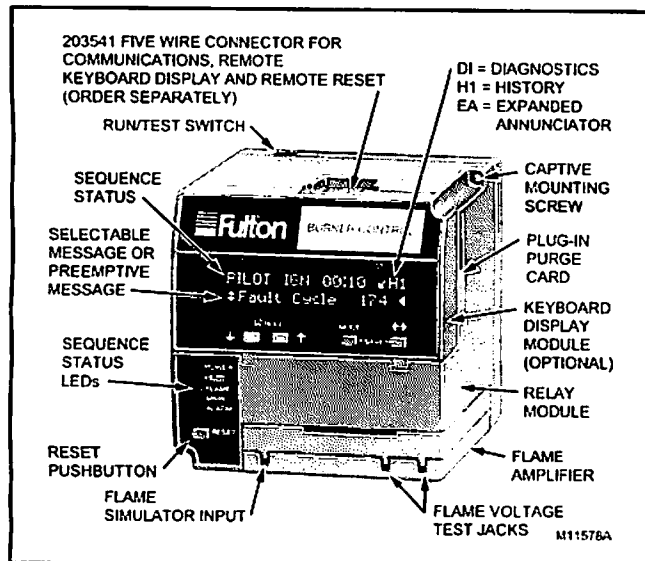




7800 SERIES System Annunciation Diagnostics and Troubleshooting

PRODUCT DATA



FULTON 7800 SERIES DIAGNOSTICS

Troubleshooting control system equipment failures is made easier with the Fulton 7800 SERIES self-diagnostics and first-out annunciation. In addition to an isolated single pole single throw (spst) alarm relay (audible annunciation), the Fulton 7800 SERIES provides visual annunciation by displaying a fault code and fault or hold message at the Keyboard Display Module (KDM) (optional). The Fulton 7800 SERIES provides 127 different diagnostic messages for troubleshooting the system.

Self-diagnostics of the Fulton 7800 SERIES enables it to detect and annunciate both external and internal system problems. Internal and external faults (eg, interlock failures, flame failures, and false flame signals) are annunciated by the

Fulton 7800 SERIES through the device ALARM light emitting diode (LED) alarm output and can be visually displayed on the Keyboard Display Module (KDM).

The KDM displays a sequence status message indicating: STANDBY, SAFE START CHECK, PREPURGE, PILOT IGN, MAIN IGN, RUN, and POSTPURGE. The selectable messages also provide visual indication of current status and historical status of the equipment such as: Flame Signal, Total Cycles, Total Hours, Fault History, Diagnostic Information and Expanded Annunciator terminal status (if used). With this information, most problems can be diagnosed without extensive trial and error testing.

Table 1 provides the sequence and status hold messages. Table 6 provides a summary of all Fulton 7800 SERIES fault messages and fault codes. In addition, Diagnostic Information and History Data are available to assist in troubleshooting the Fulton 7800 SERIES (see Table 2).

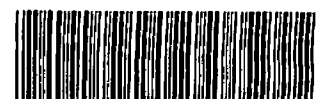
The Fulton 7800 SERIES provides diagnostic information to aid the service technician in obtaining information while troubleshooting the system. See Tables 1, 2, 3 and 4. Diagnostics Information includes Device Type, Device Suffix, Software Revision, Manufacturing Code, Purge Time, Flame Amplifier Type, Flame Failure Response Time, Selectable Jumper Configuration Status, Run/Test Switch Status and Terminal Status.

Diagnostic Information Index

The Fulton 7800 SERIES monitors input/output terminals and can display the status of the terminal at the KDM; for example: Pilot Valve T8 1< (See Table 3). A complete terminal description and terminal number are provided. The display shows the actual status of the terminal. If voltage is detected at the terminal, 1 is displayed, but if no voltage is detected at the terminal, 0 is displayed.

Historical Information Index

The Fulton 7800 SERIES retains historical information for the six most recent lockouts. Each of the six lockout records retains the cycle when the fault occurred, a fault code, a fault message and burner status when the fault occurred; see Table 2.



SERVICE NOTES:

1. The Fulton 7800 SERIES Relay Module can not operate without a KDM, Data ControlBus Module™, or an Extension Cable Assembly installed. These devices are optional with all other Fulton 7800 SERIES controls.
2. If the KDM display is scrambled, remove and remount the KDM and reset the Fulton 7800 SERIES Relay Module.
3. Reset Fulton 7800 SERIES Relay Modules by pressing the RESET button, or pressing a remote reset pushbutton wired through the Keyboard Display Module, Data ControlBus Module™, or Remote Reset

Module. A power-up reset causes an electrical reset of the Fulton 7800 SERIES, but does not reset a lockout condition.

4. Use the access slots on the sides of the Q7800A,B Wiring Subbase to check terminal voltages.
5. Maximum operating temperature of a C7012E,F Series 1 through 6 Flame Detector is reduced to 125oF (52oC) because of the duty cycle operation of the Fulton 7800 SERIES Relay Module.
6. Configuration jumpers must be selected prior to 200 hours of operation. If configuration jumpers are changed after 200 hours, lockout 110 occurs.

NOTE: In Table 1, normal sequences are in bold type, while abnormal sequences are in regular type.

Table 1. Sequence and Status Hold Messages for all Fulton 7800 SERIES Controls.

Sequence	Burner Control Status
INITIATE mm:ss	A stabilization period for the relay module to check for any fluctuations in ac line voltage inputs or control inputs on power-up or during normal operation. The timing of the INITIATE period is ten seconds before entering STANDBY .
If the relay module is in an INITIATE HOLD status, the following conditions could exist:	
INITIATE HOLD: (AC Frequency/Noise)	The relay module is waiting for excess line noise to clear up. The burner sequence cannot advance into STANDBY until the excess line noise, which prevents sufficient reading of the line voltage inputs, ceases or a line frequency error (perhaps caused by using a 60 Hz device on a 50 Hz line, or vice versa, on relay modules with date codes prior to 9730 is corrected.
INITIATE HOLD: (AC Line Dropout)	Indicates that ac line power has momentarily dropped out. The burner sequence cannot advance into STANDBY until the ac line voltage has stabilized throughout the INITIATE sequence.
INITIATE HOLD: (AC Frequency)	Indicates that line frequency is faster than the expected value. The burner sequence cannot advance into STANDBY until the line frequency returns to the proper value (perhaps caused by using a 60 Hz device on a 50 Hz line on relay modules with date codes prior to 9730).
INITIATE HOLD: (Low Line Voltage)	Indicates that low line voltage has occurred. The burner sequence cannot advance into STANDBY until the line voltage is as a sufficient level for operating parameters.
STANDBY	Indicates STANDBY status. The burner can be placed in STANDBY by opening the burner switch or if the operating controller indicates its setpoint was satisfied. If a demand is present for burner operation, the burner sequence cannot advance from STANDBY into PURGE until the recycle limits close. If an Expanded Annunciator is connected, the display messages are enhanced.
If a relay module is in a STANDBY HOLD status, the following conditions could exist:	
STANDBY HOLD: F/G (Flame Detected)	Indicates that a flame is detected. A demand is present for burner operation. The burner sequence will not advance to PREPURGE because a flame is detected as being present. The sequence cannot advance to PREPURGE until the flame signal clears. If the flame signal does not clear within 40 seconds, the relay module locks out.
STANDBY HOLD: (Preignition Interlock)	Indicates that the Preignition Interlock is not closed. A demand is present for burner operation, but the burner sequence cannot advance to PREPURGE until the Preignition Interlock proves closed. If this time exceeds a 30 second hold, the relay module locks out.
STANDBY HOLD: (Lockout Interlock)	Indicates that the Lockout Interlock is closed. A demand is present for burner operation, but the burner sequence cannot advance to PREPURGE until the Lockout Interlock proves open. If this time exceeds the 120 second hold, the relay module locks out.
STANDBY HOLD: (Running Interlock)	Indicates that the Running Interlock is closed. A demand is present for burner operation, but the burner sequence cannot advance to PREPURGE until the Running Interlock proves open. If this time exceeds the 120 second hold, the relay module locks out.
PURGE	Indicates PURGE status, the period of time the blower motor is running before Ignition period. The timing of the PURGE period is selectable.
If the relay module is in a PURGE HOLD status, the following conditions could exist:	

Table 1. Sequence and Status Hold Messages for all Fulton 7800 SERIES Controls.

Sequence	Burner Control Status
PURGE HOLD: (High Fire Switch)	Indicates that the High Fire Switch is not closed. The firing rate motor is driven to its PURGE rate position. If this time exceeds four minutes and fifteen seconds, the relay module locks out.
PURGE DELAY: (High Fire Switch Jumpered)	Indicates that the High Fire Switch is jumpered. The High Fire Switch is bypassed, welded, or otherwise prematurely closed. The system automatically adds 30 seconds to allow the firing rate motor additional drive time to attain or approach the open damper position before starting the PURGE sequence.
PURGE HOLD: TEST (Run/Test Switch)	Indicates that the Run/Test Switch is in the TEST position. The sequence cannot continue until the Run/Test Switch is placed in the RUN position.
PURGE HOLD: (Low Fire Switch Jumpered)	Indicates that the Low Fire Switch is jumpered. The Low Fire Switch is bypassed, welded, or otherwise prematurely closed. The system automatically adds 30 seconds to allow the firing rate motor additional drive time to attain or approach the closed damper position before starting the ignition sequence.
PURGE HOLD: (Running Interlock)	Indicates the Running Interlock is not closed. The sequence cannot advance to Ignition until the Running Interlock proves closed. If this time exceeds 30 seconds, the relay module locks out.
PILOT IGN mm:ss	Indicates that the timing of the PILOT IGN trial begins, in seconds. During this period of time the relay module permits the pilot valve to be open and the pilot flame to be established.
If the relay module is in a PILOT HOLD status, the following conditions could exist:	
PILOT HOLD: TEST (Run/Test Switch)	Indicates that the Run/Test Switch is in the TEST position. The sequence cannot continue until the Run/Test Switch is placed in the RUN position. (not applicable to the RM7865A).
MAIN IGN mm:ss	Indicates that the timing of the MAIN IGN trial begins, in seconds. During this period of time, the relay module permits the main valve to be open and the main flame to be established.
RUN	Indicates RUN status, which is the period of time after the Ignition Trials and before the operating controller setpoint is reached. During this time, the burner is firing under the firing rate control.
If the relay module is in a RUN HOLD status, the following condition could exist:	
RUN LOWFIRE: TEST (Run/Test Switch)	Indicates that the Run/Test Switch is in the TEST position. Normal modulation or operation cannot continue until the Run/Test Switch is in the RUN position. (Not applicable to RM7865A.)
POSTPURGE mm:ss	Indicates POSTPURGE status, which is the period of time after the RUN period, when the blower motor continues to run. The timing of the POSTPURGE period is 15 seconds. (POSTPURGE for RM7865A is 35 seconds.)
Waiting for connection...	The KDM has power but is waiting to receive a signal from the relay module to continue operation.
RESET/ALARM TEST	Indicates that the RESET button is pressed. If it is held for more than four seconds, the alarm output is energized. The alarm output will be de-energized when the RESET button is released.
ADDITIONAL SEQUENCE STATUS INFORMATION IF AN EXPANDED ANNUNCIATOR IS CONNECTED TO THE RM7800.	
BURNER OFF: (Burner Switch)	The KDM indicates the Burner Switch is not closed. The burner sequence cannot advance to PREPURGE until the Burner Switch closes.
STANDBY	The KDM indicates the burner status, STANDBY, and the Operating Control is not closed. The burner sequence cannot advance to PREPURGE until the Operating Control closes.
STANDBY HOLD: (EA Hold Message)	The KDM indicates the burner status, STANDBY, and a limit is not closed. The burner sequence cannot advance to PREPURGE until one or all limits close downstream from the Operating Control.
STANDBY HOLD: (Circuit Fault)	The KDM indicates the burner status, STANDBY, and the control input is not closed. The burner sequence cannot advance to PREPURGE until the control input closes.

Table 2. Accessing Historical and Diagnostic Selectable Messages.

Step	Operation	Press	Display	Comments
1.	Press scroll key to access Diagnostic Information.	(↑)	STANDBY Diagnostic Info>	Use the up/down scroll keys to access the selectable message. The second line will display Diagnostic Information.
2.	Press change level key to access Diagnostic Information.	(←→)	STANDBY Diagnostic Info>	Use the change level key to access the Diagnostic Information.
3.	Continue display of Diagnostic Information.	(↑)	STANDBY DI Device RM7865<	Push the (↑) scroll key to the next Diagnostic message.
4.	Continue through remaining Diagnostic Information display following step 3 as required.			
5.	Press change level key to return to the first level of Diagnostic Information data prompt or to other selectable messages.	(←→)	STANDBY Diagnostic Info>	Another display can be selected or discontinue accessing Diagnostic Information review.

NOTE: Historical Files may be similarly selected.

Table 3. Selectable Messages.

Selectable Message/Display	Description	Possible States/Range (Terminals)	Comments
Flame Signal	Flame signal strength.	0-5.0 Vdc Flame Amp (+ and - [Com])	Flame relay pull-in and drop-out value 1.25 Vdc.
Total Cycles	Total number of equipment operating cycles.	0-99,999 cycles.	Cycle counter is updated each time the main valve is energized.
Total Hours	Total number of equipment operating hours.	0-99,999 hours.	Hour counter is updated each time the main valve output is energized for 60 minutes.
Fault History> (Six most recent faults)	First level prompt for history information. Has subset level.	—	—
Fault Cycle ↙ H1	Cycle when fault occurred.	0-99,999 cycles.	—
Fault Hours ↙ H1	Run hour when fault occurred.	0-99,999 hours.	—
Fault Code ↙ H1	Number that identifies reason for lockout.	0-999	—
Fault Message ↙ H1	Indicates lockout cause.	—	—
Sequence Message ↙ H1	Indicates where lockout occurred in sequence.	—	—
Second Line Message ↙ H1	Second Line Message explains any further information available from the Fulton 7800 SERIES or can be blank if there is not a preemptive second line. H2...H6, etc.	—	—
Diagnostic Information	First level prompt for history information. Has subset level.	—	—
Device	Device type number.	RM78XX	—
Device Suffix	Device suffix number.	nnnn	—
Run/Test Sw	Position of Run/Test Switch.	RUN or TEST	Indicates if Fulton 7800 SERIES is in RUN or TEST mode.

Table 3. Selectable Messages.

Selectable Message/Display	Description	Possible States/Range (Terminals)	Comments
OperControl	Operating Control Input	1 or 0.	Indicates if input is 1 or 0., energized or de-energized.
Interlock	Running/Lockout Interlock.	1 or 0.	Indicates if input is 1 or 0, energized or de-energized.
Pilot Valve	Pilot Valve.	1 or 0.	Indicates if output terminal is 1 or 0, energized or de-energized.
Main Valve	Main Fuel Valve.	1 or 0	Indicates if output terminal is 1 or 0, energized or de-energized.
Ignition	Ignition.	1 or 0.	Indicates if output terminal is 1 or 0, energized or de-energized.
LowFire Sw	Low Fire Switch.	1 or 0.	Indicates if input is 1 or 0, energized or de-energized.
HighFire Sw	High Fire Switch.	1 or 0.	Indicates if input is 1 or 0, energized or de-energized.
PreIgn ILK	Preignition Interlock.	1 or 0.	Indicates if input is 1 or 0, energized or de-energized.
Valv/Start	Interrupted/Intermittent Pilot Valve. First stage oil valve or start input (RM7800L, M).	1 or 0.	Indicates if output is 1 or 0, energized or de-energized.

Lockout Messages (Table 4)

When the Fulton 7800 SERIES is locked out, it displays a repeating cycle of messages (in English text); see Table 4. In addition to the blockout messages, Table 4 provides the system failure and recommended troubleshooting. There are four states in the cycle:

1. State 1, see Fig. 1. Display of first state message lasts six seconds. The first line on the display shows the word LOCKOUT, followed by the fault code number and a lower case letter if an Expanded Annunciator is connected. The status of the relay module at the time of the lockout is shown on the right side of the first line as either INITIATE, STANDBY, PURGE, PFEP, MFEP, RUN or POSTPRG. The lockout reason corresponding to the fault code number is displayed on the second line, highlighted by asterisks to each side. If the lockout reason is being enhanced due to the presence of an Expanded Annunciator, a lower case letter follows the fault code number. This letter corresponds to the first-out code supplied by the Expanded Annunciator.

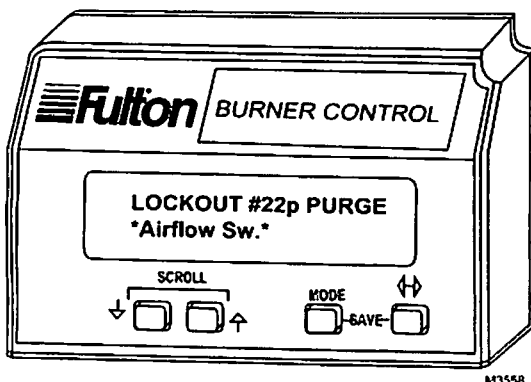


Fig. 1. Lockout message state 1.

2. State 2, see Fig. 2. Display of the second state message lasts two seconds.

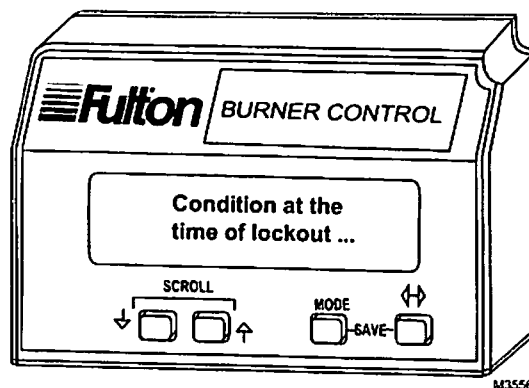


Fig. 2. Lockout message state 2.

3. State 3, see Fig. 3. Display of the third state message lasts three seconds. It is a replica of the burner status as it existed at the time of the lockout. The second line is blank if the burner status at the time of the lockout did not include a pre-emptive message (in parentheses) for the second line.
4. State 4. In the fourth state, both lines are blanked for one-half second, then sequenced to the first state.

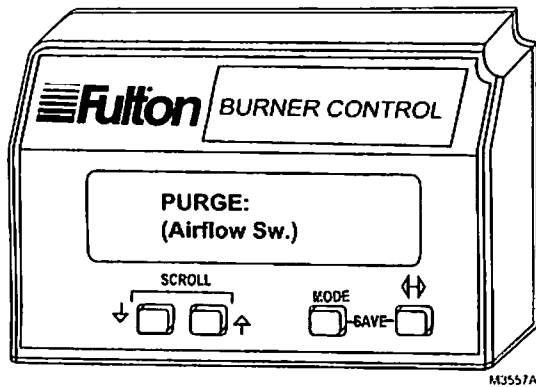


Fig. 3. Lockout message state 3.

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 1 *No Purge Card*	No card is plugged into the purge card slot.	<ol style="list-style-type: none"> 1. Make sure the purge card is seated properly. 2. Inspect the purge card and connector on the relay module for damage or contaminants. 3. Reset and sequence the relay module. 4. If fault code reappears, replace the purge card. 5. Reset and sequence the relay module. 6. If fault persists, replace the relay module.
Fault 2 *AC Frequen/Noise	Excess noise or device running on slow ac.	<ol style="list-style-type: none"> 1. Check the relay module and display module connections. 2. Reset and sequence the relay module. 3. Check the relay module power supply and make sure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 3 *AC Line Dropout*	Ac line dropout detected.	
Fault 4 *AC Frequency*	Device running on fast ac.	
Fault 5 *Low Line Voltage*	Low ac line detected.	
Fault 6 *Purge Card Error*	Purge card timing changed from the original.	<ol style="list-style-type: none"> 1. Make sure the purge card is seated properly. 2. Inspect the purge card and connector on the relay module for damage or contaminants. 3. Reset and sequence the relay module. 4. If fault code reappears, replace the purge card. 5. Reset and sequence the relay module. 6. If fault persists, replace the relay module.
Fault 7 *Flame Amplifier*	Flame not sensed when checked for a nonself-check version.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Make sure that flame detector and flame amplifier are compatible. 3. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 4. Reset and sequence the relay module. 5. If the code reappears, replace the amplifier and/or the flame detector. 6. If fault persists, replace the relay module.
Fault 8 *Flame Amp/Shutr*	Flame sensed when checked for shutter-check or ampli-check versions.	
Fault 9 *Flame Detected*	Flame sensed when shutter open and no flame is expected during STANDBY.	<ol style="list-style-type: none"> 1. Check that flame is not present in the combustion chamber; correct any errors. 2. Check wiring; correct any errors. 3. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 4. Reset and sequence the relay module. 5. If the code reappears, replace the amplifier and/or the flame detector. 6. If fault persists, replace the relay module.

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 10 *Preignition ILK*	Preignition Interlock fault during STANDBY.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Check Preignition Interlock switches to assure proper functioning. 3. Check fuel valve operation. 4. Reset and sequence the relay module; monitor the Preignition Interlock status. 5. If fault persists, replace the relay module.
Fault 11 *Running ILK On*	Running Interlock powered at improper point in sequence.	<ol style="list-style-type: none"> 1. Check wiring to make sure that interlocks are connected properly between terminals 6 and 7. Correct any errors. 2. Reset and sequence the relay module. 3. If the fault persists, measure the voltage between terminals 6 and G (ground), then terminals 7 and G. If there is line voltage at terminal 6 when the controller is off, the controller switch is bad or is jumpered. 4. If steps 1 through 3 are correct and there is line voltage at terminal 7 when the controller is closed and the fault persists, check for a welded or jumpered Running Interlock, Lockout Interlock, or Airflow Switch. Correct any errors. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Fault 12 *Lockout ILK On*	Lockout Interlock powered at improper point in sequence.	
Fault 13 *Airflow Sw. On*	Combustion airflow interlock fault during STANDBY.	
Fault 14 *High Fire Sw.*	High Fire Interlock Switch failure to close during PREPURGE.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Reset and sequence the relay module. 3. Use either the manual motor potentiometer to drive the motor to the High Fire position or use the Run/Test Switch option (if available) sequence to Prepurge drive to High Fire and place in the Test position. Adjust the High Fire Switch while in this state to make sure it closes properly. 4. Measure the voltage between terminal 19 and G (ground) while in the Prepurge drive to High Fire state. Line voltage should be present. If not, the switch adjustment is incorrect and/or the switch is defective and should be replaced. 5. Reset and sequence the relay module. If line voltage was present between the High Fire Switch and terminal 19, and the fault still persists, replace the relay module.
Fault 15 *Flame Detected*	Flame sensed when shutter open and no flame expected.	<ol style="list-style-type: none"> 1. Check that flame is not present in the combustion chamber; correct any errors. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Check wiring; correct any errors. 4. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 5. Reset and sequence the relay module. 6. If the code reappears, replace the amplifier and/or the flame detector. 7. If fault persists, replace the relay module.
Fault 16 *Flame-Out Timer*	Integrated no-flame time exceeded the limit during Pilot Flame Establishing Period.	<ol style="list-style-type: none"> 1. Measure the flame signal. If one exists, verify it meets specifications. Make appropriate burner adjustments per manufacturer instructions. 2. Make sure that the flame amplifier and flame detector are compatible. 3. If the code reappears, replace the amplifier and/or the flame detector. 4. If fault persists, replace the relay module.

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 17 *Main Flame Fail*	Main flame failure during RUN after flame is established and on for at least 10 seconds.	<ol style="list-style-type: none"> 1. Inspect the main fuel valve(s) and connection(s). 2. Make sure that the fuel pressure is high enough to supply fuel to the combustion chamber. 3. Inspect the connections to the fuel pressure switches. Make sure the switches are operating correctly. 4. Inspect the Airflow Switch and make sure it is working properly. 5. Check the flame detector sighting position; reset and cycle. 6. Measure flame signal strength. Verify it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions.
Fault 18 *Flame Detected*	Flame sensed when shutter open and no flame expected during PREPURGE.	<ol style="list-style-type: none"> 1. Check that flame is not present in the combustion chamber; correct any errors. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Check wiring; correct any errors. 4. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 5. Reset and sequence the relay module. 6. If the code reappears, replace the amplifier and/or the flame detector. 7. If fault persists, replace the relay module.
Fault 19 *Main Flame Ign.*	Flame was lost during MFEP or the first 10 seconds of the RUN state.	<ol style="list-style-type: none"> 1. Inspect the main fuel valve(s) and connection(s). 2. Make sure that the fuel pressure is high enough to supply fuel to the combustion chamber. 3. Inspect the connections to the fuel pressure switches. Make sure the switches are operating correctly. 4. Inspect the Airflow Switch and make sure it is working properly. 5. Check the flame detector sighting position; reset and cycle. 6. Measure flame signal strength. Verify it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions.
Fault 20 *Low Fire Sw. Off*	Low Fire Interlock switch failure to close during PREPURGE.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Reset and sequence the relay module. 3. Use either the manual motor potentiometer to drive the motor to the Low Fire position or use the Run/Test Switch option (if available) sequence to Prepurge drive to Low Fire and place in the Test position. Adjust the Low Fire Switch while in this state to make sure it closes properly. 4. Measure the voltage between terminal 18 and G (ground) while in the Prepurge drive to Low Fire state. Line voltage should be present. If not, the switch adjustment is incorrect and/or the switch is defective and should be replaced. 5. Reset and sequence the relay module. If line voltage was present between the Low Fire Switch and terminal 18, and the fault still persists, replace the relay module.
Fault 21 *Running ILK*	Running Interlock fault during PREPURGE.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the fan; make sure there is no blockage of the air intake and that it is supplying air. 3. Make sure the Interlock Switches are working properly and that all switch contacts are free of contaminants. 4. Reset and sequence the relay module to PREPURGE (place the Run/Test Switch in the Test position, if available). Measure the voltage between terminals 7 and G (ground). Line Voltage should be present. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Fault 22 *Lockout ILK*	Lockout Interlock fault during PREPURGE.	
Fault 23 *Airflow Switch*	Combustion airflow interlock fault during PREPURGE.	

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 24 *Internal Fault*	The flame interlock (relay module) was on when it should have been off.	<ol style="list-style-type: none"> 1. Reset and sequence the relay module. 2. If fault persists, replace the relay module.
Fault 25 *Internal Fault*	The flame interlock (relay module) was off when it should have been on.	
Fault 26 *Man-Open Sw. Off*	Manual Open Valve Switch was off when it should have been on.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Make sure that the Manual Open Valve Switch is fully open. 3. Make sure that the Manual Open Valve Switch is functioning properly and that the switch contacts are free from contaminants. 4. Reset and sequence the relay module. 5. Make sure that the Manual Open Valve Switch provides an electrical path when closed. Verify that the relay module is receiving power at terminal 17. 6. If steps 1 through 5 are correct and the fault persists, replace the relay module.
Fault 27 *Start Switch On*	Start Switch was on during PREPURGE.	<ol style="list-style-type: none"> 1. Start Switch held on too long. 2. Check wiring; verify that Start Switch was correctly connected. 3. Make sure that the Start Switch is functioning properly and that the switch contacts are free of contaminants. 4. Reset and sequence the relay module to PREPURGE; set the Run/Test Switch to Test. Make sure that there is no power at terminal 6 during PREPURGE. 5. If steps 1 through 3 are correct and the fault persists, replace the relay module.
Fault 28 *Pilot Flame Fail*	Pilot flame failure.	<ol style="list-style-type: none"> 1. Check pilot valve wiring and operation. Correct any errors. 2. Check fuel supply. 3. Check pilot pressure and repeat pilot turndown test. 4. Check ignition transformer electrode, flame detector, flame detector sighting and flame amplifier. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Fault 29 *Lockout ILK*	Lockout Interlock fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the fan; make sure there is no air intake blockage and that it is supplying air. 3. Make sure that the Lockout Interlock Switches are working properly and that all switch contacts are free of contaminants. 4. Reset and sequence the relay module to PREPURGE (place the Run/Test Switch in the Test position, if available). Measure the voltage between terminals 7 and G (ground). Line voltage should be present. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Fault 30 *Running ILK*	Running Interlock Fault.	<ol style="list-style-type: none"> 1. Inspect the Running Interlocks (including the Airflow Switch) and connections. 2. Make sure the Running Interlocks (including the Airflow Switch) are functioning properly and that switch contacts are free of contaminants. 3. Reset and sequence the relay module to PREPURGE (Run/Test Switch, if available, to Test). Measure the voltage between terminal 7 and G (ground). Line voltage should be present. 4. If steps 1 through 3 are correct and the fault persists, replace the relay module.

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 31 *Low Fire Sw. Off*	Low Fire Interlock Switch failure to close during RUN.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Reset and sequence the relay module. 3. use either the manual motor position to drive the motor to the Low Fire position, or use the Run/Test Switch option (if available). Sequence to Run drive to Low Fire and place in the Test Position. Adjust the Low Fire Switch while in this state to make sure that it is closing properly. 4. While in Run drive to Low Fire state, measure the voltage between terminal 18 and G (ground). Line voltage should be present. If not, the switch adjustment is incorrect and/or the switch is defective and needs replacement. 5. Reset and sequence the relay module. If line voltage was present between the Low Fire Switch and terminal 18 and the fault persists, replace the relay module.
Fault 32 *Airflow Switch*	Combustion Airflow Interlock fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the fan; make sure there is no blockage of the air intake and that it is supplying air. 3. Make sure that the Airflow Interlock Switches are working properly and that all switch contacts are free of contaminants. 4. Reset and sequence the relay module to PREPURGE (place the Run/Test Switch in the Test position, if available). Measure the voltage between terminals 7 and G (ground). Line voltage should be present. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Fault 33 *Preignition ILK*	Preignition interlock fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the Preignition Interlock Switches and make sure they function properly. 3. Check fuel valve operation. Valve must close within five seconds. 4. Reset and sequence the relay module. 5. During STANDBY or PREPURGE, measure the voltage between terminal 20 and G (ground). Line voltage should be present. If not, the Preignition Interlock Switches are defective and need replacement. 6. If the fault persists, replace the relay module.
Fault 34 *Control On*	CTL input was energized at the wrong time for the relay module. This fault implies a field wiring error.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module.
Fault 35 *Internal Fault*	Safety relay was off when it should be on or fuse has blown.	<ol style="list-style-type: none"> 1. Reset and sequence the relay module. 2. If fault persists, replace the relay module.
Fault 36 *Internal Fault*	Main valve terminal was off when it should be on.	
Fault 37 *Internal Fault*	Pilot (ignition) valve terminal was off when it should be on.	
Fault 38 *Internal Fault*	Ignition terminal was off when it should be on.	
Fault 39 *Internal Fault*	V2S valve terminal was off when it should be on.	
Fault 40 *Internal Fault*	Safety relay was on when it should be off.	

Table 4. Fault Messages and Recommended Troubleshooting.




Fault Code	System Failure	Recommended Troubleshooting
Fault 41 *Main Valve On*	Main Valve terminal was on when it should be off.	 WARNING Explosion Hazard. Can cause severe injury, death or property damage. 1. Remove system power, turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect the fuel valve(s) and connection(s). Make sure the switches are working correctly and are not jumpered or welded. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Fault 42 *Pilot Valve On*	Pilot (ignition) valve terminal was on when it should be off.	
Fault 43 *Ignition On*	Ignition terminal was on when it should be off.	 WARNING Explosion Hazard. Can cause severe injury, death or property damage. 1. Remove system power, turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect the Ignition terminal and connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Fault 44 *Pilot Valve 2 On*	V2S valve terminal, used as a pilot, is on when it should be off.	
Fault 45 *Low Fire Sw. Off*	Low Fire Interlock Switch failure to close or stay closed.	 WARNING Explosion Hazard. Can cause severe injury, death or property damage. 1. Remove system power, turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect the Pilot Fuel Valve 2 and connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Fault 46 *Flame Amp Type*	This fault indicates: Flame Failure Response Time (FFRT) or TYPE input from the amplifier changed while the device was powered.	
Fault 47 *Jumpers Changed*	The configuration jumpers differ from the sample taken at startup.	1. Check wiring; correct any errors. 2. Reset and sequence the relay module. 3. use either the manual motor position to drive the motor to the Low Fire position, or use the Run/Test Switch option (if available) sequence to Run drive to Low Fire and place in the Test position. Adjust the Low Fire Switch while in this state to make sure that it is closing properly. 4. While in Run drive to Low Fire state, measure the voltage between terminal 18 and G (ground). Line voltage should be present. If not, the switch adjustment is incorrect and/or the switch is defective and needs replacement. 5. If steps 1 through 4 are correct and the fault still persists, replace the relay module. 1. Remove power to the device. 2. Reseat the flame amplifier and reset and sequence the relay module.
		1. Inspect the jumper connections. Make sure that clipped jumpers are completely removed. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module.

Table 4. Fault Messages and Recommended Troubleshooting.



Fault Code	System Failure	Recommended Troubleshooting
Fault 48 *Delayed MV On*	V2S valve terminal, used as a delayed main valve, was on when it should be off.	 WARNING Explosion Hazard. Can cause severe injury, death or property damage. 1. Remove system power, turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect the V2S Fuel Valve and its connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Fault 49 *Man-Open Sw. On*	The manual open switch was on when it should be off.	 WARNING Explosion Hazard. Can cause severe injury, death or property damage. 1. Remove system power, turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect the Pilot Fuel Valve 2 and connections. Make sure the switch is working correctly and is not jumpered or welded. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Fault 50 *Jumpers Wrong*	The sequence logic detected a combination of jumpers that is illegal for the sequence (e.g., if it was correct to clip Jumper JR1 or Jumper JR2, but not both, this fault would be used when both were clipped).	1. Inspect jumpers and refer to installation instructions for compatible jumper configurations. 2. Make sure that clipped jumpers are completely removed. 3. Reset and sequence the relay module. 4. If fault persists, replace the relay module.
Fault 51 *Flame Too Strong*	Flame signal value too high to be valid.	1. Make sure that flame detector and flame amplifier are compatible. 2. Remove the flame amplifier and inspect connections. Reset the flame amplifier. 3. Reset and sequence the relay module. 4. Check the flame detector sighting position, reset and cycle. 5. Measure flame strength. Verify it meets specifications. If not, refer to the flame amplifier and/or flame detector checkout procedures in the installation instructions. 6. If the code reappears, replace the flame amplifier and/or the flame detector. 7. If fault persists, replace the relay module.
Fault 52 *Internal Fault*	Pilot Valve 2 terminal was off when it should be on.	1. Inspect Pilot V2S terminal 21 and connections. Make sure that Pilot V2S is working properly. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module.
Fault 53 *Lockout Switch*	Lockout Input fault.	1. Check wiring; correct any errors. 2. Inspect the Lockout Switch to make sure it is working properly. 3. Reset and sequence the relay module. During STANDBY or PREPURGE, measure the voltage between terminal 20 and G (ground). 220 to 240 Vac should be present. If not, the lockout switch is defective and should be replaced. 4. If fault persists, replace the relay module.

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 54 *Comb. Pressure*	Combustion Pressure Switch fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the Combustion Pressure Switch to make sure it is working correctly. 3. Reset and sequence the relay module. 4. During STANDBY or PREPURGE, measure the voltage between terminal 20 and G (ground). Line voltage should be present. If not the Combustion Pressure Switch is defective and needs replacement. 5. If fault persists, replace the relay module.
Fault 55 *Purge Fan Sw. On*	Purge Fan Switch is on when it should be off.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the Purge Fan Switch terminal 18 and connections. Make sure the switch is working correctly and is not jumpered or welded. 3. Reset and sequence the relay module. 4. If the fault persists, replace the relay module.
Fault 56 *Block Intake*	Block Intake fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any error. 2. Inspect the Block Intake Switch and make sure it is working properly. 3. Reset and sequence the relay module. 4. During PREPURGE, measure the voltage between terminal 7 and G (ground). Line voltage should be present. If not, the Block Intake Switch is defective and should be replaced. 5. If fault persists, replace the relay module.
Fault 57 *Purge Fan Sw. Off*	Purge Fan Switch is off when it should be on.	<ol style="list-style-type: none"> 1. Inspect the Prepurge Fan Switch terminal 18 and connections. Make sure the switch is working properly. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module.
Fault 67 *AC Phase*	L1 and L2 miswired/exchanged.	<ol style="list-style-type: none"> 1. Check L1 and L2 for proper line phasing.
Fault 68 *Preignition ILK*	Preignition Interlock fault.	<ol style="list-style-type: none"> 1. Check wiring; correct any errors. 2. Inspect the Preignition Interlock switches and make sure they work properly. 3. Check fuel valve operation; valve must close within five seconds. 4. Reset and sequence the relay module. 5. During STANDBY or PREPURGE, measure the voltage between terminal 20 and G (ground). Line voltage should be present. If not, the Preignition Interlock switches are defective and should be replaced. 6. If fault persists, replace the relay module.
Fault 69 - 70	—	—
Fault 71 - 75 *Device Specific*	—	—
Fault 76 - 93 *Accessory Fault*	—	—
Fault 94 - 104 *Internal Fault*	—	—
Fault 105 *Internal Fault*	Relay Module self-test failure.	<ol style="list-style-type: none"> 1. Reset and sequence the relay module. 2. If fault reappears, remove power from the relay module and reapply the power, reset and sequence the relay module. 3. If fault persists, replace the relay module.
Fault 106 *Internal Fault*	Relay Module self-test failure.	
Fault 107 *Internal Fault*	Relay Module flame signal cross-check failure.	

Table 4. Fault Messages and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Fault 109 *Internal Fault*	Negative cycle test failed; earth ground absent or line voltage phasing improper.	<ol style="list-style-type: none"> 1. Make sure that a good earth ground connection exists at the installation site and that all earth ground connections are complete and correct. 2. Make sure that the relay module and all loads operate at the same line voltage phase. 3. Reset and sequence the relay module. 4. If fault persists, replace the relay module.
Fault 110 *Internal Fault*	The configuration jumpers differ from stored values.	<ol style="list-style-type: none"> 1. Inspect the jumper connections. Make sure they match the original selection and that clipped jumpers are completely removed. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module. <p>IMPORTANT Configuration jumpers must be selected prior to 200 hours of operation. If configuration jumpers are changed after 200 hours of operation, lockout 110 occurs.</p>
Fault 111 *Internal Fault*	Relay Module configuration jumper test failure.	<ol style="list-style-type: none"> 1. Inspect the jumper connections. Make sure they match the original selection and that clipped jumpers are completely removed. 2. Reset and sequence the relay module. 3. If fault persists, replace the relay module.
Fault 112 - 126 *Internal Fault*	Relay Module self-test failure.	<ol style="list-style-type: none"> 1. Reset and sequence the relay module. 2. If fault persists, replace the relay module.
Fault 127 *Internal Fault*	Safety relay feedback circuit was in an improper state.	<ol style="list-style-type: none"> 1. Reset and sequence the relay module. 2. If fault persists, replace the relay module.

NOTE: EC78XX controls display *Internal Fault* rather than *Call Service*.

Table 5. Expanded Annunciator Hold Codes.

Annunciation Message	Symbol	System Holds
BURNER OFF: (Burner Switch)	EA	Burner Switch is open.
STANDBY HOLD: (Aux. Limit#1)	EA	Auxiliary Limit # 1 is open.
STANDBY HOLD: (Aux. Limit#2)	EA	Auxiliary Limit # 2 is open.
STANDBY HOLD: (LWCO)	EA	Open low water cutoff.
STANDBY HOLD: (High Limit)	EA	High Limit (pressure or temperature) exceeded.
STANDBY HOLD: (Aux. Limit#3)	EA	Auxiliary Limit # 3 is open.
STANDBY HOLD: (FuelSelect Off)	EA	No fuel selected.
STANDBY HOLD: (BothFuelSelect)	EA	Both fuels selected.
STANDBY HOLD: (High Oil Pres.)	EA	Oil pressure is above high oil pressure limit.
STANDBY HOLD: (Low Oil Pres.)	EA	Oil pressure is below low oil pressure limit.
STANDBY HOLD: (High Oil Temp.)	EA	Oil temperature is above high oil temperature limit.
STANDBY HOLD: (Low Oil Temp.)	EA	Oil temperature is below low oil temperature limit.

Table 5. Expanded Annunciator Hold Codes.

Annunciation Message	Symbol	System Holds
STANDBY HOLD: (Atomizing Sw.)	EA	Atomizing switch is open.
STANDBY HOLD: (High Gas Pres.)	EA	Gas pressure is above high gas pressure limit.
STANDBY HOLD: (Low Gas Pres.)	EA	Gas pressure is below low gas pressure limit.
STANDBY HOLD: (Circuit Fault)	EA	Control input is not energized.

Table 6. Expanded Annunciator Fault Codes.

Annunciation Message	Symbol	System Faults
LOCKOUT nna *Aux. Limit # 1*	EA	Auxiliary Limit # 1 is open.
LOCKOUT nnb *Aux. Limit # 2	EA	Auxiliary Limit # 2 is open.
LOCKOUT nnc *LWCO*	EA	Open low water cutoff.
LOCKOUT nnd *High Limit*	EA	High Limit (pressure or temperature) exceeded.
LOCKOUT nne *Aux. Limit # 3*	EA	Auxiliary Limit # 3 is open.
LOCKOUT nnf *FuelSelectOff*	EA	No fuel selected.
LOCKOUT nng *BothFuelSelect*	EA	Both fuels selected.
LOCKOUT nnh *High Oil Pres.*	EA	Oil pressure is above high oil pressure limit.
LOCKOUT nni *Low Oil Pres.*	EA	Oil pressure is below low oil pressure limit.
LOCKOUT nnj *High Oil Temp.*	EA	Oil temperature is above high oil temperature limit.
LOCKOUT nnk *Low Oil Temp.*	EA	Oil temperature is below low oil temperature limit.
LOCKOUT nnm *Atomizing Sw.*	EA	Atomizing switch failed to close.
LOCKOUT nnn *High Gas Pres.*	EA	Gas pressure is above high gas pressure limit.
LOCKOUT nno *Low Gas Pres.*	EA	Gas pressure is below low gas pressure limit.
LOCKOUT nnp *Airflow Switch*	EA	Airflow Switch is open when it should be closed or vice versa.
LOCKOUT nnq *Aux. ILK # 4*	EA	Auxiliary interlock # 4 is open.

Annunciation Message	Symbol	System Faults
LOCKOUT nnr *Aux. ILK # 5*	EA	Auxiliary interlock # 5 is open.
LOCKOUT nns *Other ILKs*	EA	Other Auxiliary Interlocks are open.
LOCKOUT nny *Valve Closure*	EA	Preignition Interlock or other valve closure switch is open.
LOCKOUT nnz *Other PILs*	EA	Other Preignition Interlocks are open.

Table 7. Expanded Annunciator Diagnostic Current Status Messages.

Display	Description
Burner Sw.	Burner Switch
Oper.Control	Operating Control
Aux. Limit # 1	Auxiliary Limit # 1
Aux. Limit # 2	Auxiliary Limit # 2
LLWCO	Low Water Cutoff
High Limit	High Temperature or High Pressure Limit
Aux. Limit # 3	Auxiliary Limit # 3
FuelSelectOff	Fuel Select Off
High Oil Pres.	High Oil Pressure
Low Oil Pres.	Low Oil Pressure
High Oil Temp.	High Oil Temperature
Low Oil Temp.	Low Oil Temperature
Atomizing Sw.	Atomizing Switch
High Gas Pres.	High Gas Pressure
Low Gas Pres.	Low Gas Pressure
Airflow Sw.	Airflow Switch
Aux. ILK #4	Auxiliary Interlock #4
Aux ILK #5	Auxiliary Interlock #5
All switches on	—

