for the oxygen trim control loop to be stable, the integral gain must be set correctly. Options 33.1 to 33.2 allow the integral term to be set individually for each profile combination to any value between 0.0 and 99.9%. As a general recommendation, the integral term should be initially set to 15.0%.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the integral term for any profile selection.

Option 34.0 - Trim proportional gain default (0/1) [1]
Options 34.1 to 34.2 - Trim proportional gain (0.0 – 99.9%) [1]

Options 34.0 to 34.2 are only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

If oxygen trim proportional term is not required for any profile, then set option parameter 34.0 to **0**.

If oxygen trim proportional term is required, set option parameter 34.0 to **1**. Option parameters 34.1 to 34.2 will then become available. Options 34.1 to 34.2 allow the loop gain to be set individually for each profile selection to any value between 0.0 and 99.9%.

Oxygen trim proportional gain is not normally required.

Option 35.0 – Inlet temperature sensor serial number [2]

Each CANbus device connected to the system has a unique serial number allocated to it during manufacture. This number cannot be changed and is used to uniquely identify each device.

When the system is in Commission mode the serial number of all the connected devices is read by the controller and displayed as a ‘list’ to allow the selection of the relevant serial number unit to be made.

Scrolling the list in an upward direction will scroll through all temperature sensor options available until ‘0, nothing’ is displayed. Enter this value to disconnect the specified device from any hardware.

Scrolling the list downwards will stop when the currently selected item is displayed, and the value will stop flashing.

Options 35.1 to 35.2 - Hydrocarbon ratio of fuel per profile (0.00 – 9.99) [0]

If you need to display the calculated burner efficiency or ‘Automatic Trim commissioning’, you must enter the hydrocarbon ratios for the required fuels. You can set these between **0.0** and **9.99** inclusive, where the value entered is the hydrocarbon ratio x 10.
For example, for light oil the hydrocarbon ratio is 0.157.
Therefore, the value to enter for this parameter = 0.157 x 10 = **1.57**.

Note: When firing multiple fuels, the mixture between the fuels fired may vary across the firing range of the burner. When this happens, the effective hydrocarbon ratio and calorific value of the fuel combination will change. The accuracy of the calculated efficiency and the ‘Automatic Trim commissioning’ procedure will be adversely affected by this. It maybe that these functions should not be used, in which case these values should be entered as zero.

Options 35.5 to 35.6 - Calorific values of fuels/profiles (0.0 – 99.9) [0]

These option parameters are only available if option 35.0 (inlet temperature sensor) is not set to zero.

If you need to display the calculated burner efficiency, you must enter the calorific value of the required fuels. You can set this between **0.0** and **99.9 MJ/kg** inclusive.

Note: When firing multiple fuels, the mixture between the fuels fired may vary across the firing range of the burner. When this happens, the effective hydrocarbon ratio and calorific value of the fuel combination will change. The accuracy of the calculated efficiency and the 'Automatic Trim commissioning' procedure will be adversely affected by this. It maybe that these functions should not be used, in which case these values should be entered as zero.

The table below shows the calorific values and hydrocarbon ratios of several common fuels. Use these values as a guide only.

If you need display to show the gross efficiency, then in addition to entering the gross calorific values, you must enter a non-zero value for the boiler radiated heat loss.

Fuel	Gross calorific value	Net calorific value	Hydrocarbon ratio (x10)
Gas	52.8	47.6	3.20
Light oil	45.6	42.8	1.57
Medium oil	43.1	40.8	1.35
Heavy oil	42.9	40.5	1.28

Option 35.9 - Boiler radiated heat loss (0.0 – 9.9%) [0]

This option parameter is only available if option 35.0 (inlet temperature sensor) is non- zero.

If this option parameter is set to zero the unit will calculate the net efficiency, if non-zero it will calculate gross efficiency.
For accurate calculation of boiler gross efficiency, this option parameter must be set to the value of the heat lost through the shell of the boiler at High Fire as a percentage of the burner's output at High Fire. The range of this parameter is **0.0** to **9.9%**.

Option 36.0 - Flue temperature alarm select (0 - 2) [1]

This option parameter is only available if option 30.0 is nonzero.

If option 36.0 is set to **0**, the flue temperature high and low alarms are disabled.

If option 36.0 is set to **1 or 2**, this enables the flue temperature high and low alarms, and enables option parameters 36.1 to 36.2 and 37.1 to 37.2.

Option parameter 36.0 value	Meaning
0	**Alarms disabled.** Flue Temperature alarms are disabled.
1	**Alarms enabled, no non-volatile lockout.** Flue temperature low and high alarms are enabled and option parameters 36.1 to 37.2 are enabled. If an alarm value is exceeded a fault number will appear but no non-volatile lockout will occur.
2	**Alarms enabled with non-volatile lockout.** Flue temperature low and high alarms are enabled and option parameters 36.1 to 37.2 are enabled. If an alarm value is exceeded a fault number will appear and a non-volatile lockout will occur.

Options 36.1 to 36.2 - Flue temperature low alarm values (0 – 999) [1]

Using option parameters 36.1 to 36.2, you can set a different flue temperature low alarm value for each profile combination. You can set each option parameter to any value between **0** and **999** inclusive. Set the temperature units with respect to option parameter 30.4.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the low alarm value for any profile selection.

When the flue temperature drops below the low alarm value for the selected profile, a fault number will appear.

Options 37.1 to 37.2 - Flue temperature high alarm values (0 – 999) [1]

Using option parameters 37.1 to 37.2, you can set a different flue temperature high alarm value for each profile selection. Each option parameter can be set to any value between **0** and **999** inclusive. The temperature units should be set with respect to option parameter 30.4.

If the burner is firing, you can only adjust the option parameter that relates to the selected profile. If the burner is not firing, you can adjust the high alarm value for any profile selection.

When the flue temperature rises above the high alarm value for the selected profile combination, a fault number will appear.

Option 38.0 - Oxygen alarm select (0 – 2) [1]

Option parameter 38.0 is only available when option 30.5 (oxygen input select) is not set to zero, and the optional oxygen probe interface unit is connected.

Since the oxygen alarm values relate to the oxygen set point values, you must first enter the oxygen set point values in Adjust Ratio mode.

Option parameter 38.0 value	Meaning
0	**Alarms disabled.** Oxygen low and high alarms are disabled.
1	**Alarms enabled, no non-volatile lockout.** Oxygen low and high alarms are enabled and option parameters 38.1 to 41.4 are enabled. If an alarm value is exceeded, a fault number will appear but no non-volatile lockout will occur.
2	**Alarms enabled with non-volatile lockout.** Oxygen low and high alarms are enabled and option parameters 38.1 to 41.4 are enabled. If an alarm value is exceeded, a fault number will appear and a non-volatile lockout will occur.

Options 38.1 to 38.2 - Oxygen low alarm values at Low Fire (0.0 – 99.9%) [1]
Options 39.1 to 39.2 - Oxygen low alarm values at High Fire (0.0 – 99.9%) [1]
Options 40.1 to 40.2 - Oxygen high alarm values at Low Fire (0.0 – 99.9%) [1]
Options 41.1 to 41.2 - Oxygen high alarm values at High Fire (0.0 – 99.9%) [1]

Using option parameters 38.1 to 41.2, you can set different oxygen alarm values at High Fire and Low Fire for each profile.

At firing positions other than High and Low Fire, the alarm limit is set at the average of the two points. For example, if the oxygen limit has been entered as 5% of set point at Low Fire, and 10% of set point at High Fire, then the limit at mid fire will be 7.5%.

The alarm limits may be set to any value between **0.0** and **99.9%**, where the value entered relates to a **percentage deviation** from each oxygen set point in the firing range.

An oxygen low alarm will be caused by one or more of the following events:

- The level drops below 0.5% O_2 for 30 seconds.
- The level drops below the low alarm limit for 2 minutes 30 seconds.
- The level drops below **twice** the low alarm limit for 30 seconds.

An oxygen high alarm will be caused by one or more of the following events:

- The level rises above the high alarm limit for 2 minutes 30 seconds.
- The level rises above **twice** the high alarm limit for 30 seconds.

Option parameters 42.0 to 42.6.

Parameters in the range 42.0 to 42.6 may have 2 different functions depending upon the combustion monitoring and adjustment requirements. Setting the value of option 42.0 will determine the function of options 42.1 to 42.6.
For this reason, the parameters are listed, and described twice, in the following pages with their respective functions.

Option 42.0 – Second oxygen probe or CO trim selection [2]

In applications where the flue oxygen level is critical and large amounts of trim need to be applied, correct operation of the oxygen probe may become a safety issue. For normal applications, the commissioning engineer must determine the trim limits based on his or her judgment that if the oxygen probe gives an incorrect oxygen level, trim (or lack of it) within those limits will be safe.

For applications when the oxygen feedback is genuinely safety critical, two probes and probe interfaces must be used. Enter the serial number for the second controller here, selected from devices discovered on the CANbus, as for option parameter 30.0.

In applications where CO monitoring and trim are a requirement, enter the serial number for the oxygen probe controller entered in option 30.0.

Option 42.1 – Second oxygen probe calibration offset (0 – 999) [1]

The same as option parameter 30.1, but for the second oxygen probe.

Option 42.2 – Second oxygen probe calibration gain (0 – 999) [1]

The same as option parameter 30.2, but for the second oxygen probe.

Option 42.4 – Max oxygen variation (0 – 9.9 %) [1]

Where the second oxygen probe is being used as a cross check on the first one, enter the maximum permitted variation between the two oxygen readings here. It is suggested that a value of around 0.5 % be used, but the application may demand a higher setting if the two probes are not in exactly the same part of the flue. The controller will lock out within 30 seconds if the two oxygen readings are outside the specified variation.

When this parameter is non-zero, the flue oxygen limits will be checked on a ‘worst case’ basis. This means that the low oxygen limit (see options 38.X, 39.X) is checked against the lower of the two oxygen probe readings, and the high oxygen limit (see options 40.X, 41.X) is checked against the higher of the two oxygen probe readings. If there is a fault with second oxygen probe, the burner will also lock out.

If you leave this parameter at zero (0.0), no checking will be done, but you can still read the oxygen and temperatures associated with second oxygen probe in the Engineer's Key Data (EK75-79).

Note: When there are two probes for fail-safe oxygen monitoring, each probe must be tested and calibrated at least once every six months.

Option 42.5 – Max flue temp variation (0 to 999 ºC) [1]

If this value is non-zero, the burner will lock out if the two oxygen probes vary by more than this many degrees (Celsius). You would use this in applications where flue temperature is particularly critical.

Option 42.6 – Second oxygen probe calibration enable (0 to 2) [1]

This option is identical to option 30.6, except that it relates to the second oxygen probe.
Note, the calibration gas concentration used must be as entered in option parameter 30.3.

Option 42.1 – CO measurement range ppm (0 – 999) [1]

Set this to the span value (20mA) in ppm for the CO measuring device.

Option 42.2 – CO trim gain (0 – 999) [1]

CO trim gain sets the rate at which the CO trim acts – modifies the O2 Set point.
FIREYE recommends setting this parameter to a value of 10% initially, and then adjusting to suit the application response.

Option 42.3 – CO Set point ppm (0 – 999) [1]

Set this parameter to the desired CO value for all points in the firing range.

Option 42.4 – Maximum oxygen reduction (0 – 25.0 %) [1]

Set this parameter to a limit of oxygen Set point adjustment by the CO trim function. The number is a percentage of the normal oxygen Set point.
As an example, if this value is 10% then when the burner is at low-fire and the O2 Set point is 5%, the CO trim system will only reduce the O2 Set point to 4.5%. At High fire with the O2 Set point at 3% the CO trim system will only reduce the O2 Set point to 2.7%.

Option 42.5 – Maximum oxygen increase (0 – 25.0%) [1]

Set this parameter to a limit of Oxygen Set point adjustment by the CO trim function. The number is a percentage of the normal oxygen Set point.
As an example, if this value is 10% then when the burner is at low-fire and the O2 Set point is 5%, the CO trim system will only increase the O2 Set point to 5.5%. At High fire with the O2 Set point at 3% the CO trim system will only increase the O2 Set point to 3.3%.

Option 42.6 – High CO Alarm limit ppm (0 to 999) [1]

Set this parameter to a level of CO at which an alarm will sound and F54 enunciated on the DISPLAY.
Note: there is a 30 second delay from the time the limit is exceeded until the Alarm is made and burner lockout.

Option 42.7 – CAN Combustion air pressure sensor serial number [2]

DEFAULT: 0
Where an FIREYE CAN Bus combustion air pressure sensor is used for the air/fuel profiling, select the serial number of the device from those offered, in a similar way to selecting actuator serial numbers for Option 3.x. Options 42.8 and 42.9 configure the operating limits.

Option 42.8 – Air pressure sensor limit value (mbar) [2]

Set this value to the low-pressure limit where the burner will lockout with F14.

Option 42.9 – Air pressure Error (%) [2]

Set this value to the maximum variation in air pressure allowed from set point before the burner will lockout with fault code F61.

Option 44.0 – FGR Hold-Off Mode (0 to 10) [1]

This option defines how the FGR function is delayed during start-up of the burner process. This may be from a measurement of the recirculation gases or a timer.

Option parameter 44.0 value	Meaning
0	FGR Hold-Off disabled.
1	FGR is held off until the temperature of the flue gas measured at the PT1000 terminals reaches the °C value set in option 44.1.
2	FGR is held off until the temperature of the flue gas measured at the PT1000 terminals reaches the °F value set in option 44.1.
3 to 9	No function. **Do Not Use.**
10	FGR is held off for the time set by Option 44.1.

Where temperature hold-off is required, the burner modulation sensor setting (Opt 15.0) should be selected as a CANBus type.

Where VFD speed feedback is a 4-20mA signal, and the modulation of the burner is by tracking a 4-20mA signal the options for FGR Hold-off are restricted to timer only (Value 10). See Opt 15.0 for further information.

Option 44.1 – FGR Hold-Off Limit. (0 to 999) [1]

This option defines the limit value when the FGR function is released to operate.

When option 44.0 has a value of 1 or 2, the value set represents temperature in °C or °F respectively.

When option 44.0 has a value of 10, the value set represents a time interval, in seconds, from the point that the burner is released to modulate (status 16).

Option 45.0 - Erase / Restore enable (0 - 1) [2]

CAUTION

- If this value is displayed as a ‘2’, the option parameter data has been ‘uploaded’ into the control. Make sure all option parameters are set to match the requirements of the burner to which it is connected. Failure to do so could cause a hazardous condition to occur.
- After you have checked that all option parameters match the requirements of the burner to which it is connected, reset this option parameter to zero to allow the system to operate.
- If you try to operate the system with this option parameter set to ‘2’, it will generate a fault and the control will perform a non-volatile lockout, preventing the burner from firing.

In order to erase information in memory for a specific profile selection (see option parameter 45.1), this option must be set to '1'. When the controller is set back to RUN mode this parameter will automatically reset to '0'.

In order to restore information to the control from the back-up held in the display (see option parameter 45.2), this option must be set to a ‘1’. When the controller is set back to RUN mode this parameter will automatically be reset to '0'.

If this option parameter is set to ‘2’, read the Caution message above.

Option 45.1 - Erase command (0 - 5) [2]

When the erase enable (option 45.0) is set to '1', this option parameter determines which information will be erased when the controller is set back to RUN mode.

0 - No erase.
1 - Erase profile 1.
2 - Erase profile 2.
3 - Erase profile 3.
4 - Erase profile 4.
5 - Erase all set points and initialize all option parameters.

IMPORTANT: If you select **5**, **all profile set points will be deleted and all option parameters will reset to default values**. The controller will be initialized to the factory default settings.

Option 45.2 - Restore command (0 - 999) [2]

When erase / restore enable (option 45.0) is set to '1', this option parameter allows the back-up data held in the display to be loaded into the main unit, this may take up to 5 minutes to complete during which time the controller will not allow the burner to operate.

To restore the data from the back-up held in the display set this option parameter to ‘100’.

If you select **100**, **the data from the back-up data held in the display will download into the controller unit.**

A back-up of the data held in the main controller unit is automatically stored in the display when the controller is in modulation status for a period of 15 minutes.

2. Glossary of Terms

Glossary Term	Explanation
Air-atomizing oil burner	A burner for firing oil in which the oil is atomized by compressed air which is forced into and through one or more streams of oil, breaking the oil into a fine spray.
Air damper	A valve that controls air flow for the combustion process.
Air purge	The removal of undesired matter by flushing through with air.
Ambient	Local environment e.g., ambient temperature.
Analogue signals	Varying electrical signals e.g., 0-5 V or 4-20mA.
Atomization	The process whereby a volume of liquid is converted into a cloud of tiny drops. The aim is to produce a high surface area to mass ratio, so that the liquid will vaporize quickly and burn more easily.
Atomizer	This is part of an oil burner that breaks up the fuel oil flow into tiny particles, either by mechanical means and/or the use of an atomizing medium. The oil and atomizing medium mix together in the atomizer and then flow to the oil nozzle to be discharged into the furnace.
Automatic lighter or igniter	A means for starting the ignition of fuel without manual intervention. Usually applied to liquid, gaseous, or pulverized fuel.
Auxiliary relay	Relay with a programmable function.
Backlash	See Hysteresis.
Balanced draft	The maintenance of a fixed value of draft in a furnace at all combustion rates by control of incoming air and outgoing products of combustion.
Banking	This means holding a boiler in a low-pressure or low-temperature standby mode, ready to respond to a demand for more output.
Bar	Absolute pressure in bar, where 1 bar = approx. 14.5 psi, which equates to the average atmospheric pressure at sea level.
Barometric pressure	Atmospheric pressure as determined by a barometer, usually expressed in inches of mercury or mbar.
Bar(g) or barg	Pressure in Bars measured at the Gauge; i.e. relative pressure, not absolute. This is the pressure in bars above ambient or atmospheric pressure.
Blowdown	The drain connection including the pipe and the valve at the lowest practical part of a boiler, or at the normal water level in the case of a surface blowdown. The amount of water blown down.
Blowdown valve	A valve generally used to continuously regulate the concentration of solids in the boiler. This is not the drain valve.
Blower	A fan used to force air under pressure.
Boiler	A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity, or nuclear energy.
Boiler down time	Time when a boiler is broken or not available for use.
Boiler, high-pressure, steam or vapor	A boiler in which steam or vapor is generated at a pressure exceeding 15 psig/1 barg.

Glossary Term	Explanation
Boiler, hot-water-heating	A boiler in which no steam is generated and from which hot water is circulated for heating purposes and then returned to the boiler.
Boiler, hot-water-supply	A boiler functioning as a water heater.
Boiler, low-pressure-steam or vapor	A boiler in which steam or vapor is generated at a pressure not exceeding 15 psig/1 barg.
Boiler modulation	The varying of the boiler output.
Boiler “online”	Boiler in operation.
Boiler Set point	The control temperature or pressure for the boiler.
Boiler water	A representative sample of the circulating boiler water after generated steam has been separated, and before the incoming feed water or added chemical becomes mixed with it so that its composition is affected.
Btu (British Thermal Unit)	A standard measure of energy in the British unit system. 1 Btu is the amount of heat required to raise the temperature of one pound of water by 1 degree Fahrenheit, equal to about 1055 joules.
Bumpless	Bumpless transfer allows the controller to switch from Manual to Automatic mode or vice versa, without the control output suddenly 'bumping' to a different value.
Burner	A device which combines fuel and air in proper proportions for combustion and which enables the fuel-air mixture to burn, in a stable manner, to give a specified flame size and shape.
Burner assembly	A burner that is factory-built as a single assembly or as two or more assemblies that include all parts necessary for its normal function when installed as intended.
Burner capacity	Amount of heat release a burner can deliver (i.e., amount of fuel which can be completely burned through a burner) at a given set of operating conditions.
Burner status	Shows an indication of the progress of the startup, modulation, and shut-down stages of the burner controller.
Burner turn down	The ratio of maximum burner output to minimum burner output.
Burner utilization curves	Graphical information showing how the burner is used.
Burner wind box	An enclosed chamber around a burner, in which an air pressure is maintained to ensure proper distribution and discharge of combustion air.
Calorific value	The energy available from burning a fixed quantity of fuel.
Cam	Mechanical device that converts rotary motion to linear motion.
Combustible	The heat-producing constituents of a fuel.
Combustible loss	The heat lost because of incomplete combustion of fuel.
Combustion	The rapid reaction of fuel and oxidant (usually oxygen in air) to produce light, heat and noise. Major products of combustion for hydrocarbon fuels (e.g., natural gas, refinery gas, fuel oils) are carbon dioxide and water vapor. Trace products include carbon monoxide and nitrogen oxides, which are pollutants.
Combustion (flame) safeguard	A system for sensing the pressure or absence of flame and indicating, alarming, or initiating control action.

Glossary Term	Explanation
Combustion efficiency	The fraction of carbon in the fuel that is converted into CO_2 in the flue gas, customarily expressed as a percent.
Combustion rate	The quantity of fuel fired per unit of time.
Commission Mode	A general term to cover Commission Ratio and Option Set modes - with a red touch screen background.
ComFire2	FIREYE ComFire2 is a software tool from FIREYE, used for viewing and handling the FIREYE6000 controller settings by means of a PC or laptop, via a USB interface cable.
Controller	A device designed to regulate the fuel, air, water, steam, or electrical supply to the controlled equipment. It can be automatic, semi-automatic or manual.
Control algorithm	Method of control – normally software.
Curve set	A "Curve set" is a set of data that defines the relationship between the fuel and air 'drives' at each profile set point. If these were plotted onto a graph against the increasing set point numbers, it would show several curves increasing in value, starting at low fire and finishing at high fire.
Damper	A device for introducing a variable resistance of regulating the volumetric flow of gas or air.
Differential	In a control loop, this is the difference between cut-in and cut-out points.
Draft	The difference between atmospheric pressure and some lower pressure existing in the furnace or gas passages of the steam-generating unit.
Draft control, barometric	A device that controls draft by means of a balanced damper which bleeds air into the breeching on changes of pressure to maintain steady draft.
Draft differential	The difference in static pressure between two points in a system.
Drive	A "drive" refers to a motor that drives, say, a butterfly valve. The term is sometimes used for the variable frequency / variable speed Inverter Drive Unit, which is used to control the speed of a motor.
Drum	A cylindrical shell closed at both ends, designed to withstand internal pressure.
Dry back	The baffle provided in a fire tube boiler joining the furnace to the second pass to direct the products of combustion, which is constructed of heat resistant material. (Generally refractory and insulating material).
Dry steam	Steam containing no moisture. Commercially dry steam containing not more than 0.5 percent moisture.
Duct	A passage for air or gas flow.
Dynamic plant mimic.	Graphical display showing information from a process, which is regularly updated.
Efficiency	Of boiler operation: Output in heat units divided by input in heat units. The number of BTUs contained in all steam evaporated is useful output. The number of BTUs contained in all fuel supplied to the boiler is input.
EK	Engineer's Key Data. See below.
Electronic Fuel: Air ratio control.	The process of controlling combustion using electronic devices to improve position and ratio accuracy.
ELV	Extra low voltage.

Glossary Term	Explanation
Emissions	Substances that are given off as a result of the combustion process.
Engineer's Key	This is a jargon term referring to **Engineer's Key Data**. These are the parameters stored on the system that have been programmed in by entering the Engineer's Key pass code. The abbreviation is **EK Data** or **EK**.
Excess air	The amount of air needed by a burner that is in excess of the amount required for perfect or stoichiometric combustion. Some amount of excess air, depending on the available fuel/air mixing energy, is required to assure thorough mixing of the fuel and air for complete combustion.
Exhaust	The gases that leave a combustion process.
Fan	A machine consisting of a rotor and housing for moving air or gases at relatively low-pressure differentials.
Fire rate	A number that represents, the burner output as a proportion of the power range of a burner (%).
Fire tube	A tube in a boiler having water on the outside and carrying the products of combustion on the inside.
Fire tube boiler	Boiler where hot gases from combustion flow through metal tubes which are surrounded by water (sometimes called package boilers).
Firing rate control	A pressure temperature or flow controller, which controls the firing rate of a burner according to the deviation from pressure or temperature set point. The system can be arranged to operate the burner ON-OFF, high-low or in proportion to load demand.
FGR	**F**lue **G**as **R**ecirculation. A process where some of the flue gas is re-introduced to the burner head to cool the flame and reduce NOx emissions.
Flame	A luminous body of burning gas or vapor.
Flame scanner	A device that detects if fuel is burning. The indication of the presence of a flame is transmitted to a control system in the form of an electrical signal.
Flame supervision	Monitoring the presence of the flame at the correct time and also for **no flame** at the correct time.
Flue	A passage for products of combustion.
Flue gas	The gaseous products of combustion in the flue to the stack.
Forced draft	Combustion air delivered by a fan blowing air into the burner.
Fuel:air ratio	The ratio of the weight or volume of fuel to air in the combustion mixture.
Gas valve proving (leak testing)	The process of checking the safe operation of the gas valves before starting the burner.
High Fire	The maximum output from a burner, as set during the commissioning process.
Hysteresis	Variations in a control system during operation introduced by worn linkages or mechanical connections.
Igniter	A small burner within the main burner that is ignited by a spark or other ignition source, and which provides the ignition energy required to light the main burner. It may also be called a Pilot burner.
Ignition circuit	Wiring and components that create the spark to ignite the fuel/air mixture.

Glossary Term	Explanation
Ignition point	The positions of fuel valve and air damper required in order to achieve successful ignition.
Ignition transformer	Spark generator used to ignite the fuel and air mixture
Induced draft (I.D.)	Combustion air that is sucked into the burner by a negative pressure in the combustion chamber. Negative pressure, is commonly created by a fan in the flue (I.D. Fan).
I.D. fan	A fan that exhausts hot gases from a combustion process.
Interlock	A device (or circuit) to prove the physical state of a required condition and to signal that proof to a primary safety control circuit.
Intermittent firing	A method of firing by which fuel and air are introduced and burned in a furnace for a short period after which flow is stopped, this succession occurring in a sequence of frequent cycles.
Intermittent ignition device	An igniter which burns during Light Off (the ignition phases of the burner), and while the main burner is firing. It is shut off with the main burner.
Inverter / Inverter drive unit	An inverter drive unit provides variable-frequency electrical power for varying the speed of a pump or fan motor.
IR	Infrared, usually referring to the type of flame sensor used.
Lagging	Heat insulation, an energy-saving covering on boilers, pipes, and ducts.
Lambda control	Control of excess air levels in exhaust gases (Oxygen Trim).
Lead/lag	Multi-boiler system where the load is managed to maximize the efficient use of the boilers.
Lead boiler (lead/lag).	The master boiler which controls the sequence in which the boilers are started and shutdown in a multi-boiler sequenced system
Lag boiler	A boiler that responds to the commands of the Lead boiler in a sequence.
LFH	Low Fire Hold. When the LFH function is triggered by either a manual key press or a by an input in the Option programmer, the burner modulates to Low Fire (P3) position until the until the Auto, Manual or LFH button is tapped again, or the input is released. This function could also come from a digital communications command.
Light off	An American expression that means the ignition phases of a burner, which includes spark, pilot ignition and then main flame ignition from the pilot.
Linkages	Rods and cables that join controllers to valves and actuators.
Linkage-less burners	Burners with electrically controlled servomotors to actuate valves and dampers.
Load	The required output from a boiler.
Low Fire	Minimum output of a burner.
Low Fire start	The firing of a burner with controls in a Low Fire position to provide safe operating condition during light OFF.
Low gas pressure switch	A pressure switch set to stop the burner if gas pressure is too low.

Glossary Term	Explanation
Low-oil-temperature switch	A thermostatic switch set to prevent burner operation if the temperature of the oil is too low.
mbar	Millibar, a metric unit of pressure mainly used in European countries and is derived directly from the Bar pressure unit which equals 1,000 mbar, or approximately 1 atmosphere pressure.
Mechanical cam Fuel: Air ratio control	A traditional mechanical system where the amount(s) of fuel(s) are set against the air damper, which is controlled from a single modulation motor via a cam.
Mid-fire	The mid-range power of the burner.
Modbus Interface.	Digital communications interface that uses the Modbus protocol.
Modulate	To vary the fire-rate (or burner output) in response to the boiler pressure or temperature. The analogy is the action of pressing or releasing the accelerator in a car according to traffic and road conditions.
Modulation motor	A large control motor on traditional linkage, burner control systems.
Modulation rate	See Fire rate.
Motors	The motors are the valve actuating motors that control the flow of fuel and air to the burner.
Multi-fuel burner	A burner that can fire more than one fuel, either individually or in combination.
Natural gas	Gaseous fuel occurring in nature.
Noise	An undesirable sound, electrical or electromagnetic disturbance.
Non-safety critical	Procedures or components that are not critical to the safety of the boiler/burner.
Non-volatile	This is a state that cannot be changed by removing power to the device. The state can only be changed by a pre-determined sequence of actions, such as key presses.
Oil burner	A burner that atomizes fuel oil and blows it into the combustion chamber in the form of a fine mist or vapor. Steam or mechanical motion plus air can be used as the operating medium.
Oil gun	The assembly of parts in a burner that provides atomized fuel oil mixture to the furnace for burning.
Oil tip	Part of the oil gun, which discharges the atomized fuel oil mixture into the furnace through multiple openings. The pattern of holes in the tip has a great effect on flame size and shape.
Option parameter	A number stored in the controller system that defines a function of the controller.
Oxygen trim	The process of adjusting the Fuel: Air ratio to improve the operating characteristic of the burner.
Packaged boiler	A boiler equipped and shipped complete with fuel-burning equipment, mechanical draft equipment, automatic controls, and accessories; usually shipped in one or more major sections.
Packaged fire-tube boilers	Transportable boilers which heat a water jacket (the water surrounding the tubes through which hot gases pass) to produce steam or hot water.

Glossary Term	Explanation
PID	A Proportional-Integral-Derivative (PID) controller is a generic control loop feedback mechanism widely used in industrial control systems. It calculates an "error" value as the difference between a measured process variable and a desired set point, and then attempts to reduce the error by adjusting the process control inputs. For example, in the FIREYE6000 systems, it is used to control the pressure / temperature of the boiler by modulating (varying) the fire rate.
PID Modulation	Modulation controlled by a three-term control algorithm.
Pilot	A small burner that is used to light the main burner.
Pilot flame establishing period	The length of time fuel is permitted to be delivered to a proved pilot before the flame-sensing device is required to detect pilot flame
Pilot, proved	A pilot flame that has been proved (tested) by flame-failure controls.
Plant Input	A Plant Input is a representation on the touch screen of a terminal, which may be connected to a line voltage electrical point within the boiler plant (systems). The digital status of the input (ON or OFF) is displayed within a display pane on the Touch screen. These inputs are for indication only, unlike the digital inputs on the main controller, which can be set to shut down or lock out the burner system.
Play	See Hysteresis.
POC	Proof of Closure used, for example, for gas valves and oil valves.
Post-purge	The process of clearing combustion gases from the boiler after the boiler has been shut down.
Pre-mixed flame	Situation when the fuel and air are intimately mixed before delivery to the source of ignition. The combustion process is controlled by heat conduction and diffusion of hydrocarbon and other radicals.
Pre-purge	The process of clearing the combustion chamber before starting the boiler.
Pre-purge period	A period on each start-up during which air is introduced into the combustion chamber and associated flue passages in volume to completely replace the air or fuel air-mixture before an attempt to initiate combustion.
Primary air	Air used to shape the flame from a burner.
Process heating	Heat provided to a process by steam or hot water or hot oil.
Process steam	Steam used for industrial purposes other than for producing power.
Profibus interface	Interface to the Siemens Profibus communications protocol.
Profile	A Profile is a collective term for a set of Fuel: Air ratio curves, O_2 and Flow characteristics. There can be up to 4 user-selectable profiles stored on the system. The profiles might relate to different fuel types or some other variation in combustion requirements.
Proportional control	A mode of control in which there is a continuous linear relationship the between value of the controller variable and the position of the final control element (modulating control).
PSIG	Pressure per square inch at the Gauge, i.e., relative pressure, not absolute.
Purge	Clearing or cleaning.
Purge interlock	A device to make sure that an air flow to the furnace above a minimum level exists for a defined time interval.

Glossary Term	Explanation
Regulator, gas pressure	A spring loaded, dead weighted or pressure balanced device which will maintain the gas pressure to the burner supply line
Relay outputs	Signal interface by means of a relay contact.
Retrofitted	Equipment fitted to existing equipment.
RS485 connection	Serial Communications interface using the RS485 system.
Safety shut down	The action of shutting OFF all fuel and ignition energy to the burner by means of safety control or controls, such that restart cannot be accomplished without operator action.
Safety valve	A valve that automatically opens when pressure attains the valve setting which is adjustable; used to prevent excessive pressure from building up in a boiler.
Secondary air	Main combustion Air.
SELV circuit	'Safety Extra Low Voltage', sometimes referred to as a 'Separated Extra Low Voltage' circuit.
Servomotor	A motor controlling the position of a valve or damper.
Set point	A pre-set value such as a specific speed or position that the controller is supposed to reach. Also known as the target value.
Slop	See Hysteresis.
Soot blower	A tube from which jets of steam or compressed air are blown for cleaning the fire tubes or other parts of the boiler.
Spray nozzle	A nozzle from which a liquid fuel is discharged in the form of a spray.
Stack	Flue or chimney.
Status, burner	Shows an indication of the progress of the startup, modulation, and shut-down stages of the burner controller.
Steam	The vapor phase of water substantially unmixed with other gases.
Steam Atomization	Injecting steam with oil to improve its atomization (ability to mix with air).
Steam atomizing oil burner	A burner for firing oil, which is atomized by steam. It may be an inside or outside mixing type.
Steam Gauge	A gauge for indicating the pressure of steam
Therm	A unit of heat applied especially to gas. One therm = 100,000 Btu
Thermal conductivity	The ability of a material to conduct heat, expressed as thermal power conducted per unit temperature and thickness. Metals and other thermal "conductors" have a large thermal conductivity. Refractories and other thermal "insulators" have a low thermal conductivity.
Thermocouple	A temperature-detecting device based upon the characteristics of a joining of two dissimilar metals.
Time delay	A deliberate delay of a predetermined time in the action of a safety device or control.
Trail for main flame ignition	A timed interval when, with the ignition source proved, the main valve is permitted to remain open. If the main burner is not ignited during this period, the main valve and means of ignition are cut off. A safety switch lockout follows.

Glossary Term	Explanation
Trail for pilot ignition	A timed interval when the pilot valve is held open, and an attempt made to ignite and prove (test) it. If the presence of the pilot is proved at the termination of the interval, the main valve is energized; if not, the pilot and ignition are cut off followed by a safety lockout.
Trail-for-ignition	That period of time during which the programming flame failure controls permit the burner fuel valves to be open before the flame-sensing device is required to detect the flame.
Tramp air	Any air that enters (infiltrates) the furnace through leaks. This air may be measured by the O_2 analyzer and often contributes to the burning of the fuel.
Trend data	Information that shows the operation of equipment over a time interval.
Turndown	The ratio of maximum boiler output to minimum boiler output.
UV	Ultraviolet, usually referring to the type of flame sensor.
Valve, fuel control	An automatic or manually operated device consisting essentially of a regulating valve and an operating mechanism. It is used to regulate fuel flow and is usually in addition to the safety shut-off valve. This valve can be automatic or manually opened.
Valve, manual gas shutoff	A manually operated valve in a gas line for isolating the gas supply.
Valve, manual oil shutoff	A manually operated valve in the oil line for isolating the oil supply.
Valve, manual reset safety shutoff	A manually opened, electronically latched, electrically operated safety shut-off valve, which automatically shuts OFF fuel when de-energized.
Valve, motor driven reset safety shutoff	An electrically operated safety shut-off valve designed to shut off fuel flow automatically upon being de-energized. The valve is opened and reset automatically by integral motor device only.
Vent	An opening in a vessel or other enclosed space for the removal of gas or draft.
Vertical firing	The arrangement of a burner such that discharges air and fuel vertically into the furnace.
VFD	Variable Frequency Drive.
VPS	Valve Proving System: Valve Leak Testing for gas safety.
VSD	Variable Speed Drive, often refers to a variable-frequency inverter unit.
Waste fuel	Any by-product fuel that is waste from a manufacturing process.
Waste heat	Sensible heat in non-combustible gases.
Water Injection	Injecting water with oil to improve its atomization (ability to mix with air).
Water tube	A tube in a boiler having the water and steam on the inside and heat applied to the outside.
Water tube boiler	Boiler (usually large) where water flows in metal tubes that are surrounded by the hot gases from combustion.
Wet back	A water-cooled baffle in a fire tube boiler directing the products of combustion from the furnace to the second pass.
Wet steam	Steam that contains moisture, usually as fine water droplets.

Glossary Term	Explanation
Windbox	A chamber below the grate or surrounding a burner, through which pressurized air is supplied for combustion of the fuel.
Windbox pressure	The static pressure in the windbox of a burner or stoker.

3. Notice, Warranties, Exclusive Remedies, and Limitation of Damages

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

Fireye guarantees for one year from the date of installation or 18 months from the date of manufacture, whichever occurs first, to replace, or at its option, to repair any product or part thereof which Fireye, in its sole discretion, deems to be defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. Fireye's obligations pursuant to this warranty do not extend to any products or parts thereof which Fireye determines to have been installed, operated, maintained, repaired, or altered improperly or otherwise than in conformity to Fireye's applicable instructions, or which have been subject to misuse, accident, or neglect.

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4. Section 7 Update History

New version	Date		Changes in brief
V1pt4	10.29.23	RAL	North American Version
V1pt4	03.14.24	RAL	7-26 Add text Option 44.4 °F as value of 2

——— End of Section 7 ——