



OPERATOR'S GUIDE FOR PPC6000 SERIES

DESCRIPTION:

This document supplies the owner/operator with sufficient information to make appropriate changes to operating parameters associated with normal boiler plant needs. Items such as system setpoint adjustments e.g. temperature, pressure, PID adjustments and alarm corrective action and adjustments.

The following items are covered in this manual:

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1 Introduction

As an operator there are generally only a few items of interest as far as operating the Nexus PPC6000. They are:

- Setting the system's operating pressure or temperature.
- Adjusting the cut in or cut out value.
- Manually modulating the boiler.
- Resetting the control after a safety shut down.
- Finding the Fault that caused the shut down.

All of the other options and adjustments should be done by the combustion technician, as changes to certain parameters could result in an unsafe operating mode.

2 General

The Nexus display and keypad allows the operator (or combustion technician) access to all set points and option parameters for commissioning and operating the Nexus PPC6000. The keys are labeled with their primary function on the key, their secondary function under the key. E.g.: COM/ENTER.

Several levels of passwords protect the integrity of the control. These passwords are numbers entered by using the up/down arrow keys after pressing the COM (commissioning) key. To enter the password start by pressing the COM (commissioning) key. You will have 30 seconds to reach the password value and press the ENTER (COM) key.

3 Password

The only password an operator should require is the "site Passcode." This can be set as a number from 0-999. The factory default number is 154. The site Passcode can be changed if desired, however, this requires the use of a higher-level Passcode.

Warning: Should the Passcode be changed and forgotten, the PPC6000 will have to be reprogrammed by using the higher-level Passcode. Until then, no adjustments are possible.

Operating Pressure – PID (set point) 1 or (2)*

*** NOTE: () Parentheses indicate set point 2 option parameter. E.g. Day/night.**

To set or adjust the boiler's operating pressure follow steps 1 thru 7:

1. Press the **COM** key.
2. Use the **UP** key to raise the value to **154** (or new Site Passcode, if changed).
3. Press the **ENTER** key. This is the same key as **COM**.
4. If the display shows the angular positions of the servomotors, press the **MODE** key to change to option parameters. Using the up or down key move to **OPTION 21.1 (22.1)**. This is the control value the Nexus will modulate the burner to maintain.
5. Use the left or right arrow key to move the cursor to the lower portion of the display, then using the up/down arrow key change the setting.
6. Press the **ENTER** key to accept the new set point.
7. To exit and return to the normal run mode, press the **RUN** key followed by the **ENTER** key.



Note: The next time you enter the site password you will return to the last option selected.

4 Adjusting Cut IN and Cut OUT

Follow steps 1 through 3 above.

- If the display shows the angular positions of the servomotors, press the **MODE** key to change to option parameters. Using the up or down key, move to **OPTION 21.6 (22.6) for Cut In** or **21.7 (22.7) for Cut Out**. This is the control value the Nexus will start/stop the burner after reaching the cut in/out value. This value is a differential value when option parameter 21.5 (22.5) is set at 2. That is, it is subtracted/added from/to the operating set point. Once set, this value will follow any change in the set point programmed in option 21.1 (22.1). These values are actual values if 21.5 (22.5) are set to 1. (see table below)

Option parameter 21.5 (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 21.6 (22.6) and 21.7 (22.7) are the actual limit values.
2	Deviation limit. The values entered in option parameters 21.6 (22.6) and 21.7 (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.

- Use the left or right arrow key to move the cursor to the lower portion of the display then - using the up/down arrow key, change the setting.
- Press the **ENTER** key to accept the new set point.
- To exit and return to the normal run mode press the **RUN** key followed by the **ENTER** key. See two examples below:

Deviation Example:

```

Opt 21.1 (22.1)* .....set to..... 100 psi
Opt 21.5 .....set to..... 2
Opt 21.6 (22.6)* .....set to..... 10
Opt 21.7 (22.7)* .....set to..... 10

Cut Out ..... 110 psi
Set Point ..... 100 psi
Cut In ..... 90 psi

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New Set Point 60 psi

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Cut Out ..... 70 psi
Set Point ..... 60 psi
Cut In ..... 50 psi

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Absolute Example:

Opt 21.1 (22.1)* set to 100 psi
Opt 21.5 set to 1
Opt 21.6 (22.6)* set to 110
Opt 21.7 (22.7)* set to 90

Cut Out..... 110 psi
Set Point..... 100 psi
Cut In..... 90 psi

New Set Point 60 psi

Cut Out..... 110 psi
Set Point..... 60 psi
Cut In..... 90 psi

NOTE: NEW Cut In and Cut Out values may need to be entered to achieve desired results.

5 Manual Modulation

Pressing **AUTO/MAN** key toggles the burner in and out of manual or automatic modulation. To place the boiler in manual from automatic no password is required.

1. Press the **AUTO/MAN** key
2. Use the up/down arrow keys to set the firing rate.
3. Press the **AUTO/MAN** key again to place in automatic

Note: The firing rate will be shown on the display. This function can be disabled via option parameter 1.1. To do so requires the suppliers (highest) passcode.

6 Resetting the Control

To reset the Nexus, the **MUTE/RESET** key will have to be pressed and held for three seconds to first silence (mute) the alarm and then a second press for three seconds to clear the fault. A prolonged key press will do both.

If for some reason the Nexus detects a fault, the cause of the fault will be displayed if still present. If not displayed, pressing the **ENGINEERS** key once will reveal the fault, a second press will reveal the fault and subset in the upper right hand corner. The **ENGINEERS** key is hidden behind the Fireeye® logo on the display. Pressing the logo will show the EK # to the right of which will be the fault # and any subset. Using the up/down arrow keys scrolls through the EK #'s to view other information.

Engineer's key parameter list

No.	Name	Description
EK1	Low Voltage Digital Input 1 (PA5–PA11)	Shows the state of each input.
EK2	Low Voltage Digital Input 2 (PA6–PA11)	Where : 0 = OFF (Open circuit) 1 = ON
EK3	Low Voltage Digital Input 3 (PA7–PA11)	
EK4	Low Voltage Digital Input 4 (PA8–PA11)	
EK5	Low Voltage 'HIGH' input (PA9–PA11)	
EK6	Low Voltage 'AUTO input (P10–PA11)	
EK11	Profile 1 Select – Line Voltage (PE9)	
EK12	Profile 2 Select – Line Voltage (PE10)	
EK13	Profile 3 Select – Line Voltage (PE11)	
EK14	Profile 4 Select – Line Voltage (PE12)	
EK16	Warming limit	
EK18	Boiler status	0 - Burner will not fire because the temperature / pressure measured value has exceeded the high control value. 1 - Burner will fire because the temperature / pressure measured value has fallen below the low control value.
EK19	Confirm to adjust	0 - Control not in commission mode or control is in commission mode and drives moving to setpoints. 1 - Control in commission mode and drives may be adjusted using the UP/DOWN keys.
EK20	Drive moved	0 - Control not in commission mode or control is in commission mode and drives have not been moved using the UP/DOWN keys. 1 - Control in commission mode and drives have been moved using the UP/DOWN keys.



No.	Name	Description
EK21	Positions proved	0 - Drives have stopped moving, ready for position prove test. 1 - Ready for position prove test but drives still moving.
EK22	Fault alarm	0 – No un-muted alarms (faults) present. +1 - Un-muted fault alarm present (prefix : F) +2 - Un-muted limit alarm present (prefix : L) +4 – Un-muted flue-monitoring alarm present (faults 50 to 59).
EK23	Oxygen Trim Enable	0 – Oxygen trim off or not working. 1 – Oxygen trim on and working.
EK25	CAN_TX Failures	A count of the number of times the can bus controller has failed to send a message since power-up. This should be zero unless there has been a problem.
EK26	Commission status	Current commissioning mode, where : 0 - Normal run mode. 1 - Adjust ratio mode. 2 - Commission ratio mode.
EK27	Commission setpoint	The current setpoint being commissioned. 0 - Closed setpoint. 1 - Purge setpoint. 2 - Ignition setpoint. 3 - Low fire setpoint. 4 - 24 - profile setpoints
EK28	Commission Setpoints entered	The number of setpoints that have been successfully entered during this commission ratio session.
EK29	Modulation rate (%)	The current modulation rate of the burner. 0 = Low Fire 100 = High fire
EK30	Burner Status	Status of the start-up sequence. See section 4.2 of Fireeye Bulletin PPC-6001
EK31	Fuel Profile Selected	The currently selected fuel profile.



No.	Name	Description
EK32	Number of commission setpoints	The number of setpoints entered in the current commission ratio session : 0 - No setpoints entered. 1 - Close setpoint only. 2 - Close and purge setpoints. 3 - Close, purge and ignition. 4 - 24 - profile setpoints.
EK33	Modulation mode	The current modulation mode : 0 - Auto mode. 1 - Manual from external input. 2 - Manual from keyboard. 3 - Boiler sequencing control. 4 - Low fire hold.
EK36	Nearest setpoint	The number of the profile setpoint which is nearest to the current modulation position.
EK37	Voltage reference error (V)	The error between the measured voltage reference and the calibrated value. 0.12 is the limit. The displayed value shows volts NOTE: If value goes to 0.13, F19 will be generated.
EK38	Boiler Sequencing Status	Currently unused.
EK39	Fuel Swap Status	Currently unused.
EK40	Shutdown setpoint	The nearest setpoint (EK36) when the burner last locked out.
EK42	Adjust ratio counter	The number of times adjust ratio mode has been used.
EK43	Commission ratio counter	The number of times commission ratio mode has been used.
EK44	Oxygen measured value	The current flue oxygen value as measured by the FIREYE probe (if fitted).



No.	Name	Description
EK45	Oxygen probe status	+1 - Internal fault. +2 - Internal fault. +4 - Heater fault. Causes F50. +8 - Cell temperature out of range. +16 - Cell millivolts out of range. +32 - CANbus error. +64 - Probe calibrating in reference gas. See option parameter 30.6. +128 - Probe calibrating in air. See option parameter 30.6.
EK46	Oxygen trim status	0 - O ₂ trim working, or +1 – no oxygen interface connected. +2 – no oxygen probe serial number entered, or option 30.5 not 1, or option 30.8 not 0 or trim not selected via aux input or trim not selected via serial comms +4 – O ₂ setpoints or flow values incorrect +8 - Option 30.6 not 0 +16- Not modulating +32- In commission mode +64- Probe faulty (see EK45)
EK47	Oxygen setpoint (%)	Current oxygen setpoint. This is only available if trim is enabled and working.
EK48	Excess air (%)	Excess combustion air at the current firing position.
EK49	Oxygen error (%)	Error between O ₂ measured value and O ₂ setpoint.
EK50	Trim deviation (% flow)	Deviation in air flow imposed by trim (-25 to +25%)
EK55	Main PCB issue	The issue number of the main circuit board.
EK57	CPU serial number (low 3 digits)	The 6 digit CPU board serial number. The serial number is displayed in 2 blocks of 3 digits.
EK58	CPU serial number (low 3 digits)	



No.	Name	Description
EK59	Digital (relay) outputs on.	<p>Represents which drives are currently at their setpoints, where:</p> <p>0 – All drives are at their setpoints and are not moving.</p> <p>Non- zero – One or more drives are not at their setpoint.</p>
EK60	Spare	<p>The combination of digital outputs currently switched on.</p> <p>+1 : Digital Output 1 ON. Display, PR6(COM), PR7(NO), PR8(NC). Low voltage or line voltage.</p> <p>+2 : Digital Output 2 ON. Display, PR6(COM), PR4(NO), PR5(NC). Low voltage or line voltage.</p> <p>+4 : Digital Output 3 ON. Display, PR1(COM), PR2(NO), PR3(NC). Low voltage or line voltage.</p> <p>+8 : Digital Output 4 ON. Main Unit, PE4 (line voltage out).</p> <p>+16 : Digital Output 5 ON. Not implemented.</p> <p>+32 : Digital Output 6 ON. Not implemented.</p> <p>+64 : Digital Output 7 ON. Daughterboard, PZ15 – PZ16. LOW VOLTAGE AND CURRENT ONLY.</p> <p>+128 : Digital Output 8 ON. Daughterboard, PZ17 – PZ17. LOW VOLTAGE AND CURRENT ONLY.</p>
EK61	Analog Input 1. Main Unit Terminal PB9 (also boiler measured value).	<p>The raw ADC counts from analog input 1.</p> <p>0 to 1023 for 0 to 5.00 volts.</p>
EK62	Analog Input 2. Main Unit Terminal PA12 (also remote setpoint).	<p>The raw ADC counts from analog input 2.</p> <p>0 to 1023 for 0 to 5.00 volts.</p>
EK67	Analog input 7. Daughterboard terminal PZ12(-) PZ13(+). Also VFD1.	<p>The raw ADC counts from analog input 7.</p> <p>0 to 1023 for 0 to 5.00 volts.</p>
EK68	Analog input 8. Daughterboard terminal PZ13(-) PZ14(+). Also VFD2.	<p>The raw ADC counts from analog input 8.</p> <p>0 to 1023 for 0 to 5.00 volts.</p>
EK69	Daughter board Frequency input 1 (PZ7). 0 to 12 volts.	<p>Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.</p>



No.	Name	Description
EK70	Daughter board Frequency input 2 (PZ9). 0 to 12 volts.	Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.
EK71	Daughter board Frequency input 3 (PZ11). 0 to 12 volts.	Gives the measured frequency in Hz on this input. If the input is not changing, this value will be 0 for OFF (open circuit) and 1 for ON.
EK72	Oxygen probe cell temperature.	The temperature of the zirconia cell inside the FIREYE oxygen probe, if fitted. This value should be very close to 650°C for accurate operation.
EK73	Ambient temperature.	The temperature measured by the inlet temperature sensor, if fitted. Units are °C/°F per Option 30.4.
EK74	CPU utilisation.	The percentage utilisation of the CPU. Should be less than 95% at all times.
EK75	Longest task time.	The current longest internal software task time. This is provided for manufacturers diagnostics only and may be removed in future versions.
EK76	Longest task number.	The current longest internal software task number. This is provided for manufacturers diagnostics only and may be removed in future versions.
EK77	Last program byte address.	This is the length of the currently running user / manufacturers program. If a user program is selected, this should match the program length given by the 'abacus' software.
EK78	Software issue.	The current revision of the main product firmware.
EK79	EEPROM writes counter.	The number of writes to (any) EEPROM since the unit powered up. This is provided for manufacturers diagnostics only and may be removed in future versions.
EK80 to EK89	Drive Error values for drives 0 to 9.	The current error value for drives 0 to 9. These values will freeze when the control performs a safety shutdown, so it may be possible to look at these values after a lockout to help determine the cause.



7 Fault and Fault Finding

Should the Nexus determine a fault has occurred that required the burner be shut down, the bottom portion of the display will indicate the cause. Pressing the **ENGINEERS** key will display more information, which will be found in the upper right of the display. See Section 6.0 of Fireeye Bulletin PPC-6001 for more details. Using the **ENGINEERS** key the last 33 faults or limits can be reviewed. The fault history begins with the most recent which can be found after **EK200** and will be date and time stamped. There are three aspects to each record; when it was reset, when it changed from a fault to a cleared fault and when the fault occurred. The portion of the record at the "**Fxx**" will also include the subset if any. **See Fault Subsets.**

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

All fault numbers are prefixed by a letter. This letter describes the status of the fault:

- F - This means that a fault (e.g. PSU calibration fault) has occurred and is still present. The fault may be internal or external to the unit.
- L - This means that an alarm limit fault (e.g. smoke level exceeding the high limit) has occurred and is still present.
- C - This means that a fault or alarm limit did occur but has been cleared.

For example:

- F60 - Means fault 60 has occurred and still exists.
- L75 - Means alarm limit 75 has been exceeded and is still being exceeded
- C73 - Means fault or alarm limit 73 has occurred but has subsequently been cleared.

When the unit is in a safety shutdown state both the controlled shutdown triac and safety shutdown relay will be turned off, to prevent the burner from firing.

8 Fault subsets

As an aid to fault finding, most faults have a *fault subset* that gives additional information about the type of fault or what the burner was doing when the fault occurred. Where applicable, the subsets are given in the fault listing in section 6 - Faults and Fault Finding, of Fireeye Bulletin PPC6001. For details of how to view a subset, refer to Section 6.0 of this bulletin or Fireeye Bulletin PPC6001.

9 Fault listing

Fault Number	Cause	Description
F01	External Alarm Fault 1	See Option parameters 19.1 to 19.4.
F02	External Alarm Fault 2	<i>Subset : burner status.</i>
F03	External Alarm Fault 3	
F04	External Alarm Fault 4	
F18	Not enough setpoints entered	<p>A fuel/air ratio profile has been selected which does not have at least four setpoints commissioned.</p> <ul style="list-style-type: none"> • Use commission ratio mode to enter more setpoints. <p><i>Subset : fuel code</i></p>
F19	Circuit board voltage reference fault	<p>The circuit board has an incorrect on-board reference level.</p> <ul style="list-style-type: none"> • Ensure ALL analog inputs (4-20mA, 0 – 5v) are in the range 0 to 5.0 volts. It is critical that none of the inputs are higher than 5.0 volts. • If the problem persists even when all analog inputs are disconnected, check EK37 and contact supplier. <p><i>Subset : +1 out of range, +2 zero check failed, +4 span check failed.</i></p>



Fault Number	Cause	Description
F20	Drive 0 position fault	A drive-positioning fault has occurred, which will cause a non-volatile lockout of the burner. This fault has occurred for one of the following reasons:
F21	Drive 1 position fault	1. During close position prove, when a drive stops at a position that is outside the close set position by more than five degrees.
F22	Drive 2 position fault	2. During purge position prove, when a drive stops at a position that is outside the purge set position by more than five degrees.
F23	Drive 3 position fault	3. During pre-purge, ignition or post-purge, when a drive moves from its setpoint.
F24	Drive 4 position fault	4. During modulation, when a drive is not at its correct setpoint as defined by the commissioned fuel/air ratio for the selected profile.
F25	Drive 5 position fault	A drive is defined as having moved from its setpoint if its positional error is more than 1° for 15s, or more than 5° for 1s. For positional errors between 1° and 5°, the detection time is variable between 15s and 1s.
F26	Drive 6 position fault	Note : Only the selected drives are checked. The other drives are ignored.
F27	Drive 7 position fault	<i>Subset : burner status.</i>
F28	Drive 8 position fault	
F29	Drive 9 position fault	
F32	Safety input fault	One or more of the fail-safe low voltage inputs is registering a fault. <i>Subset : Combination of failed inputs.</i>
F33	Burner input fault	One or more of the high voltage (profile select) inputs is registering a fault. <i>Subset : Failure mode.</i>
F34	Primary relay fault	One or more of the internal relays is not responding correctly. <i>Subset : Failed Relay.</i>



Fault Number	Cause	Description
F35	ADC fault	<p>One of the internal checks on the analog to digital converter has failed.</p> <p><i>Subset : Failure mode.</i></p>
F37	RAM test fault	<p>The main memory in the control has malfunctioned.</p> <ul style="list-style-type: none">• Interrupt power to the control.• This could be due to high levels of electrical interference getting into the product. Check all cables are correctly screened, and screens are terminated correctly. Ensure the mains supply is not excessively noisy.• If this fault persists, the control must be returned to the supplier. <p><i>Subset : Failed Page.</i></p>
F38	Program memory CRC fault	<p>The program memory in the control has been corrupted.</p> <ul style="list-style-type: none">• Interrupt power to the control.• This could be due to high levels of electrical interference getting into the product. Check all cables are correctly screened, and screens are terminated correctly. Ensure the mains supply is not excessively noisy.• If this fault persists, the control must be returned to the supplier. <p><i>Subset : Failed Page.</i></p>
F39	Profile table CRC fault	<p>The profile table memory in the control has been corrupted.</p> <ul style="list-style-type: none">• Interrupt power to the control.• Erase the system using option parameter 45.1 = 5 and re commission (or restore with option parameter 45.2).• This could be due to high levels of electrical interference getting into the product. Check all cables are correctly screened, and screens are terminated correctly. Ensure the mains supply is not excessively noisy.• If this fault persists, the control must be returned to the supplier. <p><i>Subset : Failed Page.</i></p>



Fault Number	Cause	Description
F41	Boiler safety limit exceeded	<p>The boiler's measured value has exceeded the pressure/temperature safety limit.</p> <p><i>Subset : 4 - safety limit exceeded</i></p>
F44	Burner not OFF.	<p>This fault will lock the burner out if the AUTO input (PA10 – PA11) is made when the control thinks the burner should not be firing. It will also occur if the AUTO input stays ON for three seconds after this control has opened the 'controlled shutdown relay' – i.e. tried to turn the burner off.</p> <p><i>Subset : burner status.</i></p>
F46	EEPROM memory CRC fault	<p>The EEPROM memory in the control has been corrupted. This memory is used to store the option parameters,</p> <ul style="list-style-type: none"> • Interrupt power to the control. • Erase the system using option parameter 45.1 = 5 and re commission (or restore with option parameter 45.2). • This could be due to high levels of electrical interference getting into the product. Check all cables are correctly screened, and screens are terminated correctly. Ensure the mains supply is not excessively noisy. • If this fault persists, the control must be returned to the supplier. <p><i>Subset : Failed Page.</i></p>
F50	Oxygen probe heater fault	<p>The probe heater has failed to heat to the correct temperature after 30 minutes of system power up.</p> <ul style="list-style-type: none"> • Is the probe heater wiring correct? • Is the probe cell thermocouple wiring correct? <p>Once the fault is rectified, it will be necessary to interrupt the power to the oxygen probe interface to make it attempt to heat the probe once more.</p> <p><i>Subset: O2 probe status.</i></p>
L52	Oxygen low limit alarm	<p>The oxygen level measured value is below the oxygen setpoint low alarm value for the current profile.</p> <p><i>Subset: 0 = Limit violation, 1 = Probe Failed.</i></p>



Fault Number	Cause	Description
L53	Oxygen high limit alarm	The oxygen level measured value has exceeded the oxygen setpoint high alarm value for the current profile. <i>Subset: 0 = Limit violation, 1 = Probe Failed.</i>
L55	Trim limit alarm	The trim drive has reached the allowed maximum deviation limit. <ul style="list-style-type: none">• Change trim limit.• Re-commission fuel / air ratio. <i>Subset : Not applicable.</i>
F57	Auto trim commissioning fault	The measured oxygen level exceeded 15.0% during auto trim commissioning. The burner is shutdown. <i>Subset : Last auto trim commission setpoint (+32 if adding air).</i>
L58	Flue temperature low alarm value exceeded	The measured flue temperature is below the low alarm value for the current profile, or the flue thermocouple is faulty. <i>Subset : Not applicable.</i>
L59	Flue temperature high alarm value exceeded	The measured flue temperature has exceeded the high alarm value for the current profile. <i>Subset : Not applicable.</i>
F60 – F69	User Faults	These fault numbers are generated by the user programmable section of the control and will vary with the application.



Fault Number	Cause	Description
F74	Profile Invalid	<p>This fault means that the control can't fire the currently selected profile because it isn't sure it still matches the burner / site configuration. It could lead to a hazardous situation.</p> <p>There are three possible causes to this fault :</p> <p>1 – A drive has been commissioned in this profile but has now been deselected. If a profile is commissioned with two air dampers but then the second air damper is de-selected with option parameter 4.0 to 4.9, obviously the profile is no longer valid.</p> <p><i>Subset : Drive number (0 to 9)</i></p> <p>2 – Servo / Drive changed. If the system is commissioned then later one of the servos is changed for a new one (i.e. different serial number), any profiles that use that servo are now considered invalid. This is to force the engineer to ensure the new servo is mechanically fixed the same way as the original one.</p> <p><i>Subset : Invalid profile + 100 (101 to 104).</i></p> <p>3 – The selected profile has been uploaded from a PC, but has not been verified on this burner.</p> <p><i>Subset : Invalid profile + 100 (101 to 104).</i></p> <p>In all cases the F74 can be cleared by switching to another (good) profile, or by re-commissioning the profile in 'commission ratio' mode, making sure all points up to and including high fire are acknowledged using the 'NEXT' key (or 'ENTER' if the points are adjusted).</p>
F75	Power-up Lockout	<p>The control has locked out on power-up. This will normally be because option parameter 1.0 is set to 1.</p> <p><i>Subset :</i></p> <p><i>0 – See option parameter 1.0.</i></p> <p><i>254 – Serial EEPROM write failure.</i></p> <p><i>255 – NV Lockout verification failed.</i></p>
F77	Secondary relay fault	<p>A secondary fault has occurred with the main 1, main 2, pilot, vent or non-volatile lockout relays. If the fault persists for 23 hours, the burner will shutdown.</p> <ul style="list-style-type: none"> • Contact supplier <p><i>Subset : Failed relay number.</i></p>



Fault Number	Cause	Description
F78	Secondary program memory checksum fault	<p>A fault has occurred with the program memory in the control. If the fault persists for 11 consecutive tests then the burner will shutdown.</p> <ul style="list-style-type: none">• Contact supplier <p><i>Subset : Not applicable.</i></p>
F79	Secondary watchdog fault	<p>A fault has occurred with the CPU watchdog. If the fault persists for 11 consecutive tests then the burner will shutdown.</p> <ul style="list-style-type: none">• Contact supplier <p><i>Subset :</i> <i>1 = Late test failed.</i> <i>2 = Early test failed.</i></p>

10 PID Tutorial

PID Adjustment

The PPC6000 utilizes an advanced algorithm in order to maintain set point over a variety of load conditions. This three term PID can be infinitely adjusted to suit almost any application. The operator should have a basic understanding of the relationship between the three terms; proportional, integral and derivative.

Proportional

Typical older modulating systems employ only proportional control. This would be similar to the slide wire type found on most steam boilers. When using only a proportional control the system rarely achieves set point as the burner firing rate is lowered as the pressure comes up. At some point the input meets the actual demand and the pressure no longer raises or lowers, thus an offset between desired set point and actual operating pressure occurs. The only time the pressure and set point are the same is if the actual load equals the lowest firing rate of the burner, this is rare. An example of proportional only set up might be; Set point is 100 PSI, proportional range is 10 PSI. That is low fire is at 100 PSI, high fire is at 90 PSI with a 1:1 relationship in between, e.g.: 95PSI equals 50% rate.

Integral

If the integral term is turned on, the control compares the actual pressure against set point at an adjustable interval. If there is an offset, the firing rate is increased by a small percentage until the next interval. This will continue until the pressure equals the set point. The same routine occurs as the pressure rises above the set point. Too much or too little integral will cause over and undershoot of the set point. Integral is set in second per repeat in the PPC6000.

Derivative

Enabling the derivative has the effect of sensing the rate of change in the process variable (pressure or temperature) and increasing or holding up the firing rate output despite the integral term. This in effect amplifies the output to anticipate the effect of a sudden change in load demand. Derivative acts inversely when the set point is exceeded. Derivative is set in seconds on the PPC6000.

A rule of thumb is; start with a P value of about 10% of set point, an I value of 10 seconds and a D value of 5 seconds. After observing the operation through normal load swings adjusting each value, usually one at a time, and observing the results. When making a change it is recommended the value be doubled or halved to determine which direction you need to go. Bear in mind, the burner should not continuously hunt or swing to maintain the desired set point. It is normal for a slight over and undershoots of set point during serious load changes.

The values for the PID's are found at option parameters 21.2, 21.3 and 21.4 for set point 1 (PID1), and 22.2, 22.3 and 22.4 for set point 2 (PID2). These values are adjustable using the **Site Passcode 154**.

11 The Startup / Shutdown Stages

The startup / shutdown stages are as follows:

Stage no.	Stage name	Description
0.	Non-volatile lockout / safety shutdown	<p>The burner is held in this state until all faults are removed.</p> <p>The 'safety shutdown' output (PE5 – PE6) will be open. The 'controlled shutdown' output on PE3 will also be OFF during this time, however if the burner was running when the fault occurred, the 'safety shutdown' output will have opened first.</p>
1.	Burner off (EK18)	<p>The burner is checked to make sure that it has switched off completely. The fuel/profile select inputs must all go OFF when the burner is switched off (or at the end of post-purge). This provides a feedback to confirm that the burner is off, and ensures that this control is always synchronised with the burner controller.</p> <p>The 'controlled shutdown' output on PE3 will be OFF during this time, however the 'safety shutdown' output PE5 – PE6 will be closed during this time.</p> <p>The control will advance to status 2 when :</p> <ul style="list-style-type: none"> - All fuel/profile select inputs are OFF - The 'boiler status' is equal to 1 (call for heat). See engineers key 18. - The 'AUTO' input (PA10 – PA11) is OFF (open).



Stage no.	Stage name	Description
2.	Wait for purge (EK5) (EK11-14) (EK31)	<p>The 'controlled shutdown' output on PE3 will be switched on, to tell the burner controller there is a call for heat.</p> <p>This control waits for a fuel/profile select signal on one of the (line voltage) terminals PE9, PE10, PE11 or PE12 and a purge request (HIGH input, PA9 - PA11 closed. This input is low voltage). This would normally come from the burner controller.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>
3. & 4.	N/A	<p>Not Applicable to PPC6000</p> <p>Note : Statuses 3 and 4 are reserved for a gas valve proving system and are not implemented on this control. This control will advance directly to status 5 once the conditions above have been met.</p>
5.	Prove closed positions (EK80-89)	<p>The fuel and air motors are moved down until they are stopped by the 'closed position' micro-switches in the servos. The final positions are compared with the closed positions stored in memory, and must be within $\pm 5^\circ$ of the stored values otherwise the control will lockout.</p> <p>Variable frequency drives must read zero. (4 mA)</p> <p>When all drives have stopped moving, the control will advance to status 7. The 'HIGH' input (PA9 to PA11) still must be made during this time.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>
6.	N/A	<p>Not Applicable to PPC6000</p> <p>Note : Status 6 is reserved for air pressure detection, and is not implemented in this control. This function must be provided by the burner controller.</p>
7.	Moving to Purge	<p>The selected motors are moved up towards the purge position. When the drives have all stopped, the control moves to status 8.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>



Stage no.	Stage name	Description
8.	Pre-purge	<p>The controller confirms all required drives are at their purge positions, and gives a 'purge proved' signal by providing (line voltage) to terminal PE8 (high-fire-switch).</p> <p>The control will remain in this status until the burner controller signals the end of pre-purge by breaking PA11 – PA9 ('HIGH' input).</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>
9.	Move to ignition positions	<p>The selected motors are moved to their ignition positions. The 'purge proved' signal is switched off. When the drives have all stopped moving, the control advances to status 10.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>
10.	Ignition	<p>The controller confirms all required drives are at their ignition positions, and gives an 'ignition proved' signal by supplying line voltage to terminal PE7 (low-fire-switch).</p> <p>The controller will hold the drives at their respective ignition positions until the signal to modulate is received from the burner controller. This is performed by closing the circuit on PA10 – PA11 (AUTO input).</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p>
11-14	N/A	<p>NOTE : Statuses 11 to 14 control the light-up sequence of the burner and are provided by the 'burner controller' device used for the application. This control will jump from status 10 to status 15 when the light up is completed.</p> <p>Not Applicable to PPC6000</p>



Stage no.	Stage name	Description
15.	Moving to low fire	<p>Once the AUTO signal is received the fuel and air motors are moved from their ignition positions to their low fire positions. These positions may or may not be the same as the ignition positions. The 'ignition prove' terminal PE7 (low-fire-switch) is switched off.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p> <p>Once the drives have reached their low fire positions, and an AUTO signal is received (PA10 - PA11), the control will advance to status 16.</p> <p>IF Option 23.0 (warming limit) is enabled, drive will remain at low fire until time set by Option 23.0 expires.</p> <p>NOTE : terminal PE7 will always be OFF during status 15.</p>
16.	Modulation (EK33)	<p>Once the fuel and air motors reach their low fire positions, they are modulated according to the demand placed on the burner.</p> <p>In this burner status the 'high-fire-switch' and 'low-fire-switch' outputs (PE8 & PE7) will come on at high and low fire respectively and may be used for indication purposes.</p> <p>If a 'HIGH' input is provided by closing PA9 – PA11, this control will move to status 17.</p> <p>If the 'AUTO' input is removed by opening PA10 – PA11, this control will modulate down to low fire then jump to status 15. Note : Terminal PE7 will not be energised in this case. This may be used to provide a low fire post purge, or a low fire hold function.</p> <p>If the fuel/profile select input is removed (PE9, 10, 11 or 12), the control will immediately move to status 1.</p> <p>If this control wishes to turn the burner off (there is no call for heat, for example), it will open the 'controlled shutdown' relay, removing power from PE3. It will remain in modulation status however, until one of the conditions above is met.</p>
17.	Move to post-purge	<p>The selected motor(s) are moved to their purge positions all others are moved to their closed positions. When the drives have all stopped, the control will move to status 18.</p>
18.	Post-purge	<p>The controller confirms all required drives are at their purge positions, and gives a 'purge proved' signal by providing (line voltage) to terminal PE8 (high-fire-switch).</p> <p>The control will remain in this status until the burner controller signals the end of pre-purge by breaking PA9 – PA11 ('HIGH' input), or the fuel/profile select input is removed (PE9, 10, 11 or 12). In either case, the control will immediately move to status 1.</p>





NOTICE

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NXOG-6001
APRIL 8, 2013
Supersedes March 9, 2007