PROGRAMMING GUIDE FOR PPC6000 SERIES

DESCRIPTION:

This document supplies the commissioning engineer with sufficient information to make appropriate setup and changes to the commissioning of the PPC6000.

NOTE: For additional information on Installation and Wiring information, please refer to the complete installation manual - **Fireye bulletin PPC-6001**

For ease of navigation (see section 1.3.1), the symbols below will be used throughout the Commissioning Process in this manual to indicate the correct application for each commissioning OPTION, for use by the Commissioning Personnel.

A convenient check box has been added to the beginning of the symbols so that the Commissioning Personnel can mark each appropriate option as it is completed.

SYMBOL	MEANS:
☐ PPC ➡	Commissioning Personnel ***MUST*** execute this option
☐ O2 ➡	For Customers with **O2 TRIM** option, Commissioning Personnel ***MUST ALSO*** execute this option
☐ VFD ➡	For Customers with **VFD** options, Commissioning Personnel ***MUST ALSO*** execute this option
☑ PPC ➡	After each appropriate option parameter is complete, **CHECK THE BOX!**

The following items are covered in this manual:

1 Commissioning the control.

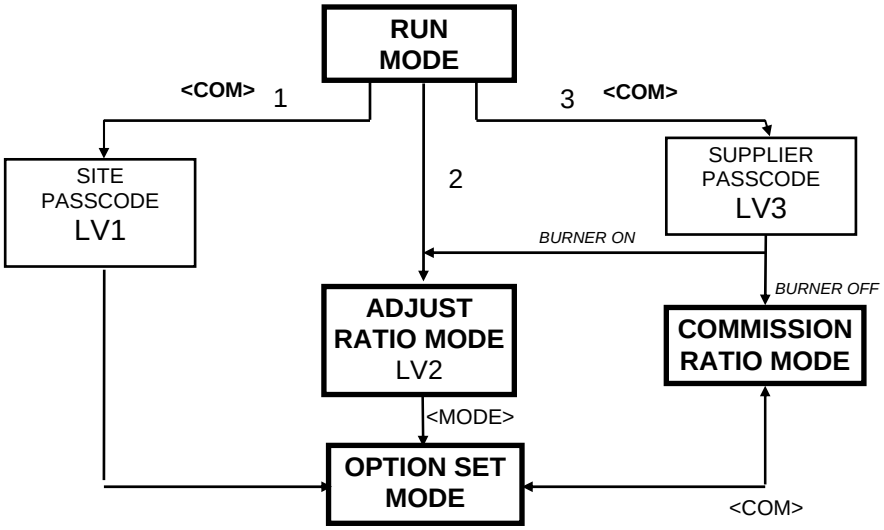
WARNING

- **This manual may cover more than one model from the PPC6000 series. Check for additional information at the end of this chapter.**
- **While the control is operating in commissioning mode or adjust ratio mode certain safety checks cannot be performed by the control and therefore the safety of the system operation is the sole responsibility of the commissioning engineer.**
- **Do not allow fuel to accumulate in the combustion chamber. If fuel is allowed to enter the chamber for longer than a few seconds without igniting, an explosive mixture could result.**
- **If a flame failure occurs at any point the control will not attempt a re-start until the fault is cleared. Before moving to the ignition position to attempt a re-start the system will perform any selected pre-purge.**

1.1 General

If any settings in the control are to be changed, it is necessary to enter a commission mode. Three passcodes are available for this purpose, shown as LV1 (Level 1), LV2 (Level 2), and LV3 (Level 3) in this manual

- *Supplier passcode* – LV3 – allows entry to all commissioning modes.
- *Adjust ratio passcode* – LV2 -- allows adjustment of some option parameters and entry to adjust ratio mode.
- *Site passcode* – LV1 -- allows adjustment of some option parameters.



1.2 Commissioning data

1.2.1 Option parameters

The PPC6000 series is configured by programming Option Parameters (memory registers), which describe the configuration of the burner and the boiler. Option parameters are set and adjusted in *Option Set* mode, but it may not be possible to adjust all of them if the burner is on.

1.2.2 Setpoints

Setpoints contain information about required motor positions. There are four profiles (or tables) of setpoints. A minimum of four positions (P0, P1, P2, and P3) **MUST** be entered for the PPC6000 to run in *automatic*.

Profile 1 (Gas) position (°)	Air position (°)		Profile 2 (Oil) position(°)	Air position(°)
2.1	1.9	CLOSE(P0)	1.7	1.9
2.1	88.9	PURGE(P1)	1.7	88.9
24.6	30.6	IGNITION(P2)	10.6	28.7
21.3	25.8	LOW FIRE(P3)	10.6	28.7
76.8	85.6	HIGH FIRE(Px)	50.2	83.5

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

1.3 The Commissioning process.

1.3.1 Navigation.

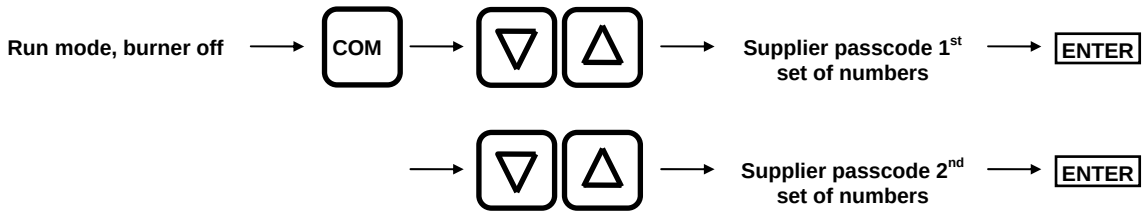
The symbols below will be used throughout the Commissioning Process in this manual to indicate the correct application for each commissioning OPTION, for use by the Commissioning Personnel.

A convenient check box has been added to the beginning of the symbols so that the Commissioning Personnel can mark each appropriate option as it is completed.

SYMBOL	MEANS:
☐ PPC ➡	Commissioning Personnel ***MUST*** execute this option
☐ O2 ➡	For Customers with **O2 TRIM** option, Commissioning Personnel ***MUST ALSO*** execute this option
☐ VFD ➡	For Customers with **VFD** options, Commissioning Personnel ***MUST ALSO*** execute this option
☑ PPC ➡	After each appropriate option parameter is complete, **CHECK THE BOX!**

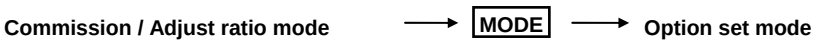
1.3.1.1 Entering commission ratio mode

To enter commission ratio mode, turn the burner off. Once the burner has completely shut down, press the key labeled **COM** and select the supplier passcode value using the **UP/DOWN** keys. The supplier passcode is normally 2 sets of three numbers and is entered as shown below.



If the entered passcode is correct, 'P 0' will be seen on the display. This represents the closed position setpoint.

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



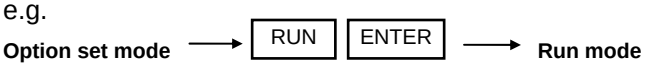
To enter option set mode, enter commission ratio mode or adjust ratio mode (see sections 1.3.1 or 1.6.2 respectively) and press the key labeled **MODE**.

1.3.1.3 Changing from option set to Commission / Adjust ratio modes

1.3.1.4 Exiting from commission mode

To exit from any commission mode to run condition, press the key labeled **RUN** and then **ENTER**.

e.g.



NOTE: Exiting from "full commissioning" mode at P3 or higher will erase any point above the displayed Px. If this is **undesirable**, **exit** "full commissioning" mode at **HIGH FIRE**.

1.4 Using option set mode

- Use the UP/DOWN keys to select the Option parameter to be adjusted.
- Use the Scroll keys to navigate between Option numbers and the Option values.
- Use the UP/DOWN keys to change the value of the option parameter. When the correct value is selected then press the ENTER key to store the new value.
- Set or adjust all of the parameters as required by moving between the parameters and adjusting as detailed above.

1.4.1 Option parameter list

CAUTION

- Use extreme care when entering option parameters. Incorrect data entry could cause a hazardous situation to occur.
- It is possible that additional parameters may be present in the unit depending on the application and/or supplier.

Note: Option parameters are marked with LV1, LV2, and LV3, which indicate what level passcode is required. If, when using the supplier passcode (LV3), it is not possible to adjust the value of an option parameter, then the burner must be turned off to make the adjustment.

Option 00.1 - Site passcode (0 - 999) LV3

This is a three digit passcode that will allow the site engineer or end-user to enter option set mode and adjust a limited range of option parameters (those not marked with 'LV2' or ' LV3' in this section). This passcode can be zero, in which case the user only needs to press the COM / ENTER key twice to enter option set mode with limited access.

Option 00.2 - Serial communications control address (0 - 15) LV3

If the control 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 control unit is connected on the CAN bus (for example to share a display), the units must all have unique addresses BEFORE THEY ARE CONNECTED TO THE SAME CANbus.

Option 00.3 - Reset hours run (0 - 1) LV3

This option parameter allows the HOURS RUN display for all fuels to be reset to zero. To perform a reset, set this option parameter to **1** and leave option set mode. When the burner begins to modulate, the HOURS RUN display will be reset and the option parameter automatically returns back to **0**.

Option 00.4 – User program select (0 / 1) LV1

This parameter may not be available. Where it is available, it allows the user to de-select the Fireye's standard modulation program, and select a user program. The user program may be modified using PC software to change the controls behavior for non-standard applications.

The programmable system only allows access to non-safety related functions such as modulation, enabling / disabling burner start-up and other similar functions. Only the user program can be modified, and Fireye's program can be re-selected at any time by changing this parameter back to zero.

Option 00.4 value	Meaning
0	Run standard manufacturer modulation program. Controls PID, control limits, and

	some Input / Output settings (see option parameters 20.0 to 29.9)
1	Run user program, if available.

Option 00.5 – Language select (0 / 1) LV1
DEFAULT: 0
This parameter may not be available. Where it is available, it allows the user to change the language used for the display. Depending on spare memory and customer requirements, this option may only change the text displayed to users in RUN mode, and not in COMMISSION mode – or all text can be changed to a second language.

Option 00.5 value	Meaning
0	Operate with standard language (usually ENGLISH).
1	Operate with alternate language, at least in RUN mode – but possibly in other modes depending on specification of the control.

Option 00.6 – Remote / Local Control (0 - 2) LV3

This parameter can be used to force the control to operate the boiler using setpoint 1 or 2, ignoring all remote influences.

Option 00.5 value	Meaning
0	Normal (remote) operation. The boiler will be controlled to setpoint 1 or 2 depending on options 20.0, 20.7 to 22.X. The setpoint and control limits can be overridden by external influences such as analog / digital inputs and serial communications.
1	The boiler will be controlled to setpoint 1 as set in option parameter 21.X. Inputs that would affect this such as the remote setpoint function on option parameter 20.7 and all serial communications inputs are disabled.
2	The boiler will be controlled to setpoint 2 as set in option parameter 21.X. Inputs that would affect this such as the remote setpoint function on option parameter 20.7 and all serial communications inputs are disabled.

Option 01.0 – Power Up Option (0 - 30) LV3

This option can be used to modify the behavior of the control 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 lockout after a power-up. An F75 will be generated which will require manual intervention to clear.
2 – 30	The control 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 control will remain in safety shutdown (but not locked out) for this time.

Option 01.1 – Keyboard Auto/Manual enable (0 - 1) LV3 [Engineer's Key 33]

DEFAULT: 1

It is possible to 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 - 2) LV3

The Fault Mute function is available via Comfire 2, on the keyboard and 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. It should be ensured that the digital input selected is not used for any other function (option parameters 1.x, 16.x and 18.x, 20.x). MUST be connected as shown in section 3.6.11.

Please note any key/button providing a fault mute function must be mounted local to the burner.

Number entered in parameter 01.2	Fault Mute Function	Digital inputs used
0	Comview & Keyboard only	NONE
1	Input 1	Input 1, PA5 to PA11 Low Voltage
2	Input 2	Input 2, PA6 to PA11 Low Voltage
3	Input 3	Input 3, PA7 to PA11 Low Voltage
4	Input 4	Input 4, PA8 to PA11 Low Voltage

Servomotor Shaft Position Warning

It is not possible to reposition the shaft of the servomotor other than to the factory settings of either clockwise or counter clockwise. That is, the shaft flat (as viewed from the shaft end) will either be in the 9-12 o'clock or 6-9 o'clock position at PO (burner off). Using the "out of the box" settings will make future replacement of servomotors easier.

Some motors have a clutch release to allow for the driven device to be rotated for inspection after commissioning. It must be noted that releasing the clutch while the motor is powered will cause the servomotor to drive back to the commissioned P0 position. Power should be removed if the clutch is used for this purpose.

PPC **Option 02.x – Drive Name LV3**

CAUTION

- The total electrical load for all connected servo motors **must not** exceed 40VA.

Each Drive connected to the system can be given a name which will than be shown on the text display, The are a maximum of 10 drives (0 – 9), which can be connected, the names are set by option parameter 02.0 to 02.9.

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

The permitted drive names are:

Number entered in parameter 02.X	Drive Name	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	VFD controlled oil pump. Can be used for oil warming – see option parameter 9.0
7	WAS	Fuel drive	YES	Waste fuel (combined fuel firing)
8	PRI	Fuel drive	YES	Primary (flame shaping) air
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

Two (or more) drives can be allocated the same name.

The number entered also tells the control information about the drive. If the number entered here is less than 10, the drive is considered a fuel. If the number is greater than or equal to 10, it is considered an air drive. This only makes a difference when oxygen trim is enabled for a particular drive, since it determines the trim direction. Selection of fuel trim or air trim is made with option parameters 31.1 to 31.4.

Primary air is considered a fuel drive since it is used for flame shaping and should normally track the fuel valve.

P P C **Option 03.x – Drive Serial Number LV3**

CAUTION

- The total electrical load for all connected servo motors **must not** exceed 40VA.

Each Drive
connected to the system has a unique serial number allocated to it during production testing. This number cannot be changed and is used to uniquely identify each drive.

When the system is in commissioning mode the serial number of all the connected drives is read by the main unit and displayed as a 'list' to allow the selection of the relevant serial number unit for each drive (0 – 9) to be made.

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

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

The display will show type information for each drive present (such as the torque rating of a servo), but the commissioning engineer should be aware of which serial number servo is connected to which item on the burner.

If the optional VFD daughterboard is fitted, four additional options are present:

Displayed Option	Meaning
-a,VFD1:mA	VFD channel 1 is used with a 4-20mA feedback
-b,VFD1:Hz	VFD channel 1 is used with an encoder pulse (frequency) feedback
-c,VFD2:mA	VFD channel 2 is used with a 4-20mA feedback.
-d,VFD2:Hz.	VFD channel 2 is used with an encoder pulse (frequency) feedback.

Variable Speed Drive Selection:

Important Note: When selecting a VSD or variable frequency drive (VFD) consideration must be given to the size and weight of the blower wheel. While a "fan" application is by nature a variable torque load, the inertia (weight) of the blower wheel must be considered. Typical HVAC type drives do not speed up or slow down large blower wheels with enough control to operate within the tolerance of the PPC or NX series control. Therefore, a VSD (VFD) with some built in breaking capability, such as a constant torque drive, should be used. At a minimum, if the drive has a constant torque setting, it must be enabled to minimize faults due to drive hunting.

If a drive serial number is changed, any profiles using that drive will require re-commissioning. A 'profile invalid' fault (see FAULT 64) will lock the burner out on an attempt to fire a profile which has had a previously commissioned drive removed. The profile can be re-commissioned by using the NEXT / ENTER keys in commission ratio mode to verify all points on the combustion curve.

PPC Option 04.x – Drive Usage Information LV3

The system will allow a maximum of four fuel / air profiles to be entered. Each drive (servo or VFD) can be selected to operate for any, all or none of these profiles. This way the system can be programmed to use the 'gas' servo (for example) on a gas profile – but not an oil profile.

When the control is firing a profile that doesn't use a specific drive, that drive can be disconnected or faulty and the control will carry on working. So if the gas servo is broken, the burner can be run on oil, for example.

The number to be entered is a binary code:
+1 if the drive is used for profile 1,
+2 if the drive is used for profile 2,
+4 if the drive is used for profile 3,
+8 if the drive is used for profile 4.

This means that the number entered is from 0 to 15:

Number entered in parameter 4.X	Drive X used for profile(s)
0	NONE
1	1
2	2
3	1,2
4	3
5	1,3
6	2,3
7	1,2,3
8	4
9	1,4
10	2,4
11	1,2,4
12	3,4
13	1,3,4
14	2,3,4
15	1,2,3,4 (ALL)

If these parameters are changed after the burner has been commissioned, any profiles affected will need to be re-commissioned. A drive selection fault will lock the burner out on an attempt to fire a profile which has had a previously commissioned drive removed.

Example of use:
Option parameter 4.0 = 4 → drive 0 used for profile 3 only.
Option parameter 4.2 = 1 → drive 2 used for profile 1 only.
Option parameter 4.0 = 15 → drive 0 used for all profiles.
Option parameter 4.4 = 5 → drive 4 used for profile 3 and profile 1 only.

PPC Option 05.x – Drive Options LV3

This parameter is used to specify direction for each servo drive. This parameter has no effect for variable speed drives (VFD). If this parameter is changed, affected profiles must be re-commissioned by a qualified engineer.

Number entered in parameter 5.X	Drive Options
0	Drive moves counter-clockwise (looking at output shaft).
1	Drive moves clockwise (looking at output shaft).

Options 06.1-06.4 – Profile Naming LV3

This selects the fuel associated with each profile (1 thru 4) to be displayed after the burner-on hours, e.g. 861 hours Profile 1 Gas, visible on the main display during operation.

Options 07.x, 08.x– *RESERVED*

V F D **Option 09.0 - Inverter control accuracy (0 / 1) LV3**

Variable Speed Drive Selection:

Important Note: When selecting a VSD or variable frequency drive (VFD) consideration must be given to the size and weight of the blower wheel. While a "fan" application is by nature a variable torque load, the inertia (weight) of the blower wheel must be considered. Typical HVAC type drives do not speed up or slow down large blower wheels with enough control to operate within the tolerance of the PPC or NX series control. Therefore, a VSD (VFD) with some built in breaking capability, such as a constant torque drive, should be used. At a minimum, if the drive has a constant torque setting, it must be enabled to minimize faults due to drive hunting.

This parameter affects all inverters connected to the unit.

Option parameter 09.0 value	Meaning
0	Low accuracy (normal setting). Control will be performed to within approximately ±0.45Hz for a 0-50Hz system.
1	High accuracy. Control will be performed to within approximately ±0.15Hz for a 0-50Hz system.

Note: When using the high accuracy setting, the control may have difficulty with controlling the speed of the inverter. If this occurs, use the low accuracy setting for reliable operation.

V F D **Option 09.1 - Inverter error tolerance (0 / 1) LV3**

This option parameter affects all inverters connected to the unit.

Option parameter 09.1 value	Meaning
0	Small tolerance (normal setting). The control will perform a non-volatile lockout if the inverter positioning error exceeds ±30 for 15 seconds or ±55 for 3 second (units conform to those seen on the display).
1	Large tolerance. The control will perform a non-volatile lockout if the inverter positioning error exceeds ±55 for 3 seconds (units conform to those seen on the display).

Note: Only use the large tolerance setting if an inverter error of up to ±55 will not cause an unsafe combustion condition to occur at any firing position.

VFD **Option 09.2** - **Inverter closed loop gain (15 – 125%) LV3**

DEFAULT: 100

This option parameter affects all inverters connected to the control.

For normal operation, use 100%. If the inverter control is unstable, reducing this value has the effect of damping the inverter's response as its speed approaches its setpoint.

VFD **Option 09.3** - **Inverter stop time (0 – 100 seconds) LV3**

Determines the minimum time between a burner shutdown and subsequent startup. Set this parameter to give the inverter(s) sufficient time to stop before the burner restarts. This parameter will increase the time the burner is held in status 5.

VFD **Option 09.4** - **Inverter acceleration time (0 –60 seconds recommended) LV3**

DEFAULT 30

The value entered for this parameter should be the time in seconds for the inverter(s) to move from minimum to maximum speed.

The inverter(s) should also be able to move from maximum to minimum speed in the same time, if this is not the case adjust the time in the inverter(s) to ensure the time to accelerate and de-accelerate are the same.

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

Note: This parameter can be set to values between 60 and 100, but this should only be used as a last resort if required, and is not recommended. If a very slow inverter is used, care must be taken during commissioning that UP / DOWN keys are not held for more than a few seconds. It is possible that the control could get out of step with the inverter and cause a position fault during the commission process. This control is not designed to work with inverters that take more than 60 seconds to drive from zero to maximum speed.

VFD **Option 09.5** – **VFD1 Speed Encoder Scaler (255 - 999) LV3**

When using encoder feedback for VFD1, this option should be programmed to ensure that the feedback signal gives between 950 and 995 when the motor is at maximum speed (drive signal at 20mA). The value for the parameter may be calculated using the following formula:

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

60

The value may need adjustment once the unit 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.

VFD **Option 09.6 – VFD2 Speed Encoder Scaler (255 - 999) LV3**

When using encoder feedback for VFD2, this option should be programmed to ensure that the feedback signal gives between 950 and 995 when the motor is at maximum speed (drive signal at 20mA). The value for the parameter may 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 once the unit 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.

Option 09.7- *RESERVED*

Option 09.8- *RESERVED*

Option 09.9- *RESERVED*

Option 14.0 – Primary Fault Relay (0-8) LV3

This option parameter assigns the primary faults to a specific relay. Relays 1 & 2 share a common connection.

Option parameter 14.0 value	Meaning	Connection Details
0	Primary faults not assigned to any relay.	N/A
1	Primary faults assigned to relay 1	Display, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Primary faults assigned to relay 2	Display, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Primary faults assigned to relay 3	Display, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Primary faults assigned to relay 4	Main Unit, PE4 (line voltage out).
5	No function.	N/A
6	No function.	N/A
7	Primary faults assigned to relay 7	Daughterboard, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.
8	Primary faults assigned to relay 8	Daughterboard, PZ18 – PZ17. LOW VOLTAGE AND CURRENT ONLY.

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

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2 – this means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so an alarm bell would be wired in series with the normally closed contacts.

Option 14.1 – Limit Relay (0-8) LV3

This option parameter assigns the limits to a specific relay. Relays 1 & 2 share a common connection.

Option parameter 14.1 value	Meaning	Connection Details
0	Limits not assigned to any relay.	N/A
1	Limits assigned to relay 1	Display, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Limits assigned to relay 2	Display, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Limits assigned to relay 3	Display, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Limits assigned to relay 4	Main Unit, PE4 (line voltage out).
5	No function.	N/A
6	No function.	N/A
7	Limits assigned to relay 7	Daughterboard, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.
8	Limits assigned to relay 8	Daughterboard, PZ18 – PZ17. LOW VOLTAGE AND CURRENT ONLY.

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

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2 – this means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so an alarm bell would be wired in series with the normally closed contacts.

Option 14.2 – Oxygen and Flue Temperature Limit Relay (0-8) LV3

This option parameter assigns the limits to a specific relay. Relays 1 & 2 share a common connection.

Option parameter 14.2 value	Meaning	Connection Details
0	Flue Limits not assigned to any relay.	N/A
1	Flue Limits assigned to relay 1	Display, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage.
2	Flue Limits assigned to relay 2	Display, PR7(COM), PR5(NO), PR6(NC). Low voltage or line voltage.
3	Flue Limits assigned to relay 3	Display, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
4	Flue Limits assigned to relay 4	Main Unit, PE4 (line voltage out).
5	No function.	N/A
6	No function.	N/A
7	Flue Limits assigned to relay 7	Daughterboard, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.
7	Flue Limits assigned to relay 8	Daughterboard, PZ18 – PZ17. LOW VOLTAGE AND CURRENT ONLY.

These relays MUST NOT be used to provide a safety function. (See below)

A relay can be used to indicate any combination of fault conditions from 14.0, 14.1 and 14.2 – this means that one relay could be used for all faults. When used for an alarm function, the relay will de-energize when in the fault condition, so an alarm bell would be wired in series with the normally closed contacts.

Option 15.0 - Modulation sensor input type (0 - 1) LV3

The modulation sensor input caters for connection to a standard 0-5V or 4-20mA signal. When using a 4-20mA sensor, the control may be used to monitor the boiler high safety limit and perform a non-volatile lockout if it is exceeded, additional external limits **must** still be in place to protect the boiler in case of a sensor failure. Ensure that the links on the circuit board are set to correspond with the requirements of the sensor/signal being used. **Incorrect link setting may damage or destroy the units being connected**.

Option parameter 15.0 value	Meaning
0	0 - 5V operation. Set the JP1 link to 'OUT'. Set the JP3 link as required. This option is used to provide a 0 to 5 volt tracking input only. The burner modulation will track the voltage applied, going to high fire for 5 volts. There is no 'measured value', just a tracking setpoint. Option parameters 15.0 to 15.5 are unavailable.
1	4 - 20mA operation. Set the JP1 link to 'IN'. Set the JP3 link to'30V'. This option allows for connection to a 4 to 20mA pressure or temperature sensor. The burner modulation will track the current applied, going to high fire for 20mA and low fire for 4mA. If the current goes outside the range, the burner will go to low fire. There is no 'measured value', just a tracking setpoint. Option parameters 15.0 to 15.5 are unavailable.
2	4 - 20mA operation. Set the JP1 link to 'IN'. Set the JP3 link to'30V'. This option allows for connection to a 4-20mA measured value input device such as a pressure or temperature sensor. The internal PID will be used, if selected.

Option 15.1 – Modulation input decimal places (0 to 2) LV2

This parameter specified the number of decimal places to which the measured value and setpoint are displayed. It also affects the scaling of the zero, span and safety limit – **it is vital that this parameter is set before parameters 15.2, 15,3 and 15.5**

Option parameter 15.1 value	Meaning
0	Measure value and setpoint displayed with no decimal places. Range of values is from 000 to 999.
1	Measure value and setpoint displayed with one decimal place. Range of values is from 00.0 to 99.9.
2	Measure value and setpoint 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) LV3

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.

If a 4-20mA sensor is used, this parameter should 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) LV3

This value is the measured value to be displayed when the sensor connected is at its maximum value.

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

PPC **Option 15.4** – **Setpoint control units (0 – 3) LV3**

This option selects the displayed units for setpoint and measured value.

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'

PPC **Option 15.5** - **Boiler high safety limit (0 - 999 / 0.0 - 99.9 / 0.00 – 9.99) LV3**

If a 4-20mA sensor is used, this parameter may still be configured to give a lockout when a high limit is reached. In this case, a value other than zero must be entered. ***Note: When a 4-20mA 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)***

This option parameter sets the minimum time the burner will take to modulate from low to high fire or vice versa. Note - only the modulation speed in AUTO mode is affected. The burner may modulate slower than this setting if the drive speeds dictate this at any point in the range.

Option 15.7 – **Bumpless Transfer (0 or 1)* LV3**

This parameter affects the burner operation whilst in MANUAL mode only.

Option parameter 15.7 value	Meaning
0	When the burner comes back on after going off, it will remain at low fire.
1	When the burner comes back on after going off, it will go to the last modulation rate that it was set to in manual mode and stay there.

Option 15.8 – Low before Off (0 or 1)* LV3

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

Option parameter 15.8 value	Meaning
0	The burner will turn off immediately when it is expected / required to.
1	The burner will modulate down for up to 30 seconds (or until low fire is reached) and then turn off.

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

Option 16.1 – Go back to pilot (0-15) LV3

This option allows a digital input to be configured to force the control to modulate down to low fire (if not already there) and then move to the ignition position (P2). When at P2 the ignition-prove output (LFS) comes on. The burner will continue to run at the ignition position until the digital input is removed.

This function can be used to prevent the burner from having to go off when the demand is low, meaning that it is ready to immediately respond to a sudden increase in demand (no pre-purge required).

The digital input number to use for this function is entered as the option parameter value.

Number entered in parameter 16.1	Digital input used :
0	None.
1	Input 1, PA5 to PA11 Low Voltage
2	Input 2, PA6 to PA11 Low Voltage
3	Input 3, PA7 to PA11 Low Voltage
4	Input 4, PA8 to PA11 Low Voltage
5	Do not use.
6	Do not use.
7	Not a real input. Used for custom applications.
8	Not a real input. Used for custom applications
9	Not a real input. Used for custom applications
10	Not a real input. Used for custom applications
11	Not a real input. Used for custom applications
12	Not a real input. Used for custom applications
13	Not a real input. Used for custom applications
14	Not a real input. Used for custom applications
15	Not a real input. Used for custom applications

Option 16.2 – Allow profile swap (0-16) LV3

This option performs exactly the same as 16.1 above except that when the control is at the pilot position, it will allow a fuel profile change without forcing the burner to go off. When the fuel profile selection changes, the ignition-prove output (LFS) will go off and the control will move all drives to the ignition (P2) positions on the new fuel profile. The LFS will then come back on.

Number entered in parameter 16.1	Digital input used :
0	None. Do not allow profile swap.
1	Input 1, PA5 to PA11 Low Voltage
2	Input 2, PA6 to PA11 Low Voltage
3	Input 3, PA7 to PA11 Low Voltage
4	Input 4, PA8 to PA11 Low Voltage
5	Do not use.
6	Do not use.
7	Not a real input. Used for custom applications.
8	Not a real input. Used for custom applications
9	Not a real input. Used for custom applications
10	Not a real input. Used for custom applications
11	Not a real input. Used for custom applications
12	Not a real input. Used for custom applications
13	Not a real input. Used for custom applications
14	Not a real input. Used for custom applications
15	Not a real input. Used for custom applications
16	Always ON. Always allow profile swap.

Option 18.1 to 18.4 – **Low Voltage Fail-safe Alarm / Lockout Inputs (0 – 360) LV3.**

These functions are all fail-safe and may be used to lockout or shutdown the burner.
The fault number generated always relates directly to the input that caused the fault (by going open circuit). Thus F1 comes from input 1, F2 comes from input 2 and F4 comes from input 4.
The lockout functions themselves are activated by putting a number into option parameters 18.1 to 18.4 for inputs 1 to 4. 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 lockout the burner and shows on the display as 'FXX'. Manual intervention (fault mute) is required to restart the burner once the fault condition has cleared. The burner will lockout 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 shutdown the burner and show on the display as 'FXX'. When the fault condition clears, this fault will change to 'CXX' and the burner will restart without manual intervention. The burner will shutdown 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. once 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 should 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 to 9 are spare and can't be selected.	**All other values will work like selection 1 (including zero). 5 to 9 are spare so new functions can be added later.**	**5** – Fault will be active after main ignition has started (status 13 onwards). Not active during post purge.
4 to 9 are spare and can't be selected.	**All other values will work like selection 1 (including zero). 5 to 9 are spare so new functions can be added later.**	**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.
4 to 9 are spare and can't be selected.	**All other values will work like selection 1 (including zero). 5 to 9 are spare so new functions can be added later.**	**All other values will work like selection 1 (including zero). 7 to 9 are spare so new functions can be added later.**

Option parameter number	Digital Input Number / Terminals	Fault number
18.1	Input 1 - PA5 to PA11, LOW VOLTAGE	F1 or L1
18.2	Input 2 – PA6 to PA11, LOW VOLTAGE	F2 or L2
18.3	Input 3 – PA7 to PA11, LOW VOLTAGE	F3 or L3
18.4	Input 4 – PA8 to PA11, LOW VOLTAGE	F4 or L4

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 when gas is selected and the main valve is open.
To set input 1 to give a second low water lockout you would enter 11 (or 1) into option parameter 18.1.
To set input 3 to give a high water alarm you would set 211 (or 200 or 210 or 201) in option parameter 18.3.
Option 19.1 to 19.4 – **Fail-safe Alarm / Lockout Display Messages LV3.**

The lockout functions are completely separate from the lockout messages. The messages are chosen from a list of 32 possible items using option parameters 19.1 to 19.4 (for inputs 1 to 4). These are the default messages, but at least some of them can be modified using serial communications and a PC.

Option parameter 19.X value	Meaning
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.
10	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 to 31	(spare)

CAUTION

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

Option 20.0 – **Set-point Select input (0 - 16) LV3**

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

Digital Input Numbers	Digital input used :
0	None. Always reads OFF.
1	Input 1 - PA5 to PA11, LOW VOLTAGE
2	Input 2 – PA6 to PA11, LOW VOLTAGE
3	Input 3 – PA7 to PA11, LOW VOLTAGE
4	Input 4 – PA8 to PA11, LOW VOLTAGE
5	Do not use.
6	Do not use.
7	Not a real input. Used for custom applications.
8	Not a real input. Used for custom applications
9	Not a real input. Used for custom applications
10	Not a real input. Used for custom applications
11	Not a real input. Used for custom applications
12	Not a real input. Used for custom applications
13	Not a real input. Used for custom applications
14	Not a real input. Used for custom applications
15	Not a real input. Used for custom applications
16	Always reads ON.

Option 20.1 – Boiler Shutdown input (0 - 16). LV3

A 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.

Option 20.2 – Low Fire Hold input (0 - 16). LV3

A 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.

Option 20.3 – Oxygen Trim Disable input (0 - 16). LV3

A high level on the input specified here will cause the oxygen trim function to switch off (if it is selected) until it is removed. The input numbers are as specified in option parameter 20.0 above. See option parameter 30.5.

Option 20.4 – Ignition Wait input (0 - 16).

A high level on the input specified here will prevent the burner from igniting. The drives stay at their ignition positions, but the light up sequence will not start until this input is removed. The input numbers are as specified in option parameter 20.0 above.

Option 20.5 – Purge Hold input (0 - 16). LV3

A high level on the input specified here will prevent the burner moving on past pre-purge. The drives stay at their purge positions, until this input is removed. The input numbers are as specified in option parameter 20.0 above.

Option 20.6 – Purge Time Start input (0 - 16). LV3

A high level on the input specified here will prevent the pre-purge time from starting. The drives stay at their purge positions, until this input is removed and the specified pre-purge time has elapsed. The input numbers are as specified in option parameter 20.0 above.

Option 20.7 – Analog Input 5 function (0 - 2). LV3

This parameter allows analog input 5 (the second modulation input) to perform specific functions.

Option parameter 20.7 Value	Digital input used :
0	This input does nothing.
1	Remote tracking input. If the control is in AUTO modulation mode accepting remote inputs, and a valid 4-20mA signal is applied, the control will modulate so as to track this input. 4mA = Low fire, 20mA = High fire. If the signal goes below 3.5mA or above 21mA, this mode will be cancelled and normal PID modulation will resume.
2	Remote Setpoint 1 Input. If the control is in AUTO modulation mode accepting remote inputs, the value of setpoint 1 can be overridden when a valid 4-20mA signal is applied to this input. The zero and span are set in option parameters 21.8 and 21.9. If deviation limits are set (see option parameter 21.5), then the high and low control limits will also move with the setpoint. If the signal goes below 3.5mA or above 21mA, this mode will be cancelled and normal setpoint 1 value will be applied.

Option 20.8 – Digital Input - Lead Boiler Select (1 - 4). LV3

This parameter selects the digital input (1-4), which selects this boiler as lead boiler.

Option 21.0 – PID (setpoint) 1 enable (0 - 1) LV1

This option parameter is used to select setpoint 1.

Option 21.1 – Set-point 1 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1

This is the control value used in the PID control loop for setpoint 1. When the control 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.

P P C **Option 21.2 –Set-point 1 proportional band (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

This is the width of the proportional band that is used by the PID control loop for setpoint 1. If the setpoint was 5.00 bar, and this term was set to 1.00, then the proportional band would be from 4.00 to 5.00 bar. A 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 setpoint is reached, then drop to low fire. Proportional control is therefore needed to prevent the measured value from overshooting.

Option 21.3 – Set-point 1 integral time (0 – 99.9 minutes) LV1

This is the integral time used in the PID control loop for setpoint 1. It may be set to any value from 0 to 999, seconds. If a value of 0 is entered the integral function is disabled, otherwise the time entered is the number of minutes the control will take to give an additional modulation change equal to that currently given by the proportional term. 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.

Integral control is required for the burner to accurately reach its setpoint.

Option 21.4 – Set-point 1 derivative time (0 – 999 seconds) LV1

This is the derivative time used in the PID control loop for setpoint 1. It may 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 boilers, but can improve the response of the modulation system to sudden load changes. Too much can cause control instability.

Option 21.5 - Setpoint 1 control limit type (0 - 2) LV3

This option parameter defines the control limit type for setpoint 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 actual limit values.
2	**Deviation limit.** The values entered in option parameters 21.6 and 21.7 represent a deviation (i.e. offset) from the setpoint 1 control value. This means that if the setpoint control value is changed, the limits are automatically changed correspondingly.

Option 21.6 - **Setpoint 1 low limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

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 - **Setpoint 1 high limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

If the boiler is on and firing, this parameter defines the measured value at which the boiler will be turned off via a controlled shutdown.

Option 21.8 – **Remote Setpoint 1 zero (4ma) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

This is the zero value for the remote setpoint function specified by option parameter 20.7.

Option 21.9 – **Remote Setpoint 1 span (20mA) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

This is the span value for the remote setpoint function specified by option parameter 20.7.

Option 22.0 – **PID (set-point) 2 enable (0 - 1) LV1**

This option parameter is used to select setpoint 2.

Option 22.1 – **Set-point 2 control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

This is the control value used in the PID control loop for setpoint 2. When the control 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) LV1**

This is the width of the proportional band that is used by the PID control loop for setpoint 2. If the setpoint was 5.00 bar, and this term was set to 1.00, then the proportional band would be from 4.00 to 5.00 bar. A 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 setpoint is reached, then drop to low fire. Proportional control is therefore needed to prevent the measured value from overshooting.

Option 22.3 – **Set-point 2 integral term (0 – 999 seconds) LV1**

This is the integral time used in the PID control loop for setpoint 2. It may be set to any value from 0 to 999, seconds. If a value of 0 is entered the integral function is disabled, otherwise the time entered is the number of seconds the control will take to give an additional modulation change equal to that currently given by the proportional term. 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.
Integral control is required for the burner to accurately reach its setpoint.

Option 22.4 – **Set-point 2 derivative term (0 - 100) LV1**

This is the derivative time used in the PID control loop for setpoint 2. It may 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 boilers, but can improve the response of the modulation system to sudden load changes. Too much can cause control instability.

Option 22.5 - **Setpoint 2 control limit type (0 - 2) LV3**

This option parameter defines the control limit type for setpoint 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 setpoint 1 control value. This means that if the setpoint control value is changed, the limits are automatically changed correspondingly.

Option 22.6 - **Setpoint 2 low limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

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 22.7 - **Setpoint 2 high limit control value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

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 22.8 – **Remote Setpoint 2 zero (4mA) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

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 22.9 – **Remote Setpoint 2 span (20mA) value (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1**

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 23.0 – Warming Enable (0 or 1) LV1

This parameter allows a warming function to be applied to the boiler, and makes option parameters 23.1 and 23.2 available. If zero is entered, no warming limit is applied.

Option 23.1 – Warming Limit (0 - 999 / 00.0 - 99.9 / 0.00 - 9.99) LV1

If, when the burner starts up and reaches modulation, the measured pressure / temperature value is lower than that specified here, the control will hold the boiler at low fire until the value specified is reached. The

control will hold the boiler 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 having once been above it, the warming function will not be re-applied. The warming function is only applied on a burner start-up.

Option 23.2 – Warming Time (0 to 999 minutes) LV1

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

Additionally, when 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.

NOTE: Further parameters (up to 29.9) may be available here if they are part of a users program or non-standard manufacturers program.

Options 24.x - Sequencing:

Sequencing (lead/lag) is managed by using the “setpoint select” function internally to choose between Setpoint 1 and Setpoint 2 via the communications bus between PPC6000’s. The “lead” or “master” boiler controls the “lag” or “slave” boiler(s) by switching them from setpoint 2 (“lag stand by” or “banking”) to the setpoint 1 values, and turns on based on Option 24.6 (lag on delay) value. The lead boiler will override the modulation rate of the last lag boiler to come on and cause it to modulate in unison with the lead (master) boiler. If both the lead (master) boiler and last lag (slave) boiler remain above the Option 24.6 value another lag (slave) boiler will be started after Option 24.7 (lag (slave) on delay) value has expired. Other lags that are on will remain at high fire until the last lag is turned off. At this point, the next lag boiler will begin to modulate with the lead (master) and so on until the lead (master) is carrying the load. The sequence in which boilers are turned on is set in Option 24.1-24.3 via communications addresses of each PPC6000. When a lead (master) boiler is deselected as lead (master) and Option 24.0 has not been changed to 0, the boiler remains as lead (master) until a new lead (master) takes control. Once the new lead (master) takes control, the previous lead (master) may be turned off based on the demand and Option 24.1-24.3 settings.

If the lead (master) boiler is turned off, or fails to come on within three minutes, while operating as the lead, sequencing will be disabled and all lag (slave) boilers will revert to their own PID settings. Should a lag boiler fail to come on within three minutes, or the PPC6000 is faulted, sequencing will immediately call for the next lag in the priority list.

If the lead (master) boiler is switched to manual modulation it will remain as lead bringing on lag (slave) boilers as required. This will allow the operator to “base load” a lead boiler if required.

The PPC6000 can be the “master” (lead) boiler in a system that has PPC5000 or NX3100/4100 series as the communications message are the same. The PPC6000 cannot be controlled by the PPC5000 or NX3100/4100 series controls as a boiler.

Stand by or Banking values

The “lag stand by” or “banking” temperature or pressure is entered as PID 2 or Setpoint 2 values however, options 22.2, 22.3, 22.4 (the P, I and D) values are unnecessary as the burner will start and remain at low fire until the “lag stand by” or “banking” cut out is reached. These values will be entered by;

1. Setting option parameter 22.0 to 1 (Enable Setpoint 2)

2. Setting option parameter 22.1 to the desired setpoint value when in stand by.
3. Setting option parameter 22.5 to 1 (Absolute Value)
4. Setting option parameter 22.6 to the desired cut in value when in stand by.
5. Setting option parameter 22.7 to the desired cut out value when in stand by.

For example: If the normal operating setpoint is 100 PSI, and the desired stand by pressure is 75 PSI. The setup would be:

Option Parameter	Setting
22.0	1
22.1	75
22.5	1
22.6	75 (cut in or minimum pressure)
22.7	80 (cut out or maximum pressure)

NOTE: When using sequencing, setpoint 2 is unavailable for use with any digital input unless the boiler is removed from sequencing completely.

Option 24.0 Sequence Slaves (number of boilers) (0-3) LV3

This option is set to 1, 2 or 3 in each PPC6000 to equal the number of lag “slave” boilers in the system. Once set, option parameters 24.1, 24.2, and 24.3 will become available. If the value is set to 0 the boiler will be taken out of sequencing and operate on its own PID. **OPTION PARAMETER 00.6 MUST BE SET TO 0 FOR SEQUENCING TO OPERATE**

Option 24.1 -24.3 Priority Number(s) LV3

The order in which boilers sequence on is entered as the communication address(s) of the boilers in **Options 24.1, 24.2 and 24.3.** The first to be turned on will have a priority number one above that of the lead boiler.

For example: If the communications address of the four boilers were 1, 2, 3, and 4 **(set in Option 0.2)**, boiler 1 master (lead), with the following entered in **Options 24.1-24.3**

Option parameter 24.x value	Comms. Address	Boiler
24.1	2	2
24.2	3	3
24.3	4	4

The sequencing order would be boiler 2, 3 and 4. If boiler 2 were set to lead via **Option 24.5,** the order would be boiler 3, 4 and 1. Setting boiler 3 to master (lead), the order would be boiler 4, 1 and 2. Other sequencing orders can be achieved by changing the communications address entered in **Options 24.1-24.3.**

Note: Communications addresses should be changed while the boilers are not in sequencing (more than one boiler on) so as not to disrupt operation.

Option 24.4 - *Reserved*

Option 24.5 – Lead (master) Boiler Select Method LV3

This option parameter selects the lead (master) boiler via the keypad, digital input or communications (Comfire 2). The values are:

0 = Not lead, operates on own PID or as commanded by master (lead)
1 = lead (master) via Keypad
2 = lead (master) via digital input. **(Digital Input Selected via Option 20.8)**
3 = lead (master) via communications such as Comfire 2.

Note: When a lead (master) boiler is deselected as lead (master) and Option 24.0 has not been changed to 0, the boiler remains as lead (master) until a new lead (master) takes control. Once the new lead (master) takes control, the previous lead (master) may be turned off based on the demand and Option 24.1-24.3 settings.

Option 24.6 - Lag (slave) On Rate (0-100%) LV3

This value determines the firing rate of the lead (master) boiler at which the first and all subsequent slave(s) (lag) boilers come on. The slave(s) (lag) boiler(s) will be delayed in coming on by the time set in **Option parameter 24.7.** At this point, the lead (master)and the will begin to modulate in unison. If the lead (master) and modulate above this point, the next as determined by priority number (**Option 24.1, 24.2, 24.3)** will be turned on. When more than one boiler is on, the master and last slave will modulate in unison while the other slaves are held at high fire.

Option 24.7 - Lag (slave) On Delay (0-999 minutes) LV3

This option sets the time delay between the modulation rate of the lead (master) boiler (and last boiler on if any) exceeding the value set in **Option 24.6** and the next being turned on.

Option 24.8 - Lag (slave) Off Rate (0-100%) LV3

When the lead (master) boiler and last boiler modulate below this modulation rate and exceed the value set in **Option 24.9,** the last turned on will be turned off. At this point, the lead (master) and the previous (if any) turned on will begin to modulate in unison until they together are below this setting. This will continue until only the lead (master) boiler remains on.

Option 24.9 - Lag (slave) Off Delay (0-999 minutes) LV3

This option sets the time delay between the modulation rate is at or below the value set in **Option 24.8** and the last turned on being turned off. This also sets the time delay between successive slaves (lag) being turned off should the modulation rate stay below the setting in **Option 24.8.**

O 2 ➡ Option 30.0 – Oxygen probe interface serial number LV3

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

When the system is in commissioning mode the serial number of all the connected devices is read by the main unit 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 oxygen probe interface options available until '0, nothing' is displayed. Enter this value to disconnect the specified device 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 device present (such as 'O2 probe'), but the commissioning engineer should be aware of which serial number device is being used for which function.

O 2 ➡ Option 30.1 - Oxygen probe calibration offset value (0 – 999) *LV3*

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.

O 2 ➡ Option 30.2 - Oxygen probe calibration gain value *(0 – 999) LV3*

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.

O 2 ➡ Option 30.3 - Oxygen probe calibration gas concentration (0.00 – 9.99%) *LV3*

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%.

O 2 ➡ Option 30.4 – Flue and inlet sensor temperature units (0 – 1) *LV3*

This option parameter is only available if option 30.0 is non zero.
This option parameter must be set 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.

O 2 Option 30.5 - Oxygen input function (0/1) *LV3*

This option parameter can only be set above 1 if option 30.0 is non zero.
Using this option parameter, it is possible 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 provide a display of the measured oxygen level.
1	**Closed loop trim.** The oxygen value is used to provide both a display of the measured oxygen level and a feedback signal for closed loop trim control function of the PPC6000 series control.

O 2 Option 30.6 - Oxygen probe calibrate enable (0 – 2) *LV3*

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

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

Option parameter 30.6 value	Meaning
0	**No calibrate.** This is the normal operating condition, where the probe is used to measure the oxygen concentration in the flue.
1	**Calibrate in air.** The probe will be calibrated for 'offset' at the normal atmospheric oxygen concentration.
2	**Calibrate in reference gas.** The probe will be calibrated for 'gain' in a reference gas with a nominal oxygen concentration the level specified in option parameter 30.3 (typically 3.0%).

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

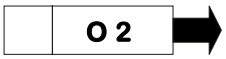
O 2 Option 30.7 - Boiler transport delay (5 – 60 seconds) *LV3*

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 may be set between **5** and **60** seconds inclusive.

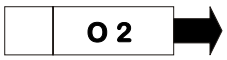
- To measure the transport delay, ignite the burner and enter adjust ratio mode. Select the low fire setpoint and allow time for the flue oxygen reading to settle. Once the oxygen reading is steady, make a step change to the fuel/air ratio and start a timer. As soon as the measured oxygen reading **begins** 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 value must be checked by the engineer.



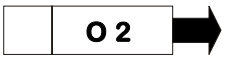
Option 30.8 - **Reset oxygen trim profile (0/1)** ***LV3*****.**

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



Option 30.9 – **Automatic trim commissioning (0 / 1) LV3**

Option parameter 30.9 value	Meaning
0	Not selected.
1	**Perform automatic trim characterization.** The control will attempt to characterize the burner profile by calculating flow values and selecting oxygen setpoints 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 control is in adjust ratio mode. • A hydrocarbon ratio has been entered for the current fuel (see option parameters 36.5 – 36.8).



Option 31.0 - **Limit Modulation Range (0 to 2)** ***LV3***

By default, the control 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). Basically, you can't take fuel or air off at low fire, and you can't add fuel or air at high fire.

This option parameter allows the engineer to overcome this limitation in one of two ways.

Firstly, the modulation range of the burner can be limited so that the burner may only modulate 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 may 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 of the boiler.

Another option, allows the control to adaptively adjust the modulation rate so that the required amount of trim can be applied. The turn down of the boiler will not normally be limited because the high and low fire positions of the trimmed drives will still be attained.

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. This setting is useful when there is extra capacity (usually air flow) available for the burner, but otherwise it will reduce the turn-down ratio of the boiler.
2	Modulation not limited, unless required for trim. Burner modulates from P_3 to P_h, but modulation will be adjusted (limited) to accommodate oxygen trim. Oxygen trim works over full range from P_3 to P_h. This setting allows oxygen trim be perform fully at all modulation positions, but may limit the displayed modulation value. The power output (and therefore turn-down ratio) should not be much affected though because the trim drives will still operate over the whole modulation range.

O 2 **Options 31.1 to 31.4 - Trim Type for profiles 1 to 4 (0 to 2) *LV3***

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

Parameter	Meaning
31.1	Trim Type for profile 1.
31.2	Trim Type for profile 2.
31.3	Trim Type for profile 3.
31.4	Trim Type for profile 4.

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

O 2 **Option 32.0 - Trim limit default (0/1) *LV3***

O 2 **Options 32.1 to 32.4 - Trim limits (0.0 – 25.0) *LV3***

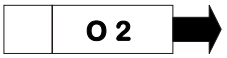
Option 32.0 is only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

It is possible for the system to trim the air or fuel drives up to a maximum deviation of ±25.0% of the total air or fuel flow for the chosen trim drives.

If option 32.0 is set to 0, the default trim limit will be ±5.0% for all profile selections. Option parameters 32.1 to 32.4 will not be available.

If option 32.0 is set to 1, it is possible to individually adjust the trim limit for each profile selection using option parameters 32.1 to 32.4. The trim limit may 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 ensure 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, option parameters 31.X should be used to setup 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%.

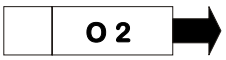


Options 33.1 to 33.4 - **Trim integral gain (0.0 – 99.9%)** ***LV3***

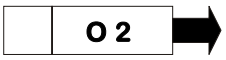
Options 33.1 to 33.4 are only available if option 30.5 (oxygen input function) has been set for closed loop oxygen trim.

In order for the oxygen trim control loop to be stable, the integral gain must be set correctly. Options 33.1 to 33.4 allow the integral gain to be set individually for each profile combination to any value between 0.0 and 99.9%. As a general recommendation, the integral gain should be initially set to 15.0%.

If the burner is firing, it is only possible to make an adjustment to the option parameter that relates to the selected profile. If the burner is not firing, the integral gain for any profile selection may be adjusted.



Option 34.0 - **Trim proportional gain default (0/1)** ***LV3***



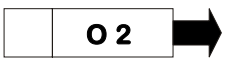
Options 34.1 to 34.4 - **Trim proportional gain (0.0 – 99.9%)** ***LV3***

Options 34.0 to 34.4 are only available if option 20.5 (oxygen input function) has been set for closed loop oxygen trim.

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

If oxygen trim proportional gain is required, set option parameter 34.0 to **1**. Option parameters 34.1 to 34.4 will then become available. Options 34.1 to 34.4 allow the loop gain to be set individually for each profile selection to any value between 0.0 and 99.9%.

Oxygen trim proportional gain is not normally required.



Option 34.5 - Calculating and entering the flow values manually – ***optional*** LV3

If the flow values are to be calculated manually, the procedure below must be followed.

Enter Adjust Ratio Mode with oxygen trim **disabled** as outlined above.

1. Select the high fire position. This will cause the display to show A(n), where n is the number of the high fire profile point.

2. Wait until the oxygen reading has stabilized, the value can be viewed using the engineer's key.

3. Record the **excess air** value at location x in the table. For single fuel profiles, this value may be found using the Engineer's Key parameter EK48 (provided the hydrocarbon ratio has been entered into the appropriate option parameter (35.1 - 35.4) for this fuel). For multiple fuel profiles, **Refer to NOTE under section Options 35.1 to 35.4**.

4. Select the profile position immediately below high fire. This will cause the display to show A(n -1).

5. Wait until the oxygen reading has stabilized and record the **excess air** value at location a_1 in the table

6. Move air dampers 1 and 2 (if fitted) **up** until they stop, so that they are at the setpoint immediately above the current position. **Do not press enter.**

7. Wait until the oxygen reading has stabilized, then record the **excess air** value at location b_1 in the table, relating to the current profile position

8. Repeat the above for all other profile positions including low fire (profile position A3), recording each time the values at locations a and b in the table. When extra air is added at P3, the time taken before the flue oxygen reading starts to increase should be measured and entered into option parameter 30.7.

9. After completing the table for all Excess Air values a and b, complete the Excess Air + 100 column, by adding 100 (i.e. $y = x + 100$, $c = a + 100$ and $d = b + 100$.

10. Complete the Ratio column by dividing c by d (i.e. $e = c/d$).

11. Complete the Airflow column by multiplying e by the previous value of f (i.e. $f_x = e_x f_{x-1}$).

12. If the system will be applying trim to the fuel, the fuel flow column must be completed. This is achieved by multiplying the airflow at each point by the ratio of excess air + 100 at high fire divided by the excess air + 100 at the actual point (i.e. $g_x = f_x(y/c_x)$).

Example of table completed for A10 (high fire) to A8. In practice, the table must be filled out down to A3 (low fire).

Profile position	**Excess Air**		**Ex. Air + 100** **y = x + 100** **c = a + 100** **d = b + 100**		**Ratio**	**Airflow**	**Fuelflow**
High fire = A***10***	X	***10***	y	***110***	----------	***99.9%***	***99.9%***
1 = A***9***	A_1 b_1	***8*** ***33***	c_1 d_1	***108*** ***133***	$e_1 = c_1/d_1$ ***0.812***	$f_1 = e_1$ (99.9) ***81.1%***	$g_1 = f_1$ (y/c_1) ***82.6%***
2 = A***8***	A_2 b_2	***9*** ***20***	c_2 d_2	***109*** ***120***	$e_2 = c_2/d_2$ ***0.908***	$f_2 = e_2$ (f_1) ***73.7%***	$g_2 = f_2$ (y/c_2) ***74.4%***

Table: Flow calculation table

Profile position	Excess Air		Ex. Air + 100 y = x + 100 c = a + 100 d = b + 100		Ratio	Airflow	Fuelflow
High fire = A	x		y				
1 = A	a_1 b_1		c_1 d_1		$e_1 = c_1/d_1$	$f_1 = e_1$ (99.9)	$g_1 = f_1$ (y/c_1)
2 = A	a_2 b_2		c_2 d_2		$e_2 = c_2/d_2$	$f_2 = e_2$ (f_1)	$g_2 = f_2$ (y/c_2)
3 = A	a_3 b_3		c_3 d_3		$e_3 = c_3/d_3$	$f_3 = e_3$ (f_2)	$g_3 = f_3$ (y/c_3)
4 = A	a_4 b_4		c_4 d_4		$e_4 = c_4/d_4$	$f_4 = e_4$ (f_3)	$g_4 = f_4$ (y/c_4)
5 = A	a_5 b_5		c_5 d_5		$e_5 = c_5/d_5$	$f_5 = e_5$ (f_4)	$g_5 = f_5$ (y/c_5)
6 = A	a_6 b_6		c_6 d_6		$e_6 = c_6/d_6$	$f_6 = e_6$ (f_5)	$g_6 = f_6$ (y/c_6)
7 = A	a_7 b_7		c_7 d_7		$e_7 = c_7/d_7$	$f_7 = e_7$ (f_6)	$g_7 = f_7$ (y/c_7)
8 = A	a_8 b_8		c_8 d_8		$e_8 = c_8/d_8$	$f_8 = e_8$ (f_7)	$g_8 = f_8$ (y/c_8)
9 = A	a_9 b_9		c_9 d_9		$e_9 = c_9/d_9$	$f_9 = e_9$ (f_8)	$g_9 = f_9$ (y/c_9)
10 = A	a_{10} b_{10}		c_{10} d_{10}		$e_{10} = c_{10}/d_{10}$	$f_{10} = e_{10}$ (f_9)	$g_{10} = f_{10}$ (y/c_{10})
11 = A	a_{11} b_{11}		c_{11} d_{11}		$e_{11} = c_{11}/d_{11}$	$f_{11} = e_{11}$ (f_{10})	$g_{11} = f_{11}$ (y/c_{11})
12 = A	a_{12} b_{12}		c_{12} d_{12}		$e_{12} = c_{12}/d_{12}$	$f_{12} = e_{12}$ (f_{11})	$g_{12} = f_{12}$ (y/c_{12})
13 = A	a_{13} b_{13}		c_{13} d_{13}		$e_{13} = c_{13}/d_{13}$	$f_{13} = e_{13}$ (f_{12})	$g_{13} = f_{13}$ (y/c_{13})
14 = A	a_{14} b_{14}		c_{14} d_{14}		$e_{14} = c_{14}/d_{14}$	$f_{14} = e_{14}$ (f_{13})	$g_{14} = f_{14}$ (y/c_{14})
15 = A	a_{15} b_{15}		c_{15} d_{15}		$e_{15} = c_{15}/d_{15}$	$f_{15} = e_{15}$ (f_{14})15	$g_{15} = f_{15}$ (y/c_{15})
16 = A	a_{16} b_{16}		c_{16} d_{16}		$e_{16} = c_{16}/d_{16}$	$f_{16} = e_{16}$ (f_{15})	$g_{16} = f_{16}$ (y/c_{16})
17 = A	a_{17} b_{17}		c_{17} d_{17}		$e_{17} = c_{17}/d_{17}$	$f_{17} = e_{17}$ (f_{16})	$g_{17} = f_{17}$ (y/c_{17})
18 = A	a_{18} b_{18}		c_{18} d_{18}		$e_{18} = c_{18}/d_{18}$	$f_{18} = e_{18}$ (f_{17})	$g_{18} = f_{18}$ (y/c_{18})
19 = A	a_{19} b_{19}		c_{19} d_{19}		$e_{19} = c_{19}/d_{19}$	$f_{19} = e_{19}$ (f_{18})	$g_{19} = f_{19}$ (y/c_{19})
20 = A	a_{20} b_{20}		c_{20} d_{20}		$E_{20} = c_{20}/d_{20}$	$f_{20} = e_{20}$ (f_{19})	$g_{20} = f_{20}$ (y/c_{20})

O 2 **Option 35.0 – Inlet temperature sensor serial number LV3**

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

When the system is in commissioning mode the serial number of all the connected devices is read by the main unit 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 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 device present (such as 'air temp'), but the commissioning engineer should be aware of which serial number device is being used for which function.

O 2 **Options 35.1 to 35.4-Hydrocarbon ratios of each fuel respectively (0.00 – 9.99) LV3**

If a display of calculated burner efficiency, or 'automatic trim commissioning' is required, the hydrocarbon ratios for the required fuels must be entered. These may be set between **0.0** and **9.99** inclusive, where the value entered is the hydrocarbon ratio x 10. For example, for a hydrocarbon ratio of 0.157, a value of **1.57** should be entered.

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.

O 2 **Options 35.5 to 35.8-Calorific values of fuels/profiles 1 to 4 respectively (0.0 – 99.9) LV3**

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

If a display of calculated burner efficiency is required, the calorific value of the required fuels must be entered. May be set between **0.0** and **99.9 MJkg^{-1}** 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. These values should be used as a guide only. If the display is required to show gross efficiency in addition to entering the gross calorific values a non zero value for the boiler radiated heat loss MUST be entered.

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

O 2 **Option 35.9** - **Boiler radiated heat loss (0.0 – 9.9%) LV3**

This option parameter is only available if option 35.0 (inlet temperature sensor) is not set to 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%**.

O 2 **Option 36.0** - **Flue temperature alarm select (0/1)** ***LV3***

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

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**, the flue temperature high and low alarms are enabled and option parameters 36.1 to 36.4 and 37.1 to 37.4 become available.

O 2 **Options 36.1 to 36.4** - **Flue temperature low alarm values (0 – 999)** ***LV3***

Using option parameters 36.1 to 36.4, it is possible to set a different flue temperature low alarm value for each profile combination. Each option parameter may 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, it is only possible to make an adjustment to the option parameter that relates to the selected profile. If the burner is not firing, the low alarm value for any profile selection may be adjusted.

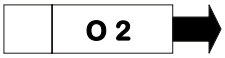
When the flue temperature drops below the low alarm value for the selected profile, a fault number will appear.

O 2 **Options 37.1 to 37.4** - **Flue temperature high alarm values (0 – 999)** ***LV3***

Using option parameters 37.1 to 37.4, it is possible to set a different flue temperature high alarm value for each profile selection. Each option parameter may 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, it is only possible to make an adjustment to the option parameter that relates to the selected profile. If the burner is not firing, the high alarm value for any profile selection may be adjusted.

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

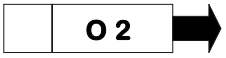


Option 38.0 - Oxygen alarm select (0 – 2) *LV3*

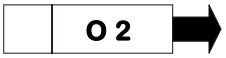
Option parameter 38.0 is only available when option **30.5** (oxygen input select) is not set to zero and the optional oxygen probe interface unit is connected.

Since the oxygen alarm values relate to the oxygen setpoint values, oxygen setpoint values must first be entered in adjust ratio mode.

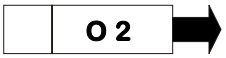
Option parameter 38.0 value	Meaning
0	**Alarms disabled.** Oxygen low and high alarms are disabled.
1	**Alarms enabled, no non-volatile lockout.** Oxygen low and high alarms are enabled and option parameters 38.1 to 41.4 will become available. If an alarm value is exceeded, a fault number will appear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



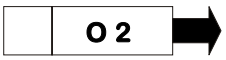
Options 38.1 to 38.4 - Oxygen low alarm values at low fire (0.0 – 99.9%) LV3



Options 39.1 to 39.4 - Oxygen low alarm values at high fire (0.0 – 99.9%) LV3



Options 40.1 to 40.4 - Oxygen high alarm values at low fire (0.0 – 99.9%) LV3



Options 41.1 to 41.4 - Oxygen high alarm values at high fire (0.0 – 99.9%) *LV3*

Using option parameters 38.1 to 41.4, it is possible to 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 interpolated between the two points. For example, if the oxygen limit has been entered as 5% of setpoint at low fire and 10% of setpoint at high fire, the limit at mid fire will be 7.5%.

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

If the burner is firing, it is only possible to make an adjustment to the option parameters that relate to the selected profile. If the burner is not firing, the alarm values for any profile selection may be adjusted.

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

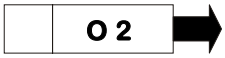
- The level drops below 0.5% O_2 for 30 seconds
- The level drops below the low alarm limit for 2 minutes
- The level drops below **twice** the low alarm limit for 30 seconds

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

When 2 probes the low alarm will also be caused by the following event:

- The difference between the oxygen values exceeds the value set in option parameter **42.4** for 2 minutes



Option 42.0 – Second Oxygen probe interface serial number LV3

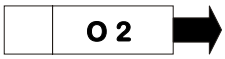
Each CANbus device connected to the system has a unique serial number allocated to it during production testing. This number cannot be changed and is used to uniquely identify each device.

When the system is in commissioning mode the serial number of all the connected devices is read by the main unit 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 oxygen probe interface options available until '0, nothing' is displayed. Enter this value to disconnect the specified device from any hardware.

The FIREYE oxygen probe and associated electronics are not fail-safe. It is for this reason that the maximum amount of oxygen trim allowed must be limited by the commissioning engineer using option parameter 32.1 to 32.4 . The trim must be limited to ensure that in the event of a probe fault (incorrect O_2 level), the combustion does not become unsafe.

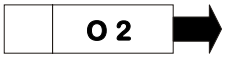
For applications demanding large amounts of oxygen trim to be applied, or where oxygen monitoring is especially critical, a second oxygen probe and controller can be selected here. The two oxygen readings from the probes can be compared when the burner is running to provide fail-safe oxygen monitoring.



Option 42.1 – Second Oxygen probe calibration offset value (0 – 999) *LV3*

This option parameter is only available if option 31.0 is non-zero.

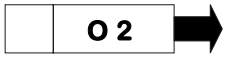
This option parameter must be set to the calibration offset value that is specified with the probe supplied.



Option 42.2 – Second Oxygen probe calibration gain value *(0 – 999) LV3*

This option parameter is only available if option 31.0 is non-zero.

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



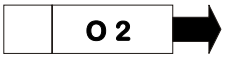
Option 42.3 – Second Oxygen probe calibrate enable (0 – 2) *LV3*

This option parameter is only available if option 31.0 is non-zero.

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

Option parameter 31.3 value	Meaning
0	**No calibrate.** This is the normal operating condition, where the probe is used to measure the oxygen concentration in the flue.
1	**Calibrate in air.** The probe will be calibrated for 'offset' at the normal atmospheric oxygen concentration.
2	**Calibrate in reference gas.** The probe will be calibrated for 'gain' in a reference gas with a nominal oxygen concentration the level specified in option parameter 30.3 (typically 3.0%).

Once this calibration has been successfully completed the values in 31.1 and 31.2 will be automatically updated.



Option 42.4 –Oxygen variation probe 1 to probe 2 *LV3*

This option parameter is only available if option 31.0 is non-zero.

This option parameter sets the maximum deviation between the oxygen values measured by the 2 separate probes before a safety shutdown occurs. The probes are checked when the burner is firing only, and the time to shutdown is 30 seconds. User intervention (i.e. fault mute) is required to restart the burner.

Option 44.0 - **Set real time clock (0/1) LV1**

Setting this option 1 enables the user to set the clock in the control used for fault logging. First set this option to 1 then adjust the options 49.1 to 49.6. When these are correct, check that this option is still at 1, then press the RUN key then the ENTER key.

Option 44.1 – Set Year (00 – 99) LV1

Option 44.2 – Set Month (1 – 12) LV1

Option 44.3 – Set Day (1 – 31) LV1

Option 44.4 – Set Hours (0 - 23) LV1

Option 44.5 – Set Minutes (0 - 59) LV1

Option 44.9 – Reset Fault Log (0 - 1) LV3

This option clears the current the fault history.
Set the option parameter to 1, then press RUN, then ENTER. The control will erase the fault history and return to run mode.

Option 45.0 - **Erase / Restore enable (0 - 1) LV3**

CAUTION

- If this value is displayed as a '2', the option parameter data has been 'up-loaded' into the control, ensure 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 all option parameters have been checked to match the requirements of the burner to which it is connected, reset this option parameter to zero to allow the system to operate.
- If an attempt is made to operate the system with this option parameter set to '2' a fault will be generated and the 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'. Once the control has left set-up mode, this parameter will automatically be 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'. Once the control has left set-up mode, this parameter will automatically be reset to '0'.

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

Option 45.1 - **Erase command (0 - 5) LV3**

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

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

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

Option 45.2 - **Restore command (0 - 999) LV3**

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 control 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 **100** is selected, **the data from the back-up data held in the display will be loaded into the main unit.**

A back-up of the data held in the main unit is automatically stored in the display when the control is in modulation status.

1.5 Commission ratio mode

1.5.1 Description

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

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

1.5.2 Using commission ratio mode

CAUTION

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

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

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

No.	Name	Comments
P0	Close	This defines the positions the motors will move to when the burner is off, and must be set to the lowest position each motor can reach.
P1	Purge	This defines the positions the motor will move to when the burner is purging, and can be set as required for each servo-motor.
P2	Ignition	Position during ignition. May be outside the normal firing range.
P3	Low fire	Low fire setpoint.
.....	.....	
Px	High fire	High fire setpoint, which is the last setpoint entered (max. P24)

The procedure for entering or modifying a profile is as follows: **Please see Appendix, Section 2.3 for suggestions on developing a profile.**

1. Enter commission ratio mode (see section 1.3.1). P0 (close) is displayed.
2. If the close setpoint has been entered before and no change is required, press **NEXT**. Otherwise, move each motor to its lowest position and press **ENTER**. P1 (purge) is displayed (flashing).
3. The controlled shutdown relay should now close (if there are no faults, and there is a call for heat – see engineers key 18). The burner controller should now apply power to the profile select input for the required profile (PE9 to PE12). If the purge position has been set before the selected motors will automatically move to their relevant P1 positions and stop, if no change is required press **NEXT**. Otherwise, move each motor to its required pre-purge position and press **ENTER**. If the purge setpoint has not been entered before move each motor to its required position and press **ENTER**. P1 (purge) is displayed. Please note that if a purge position for a particular drive has not been entered before the drive will remain at its closed position. **The engineer must ensure that the main combustion air damper is set to open enough to purge the boiler.**
4. Once P1 (purge) has been confirmed by pressing ENTER the unit will give a purge prove output. The unit will remain at the pre-purge position until it receives the request from the burner controller to move to the ignition position. If the ignition setpoint has been entered before, the drives will move to their ignition positions and once all drives stop moving P2 (ignition) will be displayed, if a change is required or the ignition setpoint has not been entered before, move all the motors being used to their required ignition positions and press **ENTER**.
5. **To attempt ignition of the burner, hold down the NEXT key for approximately three seconds, this will give an ignition prove output to the burner controller.** If it is wished to change the ignition position adjust the relevant drive(s) and press **ENTER**, if the position is acceptable press **NEXT**. **Once the unit receives the request to modulate from the burner controller P3 will be displayed.**
6. If the low fire setpoint has been entered before and no change is required, press **NEXT**. Otherwise, move each drive to the required low fire position and press **ENTER**. P4 (next profile setpoint above low fire) is displayed.
7. Repeat step 6 for each required profile setpoint, up to a minimum of P4 and a maximum of P23.
8. Leave commission ratio mode. The last profile setpoint entered will become the high fire setpoint.
   - If a controlled shutdown occurs, the control will return to step 2. The setpoints entered in the current commissioning session are not lost and the **NEXT** key may be used to step through the start-up sequence and fire the burner.
   - If a non-volatile lockout occurs, the setpoints are kept in the same way as for a controlled shutdown. It will be necessary to remove all faults before moving further than step 2.
   - If power is removed from the controller the setpoints entered in the current commissioning session will be lost.

1.5.3 Leaving commission ratio mode

Commission ratio mode → RUN ENTER → **Run mode**

To leave commission ratio mode and return to run mode, press the key labeled **RUN** followed by the key labeled **ENTER.**

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

1.6 Adjust ratio mode

1.6.1 Description

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

- Using adjust ratio mode, it is possible to modify the motor positions for any setpoint in the firing range from low to high fire (P3 and higher).
- It is also possible to view all setpoints (P0 and higher), even with the burner off.
- The setpoints may be chosen in any order.
- It is **not** possible to modify any motor position so that it is higher than the high fire setpoint.
- It is **not** possible to modify the close, purge or ignition positions (P0, P1 or P2 respectively). For this, commission ratio mode must be used.

1.6.2 Entering adjust ratio mode

To enter adjust ratio mode, turn the burner on. Once the burner begun its startup sequence, press the key labeled **COM** and obtain the adjust ratio passcode value using the **UP/DOWN** keys. Once the correct passcode value has been obtained, press the key labeled **ENTER**.

If the entered passcode was correct, ‘A n’ will be seen on the display, where n is the number of the setpoint currently under adjustment.

1.6.3 Using adjust ratio mode

CAUTION

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

- To adjust the position of a servo-motor or inverter, select the relevant drive and use the **UP/DOWN** keys.
- To change the setpoint being modified, using the scroll key select the setpoint and then use the **UP/DOWN** keys.

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

No.	Name	Comments
A0	Close	The close setpoint cannot be altered in adjust ratio mode.
A1	Purge	The purge setpoint cannot be altered in adjust ratio mode.
A2	Ignition	The ignition setpoint cannot be altered in adjust ratio mode.
A3	Low fire	Low fire setpoint.
.....	.....	
Ax	High fire	High fire setpoint, which was the last setpoint entered (max P24)

The procedure for modifying a setpoint is as follows :

1. Enter adjust ratio mode. ‘A n’ is displayed in the window, where n is the number of the setpoint that is closest to the current firing position.
2. Use the scroll key to select the setpoint and use the **UP/DOWN** keys to move to the setpoint in the firing range to be altered.
3. Wait for the ‘A n’ display to stop flashing and modify the drive(s) as required.
4. If the modified positions are not required, press the **NEXT** key to return the drive(s) to their original positions or use the scroll key to move to a different setpoint.
5. Press the **ENTER** key to store the new drive positions for the current setpoint.
6. Repeat steps 2-5 as required. Each time step 5 is completed, the new positions will be stored permanently.
7. Leave adjust ratio mode.

If the ‘A n’ display is flashing, it will not be possible to adjust the position of any of the drives. This may be for one of the following reasons :

- The burner is not firing. Switch the burner on and wait for the control to begin modulating.
- The current setpoint is A0, A1 or A2. Use commission ratio mode to adjust these setpoints.

- The drive(s) are moving to the required positions. Wait for the drive(s) to stop moving.

1.6.4 Leaving adjust ratio mode

Adjust ratio mode → [RUN] [ENTER] → **Run mode**

To leave adjust ratio mode and return to run mode, press the key labeled **RUN** followed by the key labeled **ENTER**.

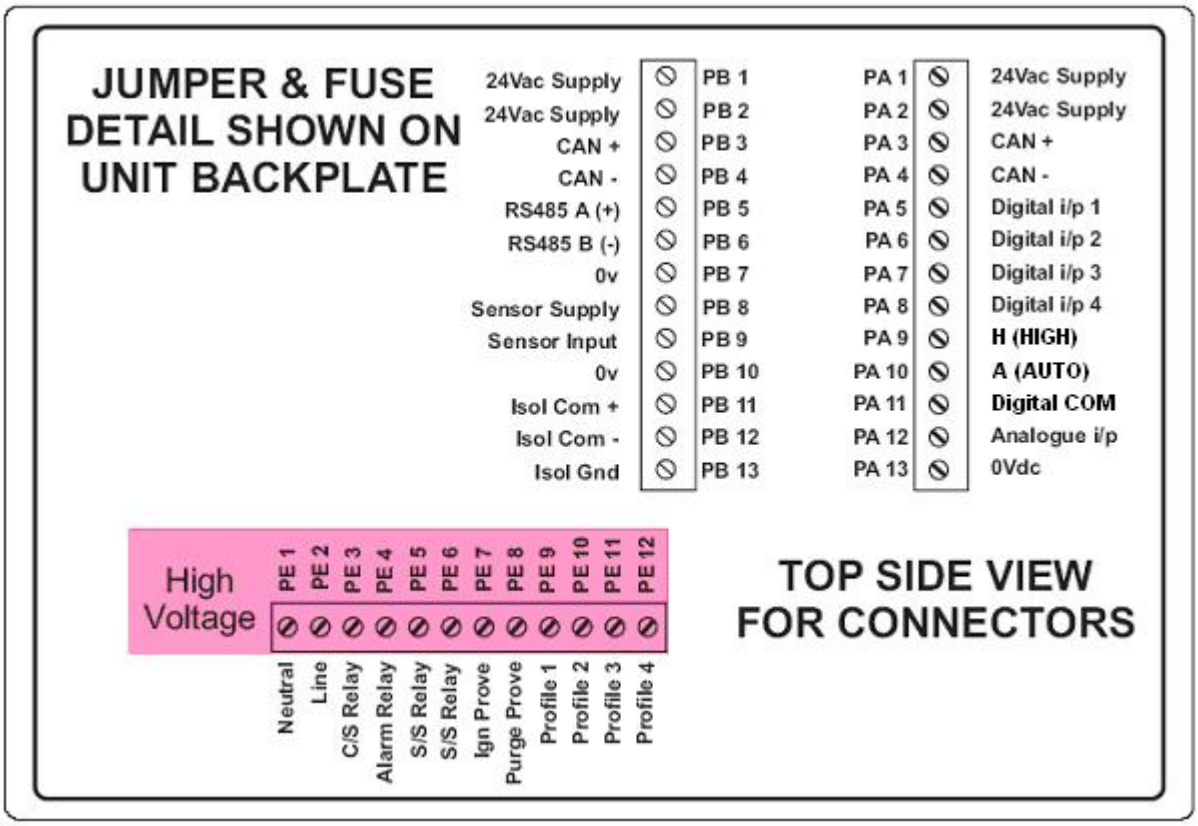
1.7 Interrogating the software issue

There are two methods for finding the software issue :

1. From run mode, press the **COM** key.
2. Use the engineer's key. Refer to Fireye bulletin PPC-6001 section 6.6 for details.

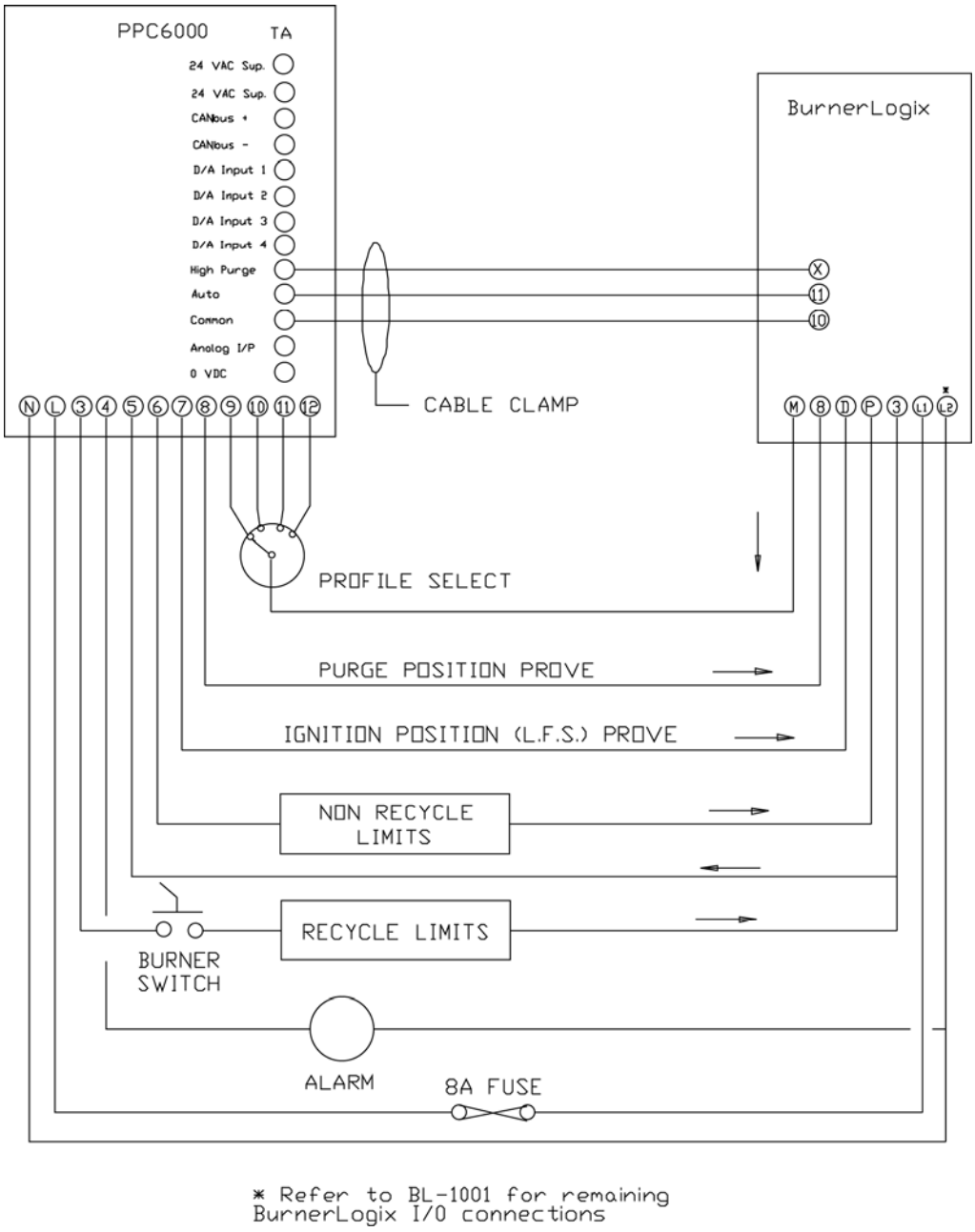
2 Appendix

2.1 Terminal Designation



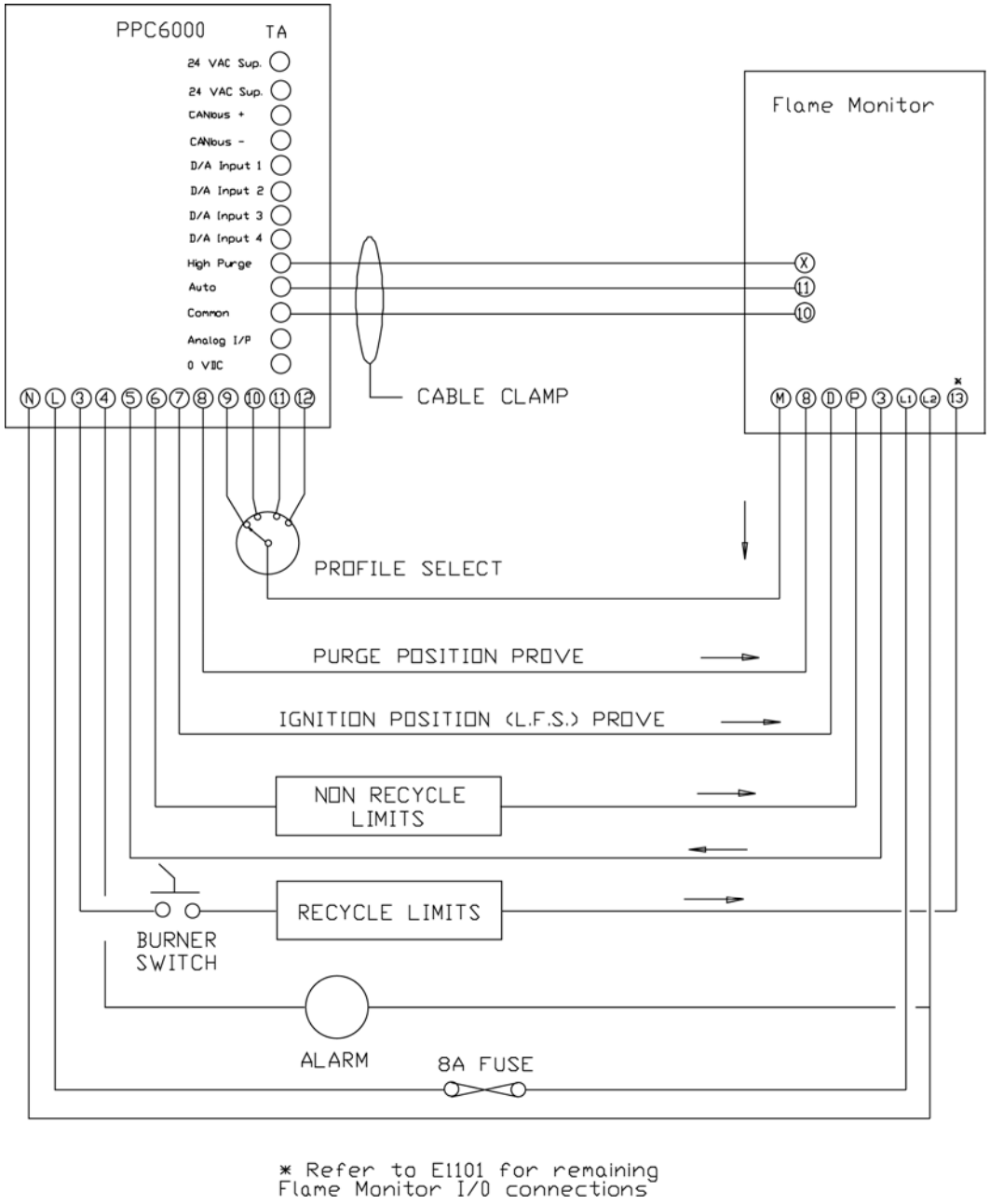
Note: All wiring to terminals “PA & PB” are low voltage and must be braided shielded wire per table 2.6.1A of Fireye Bulletin PPC-6001. Wiring to terminals “PE” are line voltage. The maximum wire size is 16AWG (19.3mm) for all terminals.

2.2 Typical Wiring Diagram / BurnerLogix



* Refer to BL-1001 for remaining BurnerLogix I/O connections

Typical Wiring Diagram / E110 Flame Monitor



2.3 Combustion Profile Setup Guideline

It is safe to say that most burners do not have fuel and air control devices that have linear flow characteristics. When commissioning the Fireye Nexus/PPC parallel positioning system, the following procedure will help assure the maximum benefit will be realized. Before starting the installation, the commissioning engineer should try to verify the maximum combustion air damper (flow) position so as to know the "target" high fire position. This can be done by rotating the original jack shaft before it is removed and measuring the air damper opening. If possible, it should be marked for reference.

There are 24 points available for creating a profile, P0 (closed/off) to P23 (high fire). The first three positions, P0, P1&P2 are required to reach ignition which may or may not be the same as low fire (P3). After establishing a good low fire and entering the values at P3, the display will now indicate P4 with the drives at the P3 position. At this time the main air drive or drives should be increased a minimum of one degree or until the observed oxygen level increases approximately 1.0 to 2%, **do not press enter at this time**. At this point the fuel drive should be increased slowly to bring the oxygen level back down to the desired level and entered at this time. Following this procedure from low to high fire will yield a relatively linear profile. That is to say, each position will increase the fuel and air flows by nearly equal amounts from low to high fire, thus making the profile somewhat linear. This will aid in setting up O2 trim.

The PPC6000's **Engineers Key 44 (see section 6.6)** displays the actual O2 value of the Fireye oxygen probe when fitted. It should be noted that the reading of the Fireye probe will be between 1 and 1.5% **lower** than most portable combustion analyzers. This is normal and due to the difference between wet and dry samples. Bear in mind the PPC6000 will trim to the value of the Fireye probe, not to the value of a portable analyzer.

For example:

Position	Air Drive	Fuel Drive	Observed O2%	Increased O2%
P3	5.0	15.0	7.0	9.0
P4	7.5	18.0	7.0	9.0
P5	12.0	22.0	6.0	8.0
P6	17.0	28.0	5.0	7.0
P7	24.0	33.0	4.0	6.0
P8	29.0	38.0	4.0	6.0
P9	35.0	45.0	4.0	6.0
P10	43.0	55.0	3.5	5.0
P11	53.0	67.0	3.5	5.5
P12	66.0	79.0	3.5	5.0
P13	80.0	88.0	3.5	High Fire

NOTE: The angular change in the air drive position required to achieve the 1.0 to 2.0% increase in observed oxygen level may increase as the burner fires at higher rates. This is normal as the air "damper" will not likely be linear. When approaching high fire large increases in the air drive servomotor travel may be required to increase the oxygen reading by 1.0 to 2.0%. As a rule, this should be avoided as the burner is potentially "out of air" and in so doing, the effective input to the boiler will be negligible. This would also affect the operation of oxygen trim should this option be used.

This manual may be downloaded from the Fireye web site at: www.Fireye.com, Click on "Bulletins" or search by bulletin number.

NOTICE

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

WARRANTIES

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

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