



Section 5: Faults and Fault Finding

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1. Faults and Fault Finding

1.1 The Fault Display

The NX6300 series controllers carry out a number of internal and external checks during operation. If a fault is found, a fault number (displayed with a text description) is used to identify the type of problem. (See 1.5 List of Fault Code Numbers.)

Many of the faults detected and displayed by the controller will cause a non-volatile lockout of the burner, i.e., removing the power to the controller will not cancel the fault. Some fault or limit messages will be displayed as a warning, but operation of the burner will not be affected.

Each fault number is prefixed on the display by a letter as follows:

- F** This means that a fault has occurred and is still present. The fault may be internal or external to the controller.
- C** This means that a fault did occur but has now cleared.
- L** This means a programmed limit has been exceeded.

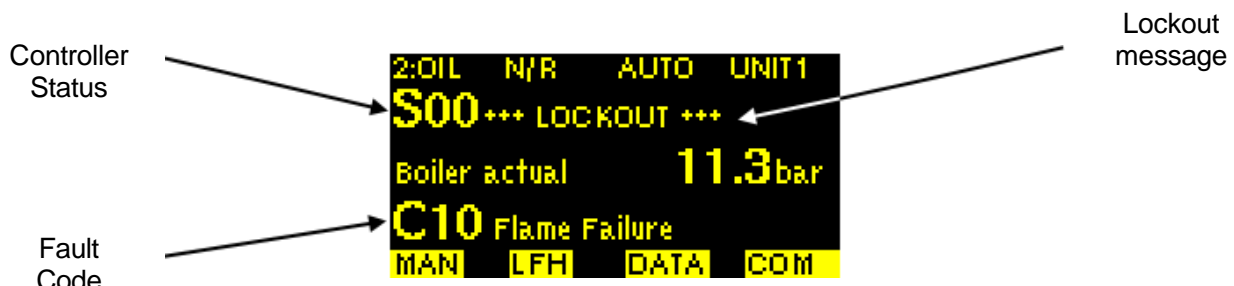
Many of the faults detected and displayed by the controller will cause a non-volatile lockout of the burner. Other faults will be displayed as a warning, but operation of the burner will not be affected. A complete list of faults can be found later in this chapter.

A fault history is available through the Engineer's Key Data, stored in the display unit memory, even if there is a power loss to the controller. For further information see 1.6.1 System Event History.

1.2 What to do when a Fault occurs

If faults or limits are present and the alarm or limit alarm is ON, then press the **MUTE RESET** key to mute the alarm (open the relay contacts).

The display will show a message similar to this screen.



Fault screen

Take note of the fault message and use the Fault Listing to identify why the fault occurred.



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If the faults that cause a non-volatile lockout are still present when the alarm is muted, then the alarm will operate again when the fault clears, to indicate to the operator that the burner may be restarted.

After all faults have been diagnosed, rectified, and cleared, press the **MUTE RESET** key for about three seconds to remove the fault messages and re-start the burner.

The function of the **MUTE RESET** key may also be achieved via digital Communications or by using the FAULT MUTE input. See option parameter 1.2.

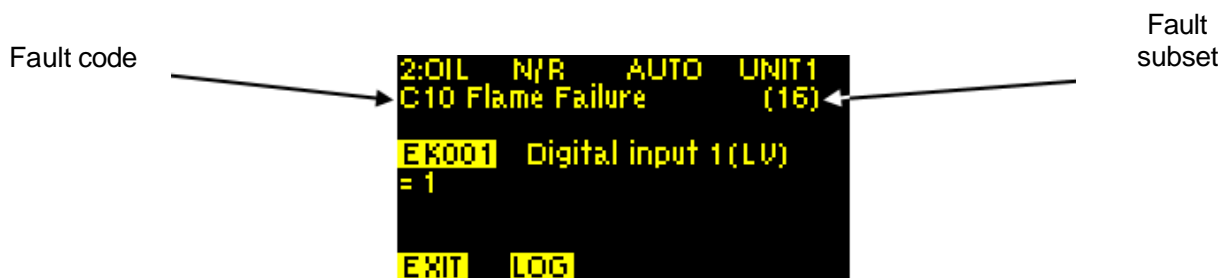
1.3 Non-Volatile Lockout

If power is removed from the controller while a fault is still present, the fault will be stored in non-volatile memory. When power is restored to the controller, the fault number will still be present, and you will need to clear the fault before restarting the burner.

1.4 Fault Subsets

As an aid to fault finding, most faults also have a **fault subset** that gives additional information about the type of fault, or what the burner was doing when the fault occurred. The subset information can be interrogated by pressing the EK button.

For example, this display indicates C10 = Cleared Fault Code 10, and Subset = 16.



EK screen showing fault and subset

The individual subsets have a code number in the sequence 1,2,4,8,16,32,64 and 128. However, there is only space on the display for 3 digits, so the displayed subset number represents the addition of individual subset codes.

For example, if a subset number is displayed as 3, this means that a combination of subset 1 AND subset 2 occurred: hence $1+2=3$.

Subset no. 13=subsets $8+4+1$.

Subset no. 57=subsets $32+16+8+1$.

Subset no. 103=subsets $64+32+4+1$.

Where applicable, the subsets are shown in this manual in 1.5, "List of Fault Code Numbers".

You can view the fault subsets on the system by looking at the Engineer's Key Data. For details, see section 1.6.



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1.5 List of Fault Code Numbers

These fault codes are shown on the two-line text display. See “The Fault Display” in 1.1.
The Touch screen display shows the following:

Fault No	Display text	Possible reason + Subset when fault occurred
F01	External Alarm Fault 1	One of the low voltage alarm / lockout inputs is causing an alarm.
F02	External Alarm Fault 2	The fault may be prefixed by either an ‘L’ or an ‘F’ and may or may not shutdown / lock out the burner. See Option parameters 18.1 to 18.6? <i>Subset = burner status number</i>
F03	External Alarm Fault 3	
F04	External Alarm Fault 4	
F05	External Alarm Fault 5	
F06	External Alarm Fault 6	
F10	Flame Failure	The flame detector did not register the presence of a flame when a flame should be present. <ul style="list-style-type: none">• If there is a flame, check the wiring. <i>Subset = X + burner status number</i> <i>Where X= 100 for Flame1 and X=200 for Flame2</i>
F11	False Flame	The flame detector registered the presence of a flame when it should not be present or when the shutter (if selected) was closed. <i>Subset = X + burner status number, where X= 100 for Flame1 and X=200 for Flame2</i>
F12	External Alarm from Input 12	The high voltage alarm / lockout input number 12 is causing an alarm. The alarm number is prefixed by either an ‘L’ or an ‘F’ and may or may not shut down / lock out the burner. See Option parameter 16.3. <i>Subset = burner status number</i>
F13	External Alarm from Input 13	The high voltage alarm / lockout input number 13 is causing an alarm. The alarm number is prefixed by either an ‘L’ or an ‘F’ and may or may not shutdown / lock out the burner. See Option parameter 16.4. <i>Subset = burner status number</i>
F14	Main (secondary) combustion air pressure not detected	The main combustion air pressure switch failed to register air pressure when it should be present. <i>Subset = burner status number</i>



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Fault No	Display text	Possible reason + Subset when fault occurred
F15	Main (secondary) combustion air pressure detected when it should not be.	<p>The main combustion air pressure switch registered air pressure when it should not be present (<i>subset: 1</i>), or the air pressure switch registered air pressure for more than 3 minutes after the burner was turned OFF (<i>subset: 2</i>).</p> <p><i>This fault will also occur if Opt 6.x is not set.</i></p>
F18	Not enough set points entered	<p>A profile has been selected which does not have at least four set points commissioned. Use Commission Ratio mode to enter more set points.</p> <p><i>Subset = profile number</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">• Make sure ALL analogue inputs (4-20 mA, 0 – 5 V) are in the range 0 to 5 Vdc. It is critical to the controller operation that none of the inputs is higher than 5 V.• If the problem persists even when all analogue inputs are disconnected, check EK37 and contact supplier. <p><i>The subsets are binary coded and added up, hence Subset:</i> <i>1 = out of range,</i> <i>2 = zero check failed,</i> <i>3 = 1+2 = out of range AND zero check failed;</i> <i>4 = span check failed,</i> <i>5= 1+4 = out of range AND span check failed;</i> <i>6= 2+4= zero check failed AND span check failed, etc.</i></p>



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Fault No	Display text	Possible reason + Subset when fault occurred
F20	Drive 0 position fault	<p>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:</p> <ol style="list-style-type: none"> 1. During 'Close' position prove, the measured position is in error, to the commissioned 'Close' position, by more than five degrees. 2. During Purge position prove, the measured position is in error, to the commissioned 'Purge' position, by more than five degrees. 3. During pre-purge, ignition, or post-purge when a drive moves from its set point. 4. During modulation, when a drive is not at its correct set point as defined by the commissioned fuel: air ratio for the selected profile. <p>A servo drive is defined as having moved from its set point 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.</p> <p>Inverter (VSD) drive error bands variable and set in option parameter 09.1.</p> <p>Note: Only the selected drives (i.e., used on the current fuel/air profile) are checked. The other drives are ignored.</p> <p><i>Subset = burner/CANbus/internal servo status number.</i></p> <p><i>000 to 016 = Burner status when the fault occurred.</i></p> <p><i>032 to 048 = CANbus communications error. Display shows ERR1 under the drive name.</i></p> <p><i>>64 = Internal servo fault. Display shows ERR2 – ERR7 under the drive name.</i></p>
F21	Drive 1 position fault	
F22	Drive 2 position fault	
F23	Drive 3 position fault	
F24 to 31	Not used	
F32	Safety input fault	<p>One or more of the fail-safe low voltage inputs is registering a fault. Check digital inputs 1 to 4 are wired to the correct commons.</p> <p><i>Subset = 0 to 128. Work out the binary number of the number displayed, to see which digital inputs have failed.</i></p> <ul style="list-style-type: none"> • Check the panel wiring.



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Fault No	Display text	Possible reason + Subset when fault occurred
F33	Burner input fault	<p>One or more of the fail-safe high voltage inputs is registering a fault.</p> <p><i>Subset = 0 – One or more of the inputs is On in the wrong phase, possibly Line voltage pick-up.</i></p> <p>+1 = TB1-1 input faulty +2 = TB1-3 input faulty +3 = TB1-2 input faulty</p> <ul style="list-style-type: none">• Check the panel wiring.
F34	Primary relay fault	<p>One or more of the internal relays is not responding correctly.</p> <p><i>Subset when the fault occurred:</i></p> <p><i>1- 10 = Failed Relay number.</i></p> <p><i>100 = i/p13 (PE8) is not detecting the ignition o/p at the correct time when Option 8.0=1.</i></p> <ul style="list-style-type: none">• Check the panel wiring.
F35	ADC fault	<p>One of the internal checks on the analogue to digital converter has failed.</p> <p><i>Subset = Failure mode when the fault occurred.</i></p> <ul style="list-style-type: none">• Check the panel wiring.
F36	Reset fault	<p>The controller is detecting Reset commands either by button pushes or an external event (5 in 15 mins), when there are no faults present.</p> <p>Power down or enter Commission mode to reset and clear this fault.</p>
F37	RAM test fault	<p>The main memory in the controller has malfunctioned.</p> <ul style="list-style-type: none">• Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. <p>This could be due to high levels of electrical interference getting into the product.</p> <ul style="list-style-type: none">• Check that all cables are correctly screened, and the screens are terminated correctly. Make sure the mains supply is not excessively noisy.• If this fault persists, return the controller to the supplier. <p><i>Subset = Failed Page number in memory map when the fault occurred.</i></p>



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Fault No	Display text	Possible reason + Subset when fault occurred
F38	Program memory CRC fault	<p>The program memory in the controller has malfunctioned.</p> <ul style="list-style-type: none"> Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. This could be due to high levels of electrical interference getting into the product. <p>Check all cables are correctly screened, and screens are terminated correctly.</p> <ul style="list-style-type: none"> Make sure the mains supply is not excessively noisy. If this fault persists, the controller must be returned to the supplier. <p><i>Subset = Failed Page number in memory map when the fault occurred.</i></p>
F39	Profile table CRC fault	<p>The profile table memory in the controller has been corrupted.</p> <ul style="list-style-type: none"> Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. 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. Make sure that the mains supply is not excessively noisy. If this fault persists, the controller must be returned to the supplier. <p><i>Subset = Failed Page number in memory map.</i></p>
F40	Not used	
F41	Boiler safety limit exceeded	<p>The boiler's measured value has exceeded the pressure/temperature safety limit, or the ETC pressure/temperature sensor is not responding correctly.</p> <p><i>Subset =</i> <i>1 = sensor feedback < 1 V,</i> <i>2 = sensor feedback > 5 V,</i> <i>3 = sensor failed during test,</i> <i>4 = safety limit exceeded</i> 255 = CANBus communications fault</p> <ul style="list-style-type: none"> Check the panel wiring.
F42	Valve prove (leak) test fault	<p>The measured gas pressure was not correct during the gas valve leak test.</p> <p><i>Subset = Valve prove status number.</i></p>



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Fault No	Display text	Possible reason + Subset when fault occurred
F46	EEPROM memory CRC fault	<p>The EEPROM memory in the controller has been corrupted. This memory is used to store the option parameters.</p> <ul style="list-style-type: none"> Switch the controller OFF for 10 seconds and switch ON again, to see if the fault clears. Erase the system using option parameter 45.1 = 5 and re-commission (or restore with option parameter 45.2). <p>This could be due to high levels of electrical interference getting into the product.</p> <ul style="list-style-type: none"> Check all cables are correctly screened, and screens are terminated correctly. Make sure the mains supply is not excessively noisy. If this fault persists, return the controller to the supplier. <p><i>Subset = Failed Page number in memory.</i></p>
F47 to 49	Not used	
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>After the fault is rectified, you need to interrupt the power to the oxygen probe interface, to attempt to heat the probe once more.</p> <p><i>Subset: not applicable.</i></p>
L52	Oxygen low limit alarm	<p>The oxygen level measured value is below the oxygen set point low alarm value for the current profile.</p> <p><i>Subset = 0 = Limit violation, 1 = Probe Failed.</i></p>
L53	Oxygen high limit alarm	<p>The oxygen level measured value has exceeded the oxygen set point high alarm value for the current profile.</p> <p><i>Subset = 0 = Limit violation, 1 = Probe Failed.</i></p>
F54	Oxygen probes mismatch fault	<p>This fault occurs when two oxygen probes are used to give fail-safe oxygen monitoring. If this fault occurs, check, and calibrate both oxygen probes. It may be necessary to increase option parameter 42.4 or 42.5 (within safe limits) if the oxygen probes are in different parts of the flue.</p> <p>The safe limits of the variation allowed between the Oxygen readings will most likely be determined either by 'local codes of practice', or as recommended by a competent combustion authority and agreed by the process owners.</p> <p>Subset = 1 = Oxygen values do not match, 2 = Flue temperatures do not match 3 = Both flue temperature and oxygen levels do not match 255 = Second oxygen probe is faulty / not ready. See EK 76.</p>



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Fault No	Display text	Possible reason + Subset when fault occurred
F54	CO High Limit	CO level too high – see option 42.6 setting.
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 set point (+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	Not used	
F61	Air pressure level fault.	The measured air pressure has exceeded the limit set by option 42.9 for more than 6 seconds. <i>Subset = profile set point.</i>
F63	Option parameters uploaded	The option parameters have been uploaded via serial communications. Check all values are correct and match the application, then set option parameter 45.0 to 0. <i>Subset: Not applicable.</i>



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Fault No	Display text	Possible reason + Subset when fault occurred
F64	Profile Invalid	<p>This fault means that the controller can't execute the currently selected profile because the profile data does not match burner / site configuration. It could lead to a hazardous situation.</p> <p>There are three possible causes to this fault:</p> <ol style="list-style-type: none">1. A drive has been commissioned in this profile but has now been deselected. E.g. - 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, then the profile is no longer valid. <i>Subset = Drive number (0 to 4)</i>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 the original servo are now considered invalid. (This is to ensure that the maintenance engineer checks that the new servo is mechanically fixed the same way as the original one.) <i>Subset = Invalid profile + 100 (101 or 102).</i>3. The selected profile has been uploaded from a PC but has not been verified on this burner. <i>Subset = Invalid profile + 100 (101 or 102).</i> <p>In all cases the F64 can be cleared by switching to another (valid) 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>
F65	Power-up Lockout	<p>The controller has locked out on power-up. This will normally be because option parameter 1.0 is set to 1.</p> <p><i>Subset =</i> <i>1 – See option parameter 1.0.</i> <i>254 – Serial EEPROM write failure.</i> <i>255 – NV Lockout verification failed.</i></p>



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Fault No	Display text	Possible reason + Subset when fault occurred
F66	Flame Test	<p>For Option 12.0 = 0, or 13.0=1 The flame test (dark test) has failed. This could be a problem with the flame input circuit, or a shutter problem / failed UV tube if a shuttered UV is used.</p> <p><i>Subset =</i> 1 = Shutter not detected 2 = Input circuit failure 3 = Input stuck ON or terminals short circuit.</p> <p>For Option 12.0 or 13.0=5. <i>Subset = +100 for Flame 1 and +200 for Flame 2.</i> +1 = CANBus time out (e.g., 101) – check wiring. +2, +3, +4 = Detector memory fault – Replace. +5, +6 = Detector internal fault – Replace. +7 = Shutter/dark check fault, or UV tube failed – check the operation out of the burner</p>
F67	Secondary relay fault	<p>A secondary fault has occurred with the main 1, main 2, pilot, vent, or non-volatile lockout relays.</p> <ul style="list-style-type: none">Contact supplier. <p><i>Subset = Failed relay number.</i></p>
F68	Secondary program memory checksum fault	<p>A fault has occurred with the program memory in the controller.</p> <ul style="list-style-type: none">Contact supplier. <p><i>Subset: Not applicable.</i></p>
F69	Secondary watchdog fault	<p>A fault has occurred with the CPU watchdog.</p> <ul style="list-style-type: none">Contact supplier. <p><i>Subset:</i> 1 = Late test failed. 2 = Early test failed.</p>
F70 – F79	User Faults	<p>These fault numbers are generated by the user-programmable section of the controller and will vary with the application.</p>
L89	FGR input fault.	<p>The 4-20mA input selected by Opt 44.0 is out of range – FGR will be held at P3 position.</p>

1.6 The Engineer's Key Data (EK)

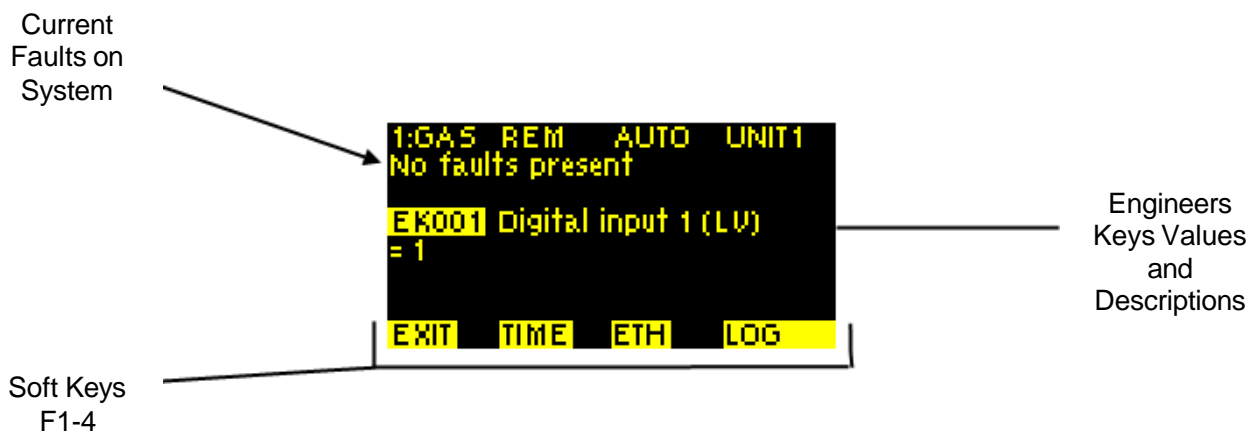
By selecting the Engineer's Key Data, you can read the values of internal system variables, and external input and output states. You can also see the current faults on the system, and their associated **fault subsets**, which give more detailed information about a fault.

When using the Engineer's Key Data you cannot change any parameters, so you cannot affect the operation of the burner.



From the normal run display, press the Engineer's Key Data button:

This is the Engineers Key screen; it is used to view the value or status of various control parameters. It is accessed using the Engineers Key on the keypad.



Engineers Keys Screen

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

Viewing EK data

- Use the UP or DOWN keys to change the EK number and view its corresponding data.
- Press the F1 **EXIT** button to go back to the normal run display.



Timeout: The display system will automatically revert to the normal run display if a key has not been pressed for one minute.

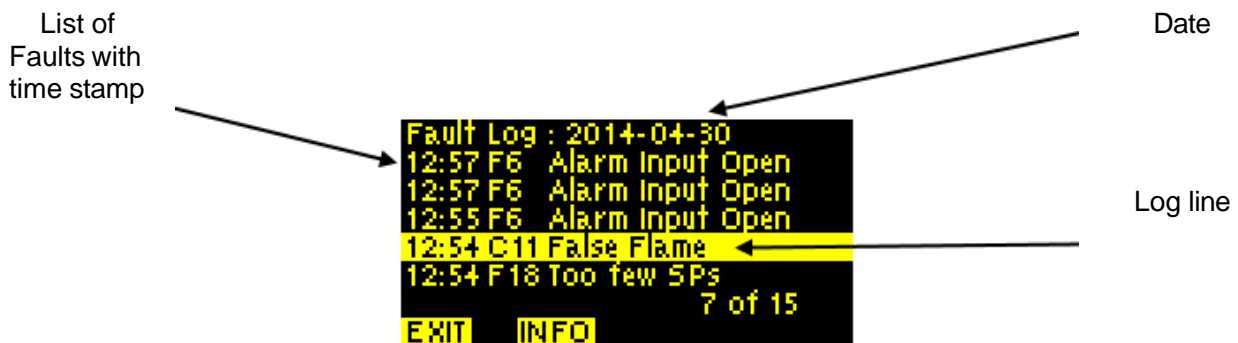
1.6.1 System Event History

The display modules store information on past events and faults. The memory in the display unit will store the last 128 events/faults and the associated status data. You can see the full set using the ComFire2 software interface to a Windows PC or laptop.

The Engineer's Key screen allows you to access the Event History Log.

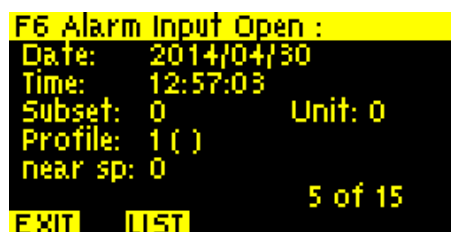
View the Event History Log

- To view the event history, press the F4 **LOG** button from the EK screen.
- Use the UP  or DOWN  keys to index up and down through the log of events.





Event Log screen

Further information on each event may be read by pressing the **INFO** key to reveal a display like this:



Log Information screen

You can navigate to earlier event log pages by using the   UP/DOWN keys.



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1.6.2 Engineer's Key Data (EK) Parameter List

EK No.	Name	Description	
EK1	Low Voltage Digital Input 1 TB5-11/12 – TB5-7	Shows the state of each input. Where: 0 = OFF 1 = ON	
EK2	Low Voltage Digital Input 2 TB5-11/12 – TB5-8		
EK3	Low Voltage Digital Input 3 TB5-11/12 – TB5-9		
EK4	Low Voltage Digital Input 4 TB5-11/12 – TB5-10		
EK5	High Voltage Digital Input 5 TB1-2		
EK6	High Voltage Digital Input 6 TB1-3		
EK7 - 13	Unused in this controller type.		
EK14	Burner Select Input (High Voltage) TB1-1		
EK15	Air pressure detected.		The air pressure is above the threshold set in Opt 42.8, or the air pressure switch is made.
EK16	Low Fire Hold or Warming limit active.		0 = Burner free to modulate. 1 = Either Low Fire Hold is selected, or the measured value is below the warming limit. The burner is held at Low Fire if the controller is in Auto or Sequencing mode.
EK17	Flame Detected		0 = No flame detected. 1 = Flame detected. When both Flame1 and Flame2 selections are enabled then this value will only show '1' if both inputs are above their flame threshold.
EK18	Plant status	0 = The Burner will not fire because the temperature / pressure measured value has exceeded the Cut-out value. 1 = The Burner will fire because the temperature / pressure measured value has fallen below the Cut In value.	



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EK No.	Name	Description
EK19	Confirm to adjust	<p>0 = Either the Controller is not in Commission mode, or the controller is in Commission mode and the drives are moving to the set points.</p> <p>1 = The Controller is in Commission mode, and you can adjust the drives using the UP/DOWN keys.</p>
EK20	Drive moved	<p>0 = Either the Controller is not in Commission mode, or the controller is in Commission mode and the drives have not been moved using the UP/DOWN keys.</p> <p>1 = The Controller is in Commission mode and the drives have been moved using the UP/DOWN keys.</p>
EK21	Positions proved	<p>0 = The motor or servo position feedback have stopped changing, ready for the position prove test.</p> <p>1 = Ready for the position prove test, but the drives are still moving.</p>
EK22	Fault alarm	<p>0 = No un-muted alarms (faults) present. +1 = Un-muted fault alarm present (prefix: F)</p>
EK23	Oxygen Trim Enable	<p>0 = Oxygen trim is OFF or not working. 1 = Oxygen trim is ON and working (EK46 = 0).</p>
EK24	Oil warming Active	The burner will not fire because the oil is not up to temperature and the oil warming function is active.
EK25	CAN_TX Failures	<p>This is a count of the number of times the CANbus controller has failed to send a message since power-up.</p> <p>This should be zero unless there has been a problem.</p>
EK26	Commission status	<p>This shows the current Commission mode, where:</p> <p>0 = Normal Run mode. 1 = Adjust Ratio mode. 2 = Commission ratio mode.</p>
EK27	Commission set point	<p>The current set point being commissioned.</p> <p>0 = Closed set point. 1 = Purge set point. 2 = Ignition set point. 3 = Low Fire set point. 4 to 24 = profile set points</p>



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EK No.	Name	Description
EK28	Commission Set Points entered	The number of set points 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	The Status of the start-up sequence. See section 1, "Description of Operation".
EK31	Fuel Profile Selected	The currently selected fuel profile.
EK32	Number of commission set points	The number of set points entered for the currently selected profile: 0 = No. of set points entered. 1 = Close set point only. 2 = Close and purge set points. 3 = Close, purge and ignition. 4 to 24 = profile set points.
EK33	Modulation mode	The current Modulation mode: 0 = Auto mode. +1 = Manual from keypad. +2 = LFH (Low Fire Hold) from keypad. +4 = Local 1. +8 = Local 2. +12 = Burner switched OFF from display command.
EK34	Flame1 value	Flame Signal value received from CAN Flame 1 device or Photocell / Flame Switch input. 0 = Fully dark (no flame).
EK35	Flame 2 value	Flame Signal value received from CAN Flame 2 device: 0 = Fully dark (no flame).
EK36	Nearest set point	The number of the profile set point that is nearest to the current modulation position.
EK37	Voltage reference error (V)	The error between the measured voltage reference and the calibrated value. Typically, this value will be <0.05 V. If it is above 0.12 V then fault F19 will occur. When the value is high, make sure that all ELV (low voltage) inputs are less than 5 Vdc.
EK38	RS485 Communications status	Toggles between 1 and 0 when the RS485 communications is active.



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EK No.	Name	Description
EK39	Fuel Swap Status	If this status is >0, then the controller is in the process of performing a fuel profile swap (without turning the burner OFF).
EK40	Shutdown set point	The nearest set point (EK36) when the burner last locked out.
EK41	Customer type no.	
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 ETC probe (if fitted).
EK45	Oxygen probe interface status	<p>+1 = Internal temperature sensor fault.</p> <p>+2 = Probe age warning (indication when burner is OFF).</p> <p>+4 = Probe heater fault – requires CAN power cycling to reset.</p> <p>+8 = Heater PID system not operating correctly. This could be evident for 1 minute after wake-up/power-up.</p> <p>+16 = Input signals out of range. This could be flue t/c, internal temperature, 4-20mA inputs.</p> <p>+32 = Probe is in sleep mode.</p> <p>+64 = Probe calibrating in reference gas. See option parameter 30.6.</p> <p>+128 = Probe calibrating in air. See option parameter 30.6.</p> <p>+255 = CAN communications error.</p>
EK46	Oxygen trim status	<p>0 = O₂ trim working, or</p> <p>+1 = no oxygen interface connected.</p> <p>+2 = no oxygen probe serial number entered,</p> <p>or option 30.5 is not 1,</p> <p>or option 30.8 is not 0</p> <p>or no trim type is selected by option 31.x,</p> <p>or, trim is not selected via dig i/p, serial comms.</p> <p>+4 = O₂ set points or flow values are incorrect</p> <p>+8 = Option 20.6 is not 0</p> <p>+16 = Not modulating</p> <p>+32 = In Commission mode</p> <p>+64 = Probe faulty (see EK45).</p>



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EK No.	Name	Description
EK47	Oxygen set point (%)	Current oxygen set point. 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 set point.
EK50	Trim deviation (% flow)	Deviation in airflow imposed by trim (-25 to +25%)
EK51	Gas pressure (display units)	N/A
EK52	VPS Valve close time t_{test} (s)	The Time for which each half of the valve leak prove test will be conducted. This time counts down to zero during stages 2 and 4 of the valve leak prove test.
EK53	Gas pressure change (display units)	N/A
EK54	Valve prove status	Status of the valve leak test sequence.
EK55	Main PCB issue	The issue number of the main circuit board
EK56	Firmware issue.	The current revision of the main product firmware.
EK57	Spare	N/A
EK58	CPU serial number (low 4 digits)	The CPU board serial number.
EK59	Drives at set point	Represents which drives are currently at their set points, where: 0 = All drives are at their set points and are not moving. Non-zero = One or more drives are not at their set point.
EK60	Digital (relay) outputs ON.	The combination of digital outputs currently switched ON. +1: Digital Output 1 ON. Display, PR3(COM), PR1(NO), PR2(NC). Low voltage or line voltage. +2: Digital Output 2 ON. Display, PR3(COM), PR5(NO), PR4(NC). Low voltage or line voltage. +4: Digital Output 3 ON. Display, PR7(COM), PR9(NO), PR8(NC). Low voltage or line voltage.
EK61	Analogue Input 1. Main Unit TB4-8.	The Voltage detected at the terminal. 4 mA = 0.600 V 20 mA = 3.000 V



Section 5: Faults and Fault Finding

EK No.	Name	Description
EK62	Analogue Input 2. Main Unit TB4-9.	The Voltage detected at the terminal. 4 mA = 0.600 V 20 mA = 3.000 V
EK63 - 68	Unused.	
EK69	Frequency input 1 TB4-5.	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.
EK70 - 71	Unused.	
EK72	Oxygen probe cell temperature.	The temperature of the zirconia cell inside the ETC oxygen probe, if fitted. This value should be very close to 820°C for accurate operation.
EK73	Ambient air temperature.	The temperature measured by the inlet temperature sensor, if fitted. Units are °C.
EK74	CPU utilization (%).	The percentage utilization of the CPU. This should be less than 95% at all times.
EK75	CO level (ppm)	CO level as determined from the 4-20mA signal into the ETC6081 PG terminals.
EK76	Modified Oxygen set point	This is the value of the set point when modified by the CO trim function.
EK78	CO trim modifier	This is the amount of CO trim where a value of $\pm 500 = \pm 1\%$ of Oxygen set point. Constantly changing if CO trim is active.
EK79	Oxygen set point before trim.	This is the original Oxygen set point before CO trim modification. CO trim = EK76-EK79
EK80 - 84	Drive Error values for drives 0 to 4.	The current error value for drives 0 to 4. These values will freeze when the controller performs a safety shutdown, so it may be possible to look at these values after a lockout to help determine the cause.
EK85 to EK89	Unused.	
EK90	Burner cycles	The number of times the burner has attempted to start.
EK91	Burner Lockouts	The number of times the burner has locked out.

EK No.	Name	Description
EK92	Commission data backup verification progress.	This value increases as the backup is verified when the burner is running. If a difference between the actual commissioning data and the backup is found, it will go to zero. A value of 999 indicates that the entire backup has been verified so all commissioning data are backed up in the display module's internal flash memory.
EK93	Flow Value	<p>The instantaneous calculated air or fuel flow value, as used by the oxygen trim function.</p> <p>If flow values have been entered during commissioning for the current profile, this value will show the flow rate that corresponds to the current modulation rate.</p> <p>At High Fire, the value will be 99.9%.</p> <p>At Low Fire, it will be this value divided by the turn down ratio of the burner.</p> <p>If fuel trim is active, this value will track air flow.</p> <p>If air trim is active, this value will track fuel flow.</p>
EK94	Photocell dc signal level	<p>If option 12.0=2 then the flame signal is determined by the amount of flicker in the signal. EK 94 shows the average DC voltage level on the input, which corresponds to the resistance of the cell due to background IR radiation. Typical values are between 30 (cold) and 200 (hot).</p> <p>Range 0 = 0 volts = open circuit cell, 255 = short circuit cell.</p>
EK95- Ek99	Spare, (not in use)	N/A
EK100	Firmware type PT22xxxx	This shows the last four digits of the firmware part number for the controller firmware. It is used to identify the product variants.



CAUTION

- The product allows for customization of various non-safety-critical functions, including the modulation control.
- The **EK Engineers' Key codes shown below** relate to the default modulation control function programmed into the control at the factory. To verify that this has not been replaced by an application-specific function, check with the equipment supplier and / or check the option parameter.



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No.	Name	Description
EK101	PID1 Active	If the value is 1, then Set point / PID set 1 is active.
EK102	PID2 Active	If the value is 1, then Set point / PID set 2 is active.
EK103	Control Limits Active	If the value is 1, the control limits are active and will turn the burner ON and OFF as the load dictates. The low and high limits are shown on EK153 and 154. If the control limits are holding the burner OFF, then EK18 will be zero.
EK104	User Modulation mode	This will normally be zero. A custom modulation program may change this value if it is modifying the modulation rate.
EK105	PID not required	If this value is 1, the internal modulation PID is not running. This may be because the burner is OFF, or in Commission / Manual mode, or for another reason.
EK106	Burner Firing	If this value is 1, either the burner is firing (fuel valves open), or it is in post-purge.
EK107	Warming Limit Active	If this value is 1, then the warming limit function (see option parameter 23.0) is holding the burner at Low Fire (status 15).
EK108 to EK109	Not used by the standard manufacturers program. They may be used by a custom program.	N/A
EK110	Control Limit Exceeded	The Measured value is greater than the High limit set by Option 21.7 or 22.7/
EK111 to EK114	Not used by the standard manufacturers program. They may be used by a custom program.	
EK115	Communications modulation control active.	Modulation is under control of digital communications – Modbus or ProfiBus.
EK116 to EK125	Not used by the standard manufacturers program. They may be used by a custom program.	
EK126	Measured value within the P band.	The measured value is within the P band set by Opt. 21.2 or 22.2.
EK127 to EK132	Not used by the standard manufacturers program. They may be used by a custom program.	
EK133	Set point 2 selected remotely	1= SP2 is selected by digital communications – Modbus or ProfiBus.
EK135 to EK137	Not used by the standard manufacturers program. They may be used by a custom program.	



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No.	Name	Description
EK138	Set point 1 selected remotely	1 = SP1 is selected remotely via serial communications, which could be as a Lag in Boiler Sequencing, or via Modbus.
EK139 to EK150	Not used by the standard manufacturer's program. They may be used by a custom program.	N/A
EK151	Set point 1 control value	The actual value of set point 1 now being applied.
EK152	Set point 2 control value	The actual value of set point 2 now being applied.
EK153	Low control limit	The actual value of the process low control limit (e.g., low steam pressure cut-in point) being applied.
EK154	High control limit	The actual value of the process high control limit (e.g., high steam pressure cut-out point) being applied.
EK155	Spare	N/A
EK156	Measured Value	The current boiler measured value (actual value) shown with increased precision.
EK157	AUTO modulation rate	The modulation rate that the boiler will fire to if in AUTO mode (provided option parameter 15.0 is not zero or 1).
EK158 to EK199	Not used by the standard manufacturers program. They may be used by a custom program.	N/A
EK200	Prog Version:	Currently running manufacturers / custom (user) modulation program revision number (if applicable).



Section 5: Faults and Fault Finding

1.7 Troubleshooting

1.7.1 Display / General Problems

Problem	Possible cause	Suggested action
Display shows its serial number but not data from controller	Display CANbus wired incorrectly. Main controller not running.	Check the wiring of CANbus (PT3 and PT4). Check main controller low voltage electronics fuse FS2. If blown, investigate all low voltage external wiring and replace fuse, if necessary, with a new one of the correct type and rating.
Display updates slowly or seems to freeze when scrolling a parameter number.	One of the CAN devices has the two CAN wires crossed over.	Check the wiring of the CANbus cable.
Display will not light at all.	24 VAC supply to display missing. Controller not running.	Check for 24 VAC on PT1 and PT2. Check the fuse FS1. If blown, investigate all high and low voltage external wiring and replace fuse, if necessary, with a new one of the correct type and rating.
Measured value incorrect.	Wrong sensor voltage. Wrong sensor input type. Incorrect sensor wiring. Wrong zero or span.	Check SENS SUPP link (see section 2, "How to Install and Wire the System"). Check wiring to terminals TB4-4, TB4-9 and TB4-10. Check option parameters 15.0, 15.1, 15.2.
Hours run shows '---'.	No profile selected.	Select oil or gas profile.
Modulation rate is 0.	Burner not modulating.	Wait for burner to finish start-up sequence.
Burner status is flashing.	Controller in non-volatile lockout mode.	Burner status before shutdown displayed.



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1.7.2 Startup Problems

Problem	Possible cause	Suggested action
Burner will not start.	Controller in non-volatile lockout. High control limit exceeded. Control in Commission Ratio mode. Burner OFF via serial comms. Air pressure switch still made. No fuel selected. Burner not selected.	Hold the Mute Reset key for 4 second to clear faults. Check EK18 and wait for the press/temp to drop. Press NEXT to advance to the next set point. Turn the burner ON using the ComFire2 software (if connected), or Profibus / Modbus interface. Use section 1 "Description of Operation" and burner status (EK30) to define why the controller is waiting. Also check EK31≠0, EK10=1, EK15=0.
Drive positioning fault occurs before drives move to purge.	Stored close positions do not match actual close positions.	Check feedback potentiometers and motor micro-switches. Reset close positions using Commission Ratio mode.
Drive positioning fault occurs when drives reach purge.	Stored purge positions cannot be reached.	Check feedback potentiometers and motor micro-switches. Reset purge positions using Commission Ratio mode.
Drives stuck at ignition and burner has not fired.	Drives cannot reach ignition position. 'Ignition Wait' input is holding controller at status 9.	Check actuator linkages. Check digital input settings and connections
Pilot, main 1 and main 2 valves will not open.	No feed on BURNER SEL.	Check terminal TB1-1.
Drives stuck at ignition and burner has fired.	Ignition time has not elapsed.	Wait for ignition time to elapse. Reduce ignition time(s) (option parameters 7.6 and 7.7).



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1.7.3 Commissioning Problems

Problem	Possible cause	Suggested action
Cannot get past P0.	See 'burner will not start' above.	See 'burner will not start' above.
'Px' or 'Ax' display flashes constantly and motor positions cannot be altered.	Drives are moving to position. Burner OFF in Adjust Ratio mode. Valve leak test in progress.	Wait for drives to position. Turn burner ON if you need to adjust points A03 onwards. Wait for the valve leak test to finish.
Option parameter not available.	Another option parameter must be set first.	Set option parameter (usually XX.0) to a non-zero value to enable other parameters the in group.
Option parameter not adjustable.	Wrong passcode entered or burner firing.	Enter the supplier passcode and/or turn the burner OFF before changing the value.
Not possible to enter Commission Ratio mode.	Supplier passcode incorrect. Burner firing (goes into Adjust Ratio mode).	Enter correct passcode. Turn burner OFF and try again.
Not possible to enter Adjust Ratio mode.	Supplier passcode incorrect.	Enter supplier passcode with the burner ON.

1.7.4 Gas Valve Leak Test Problems

Problem	Possible cause	Suggested action
Leak test sequence takes a long time.	Nominal gas pressure, test volume or leakage rate wrong.	Check option parameters 10.1 to 10.7. Expected time shown on EK52.
Main valve 2 does not open.	Vent valve has been selected.	Check option parameter 10.7.
Vent valve does not open.	Vent valve not selected or wrong sense.	Check option parameter 10.7.
Main valve 1 and/or main valve 2 do not open.	Valve leak test not selected. No feed on BURNER SEL.	Check option parameter 10.0. Check for feed on terminal TB1-1.

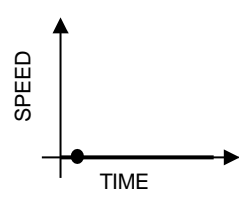
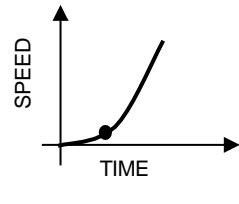
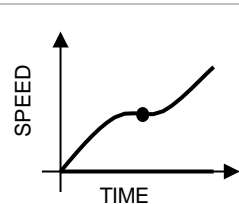
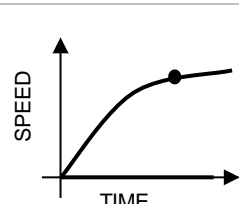

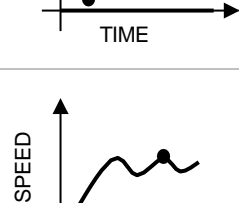


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1.7.5 Modulation Problems

Problem	Possible cause	Suggested action
Sensor or modulation rate inaccurate.	V/I input setting incorrect.	Check option parameter. Check the sensor supply connection.
Intermittent positioning faults.	Profile set point is too close to the P00 micro-switch position. Poor Earth or screening. Feedback potentiometer faulty. Poor communication to servomotor(s).	Move the set point away from the P00 position. Check wiring. Move the motor across range and check the feedback in Commission Ratio mode with the burner OFF. Check wiring.
Controller stuck at Low Fire.	Meas. value exceeds set point. Warming limit active Controller in MANUAL mode. External Low Fire hold, or missing AUTO input from burner controller. In Manual mode.	No fault. Wait for boiler to warm up. Check EK16. Press the AUTO key to change to auto mode. Remove feed from Aux inputs (if selected). Check EK 6. Increase the mod. rate using 'UP' key.
Controller stuck at a modulation rate.	Serial communications. Controller in Commission mode.	Disable or change modulation control from remote software. To enter Run mode, press RUN then ENTER.

1.7.6 Inverter (Variable Frequency Drive) Problems

Problem	Possible Cause	Solution
	<ul style="list-style-type: none"> Inverter does not start because it does not receive a RUN signal. 	<ul style="list-style-type: none"> Make sure that the inverter receives a RUN signal from the daughter board fitted to the NX6300.
	<ul style="list-style-type: none"> Inverter has a slow start. Non-linear output from inverter or inverter's PID is enabled 	<ul style="list-style-type: none"> Make sure that the inverter's slow start feature is disabled. Check that the inverter's output is selected to be linear, and that the inverter's own PID loop is disabled.
	<ul style="list-style-type: none"> Current limit reached Noise 	<ul style="list-style-type: none"> Slow down the inverter by increasing its acceleration / deceleration time settings. Check cable screens.
	<ul style="list-style-type: none"> Current limit reached. Non-linear output from inverter or inverter's PID is enabled. 	<ul style="list-style-type: none"> Slow down the inverter by increasing its acceleration / deceleration time settings. Check that the inverter's output is selected to be linear, and that the inverter's own PID loop is disabled.
	<ul style="list-style-type: none"> Fan failed to stop before restart. 	<ul style="list-style-type: none"> Increase the inverter stop time by increasing option parameter 09.3.
	<ul style="list-style-type: none"> Control is unstable. 	<ul style="list-style-type: none"> Adjust option parameters 9.0 and 9.2 to reduce accuracy & slow down control response. Check Option parameter 9.4 matches the acceleration / deceleration time programmed into the VSD. VSD is current limiting. Increase acceleration / deceleration time in VSD and option parameter 9.4.

In extreme cases, you may need to increase the inverter error tolerance to prevent non-volatile lockouts caused by positioning faults (set option 9.1 = 1). **This must only be changed if an inverter error of ± 55 will not cause unsafe combustion.**



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1.7.7 Oxygen Measurement and Trim Problems

Problem	Possible cause	Suggested action
Oxygen display not available.	The serial number of the oxygen probe interface unit has not been entered.	Enter the serial number into option parameter 30.0
No inlet temperature display	The serial number of the inlet temperature unit has not been entered.	Enter serial number into option parameter 35.0
Inlet or flue temperature display flashes 'Hi'	Inlet air temperature sensor / O ₂ probe is not installed and wired correctly.	Check the wiring.
No efficiency display or efficiency incorrect.	No oxygen display. No inlet temperature display. No calorific value for the current fuel been entered into 35.X?	See 'No oxygen display' See 'No inlet temperature display' Enter the value for the fuel in use.
Oxygen display shows '---'	Probe not to operating temperature, or other probe fault.	Check EK45. Check EK72 – must be above 800°C to function.
Oxygen trim will not work.	Trim is not operative. Boiler just fired up. Probe calibration values not entered correctly. Probe not heated up yet. Probe installed incorrectly. Set to monitor only. Probe in calibration. Trim being reset. Trim limits set to 0.0% of flow. Trim integral gain set to zero. Commissioning data missing.	Use EK45 and 46 to decide if trim is operative. Check that option 30.5 =1. Check option parameter 31.1 to 31.4. Wait for the boiler transport time (after ignition). Wait for modulation. Re-enter values (options 30.1,30.2) Check EK75 – must be above 800°C to work. Check wiring. Check option parameter 30.5 set to 1. Check option parameter 30.6 set to 0. Check option parameter 30.8 set to 0. Check option parameters 32.X. Check option parameters 33.X are non-zero. Check oxygen and flow values been entered for all profile points in the firing range.



Section 5: Faults and Fault Finding



2. Section 5 Update History

New version	Date		Changes in brief
V1pt4	10.29.23	RAL	North America Version

———— End of Section 5 ————

