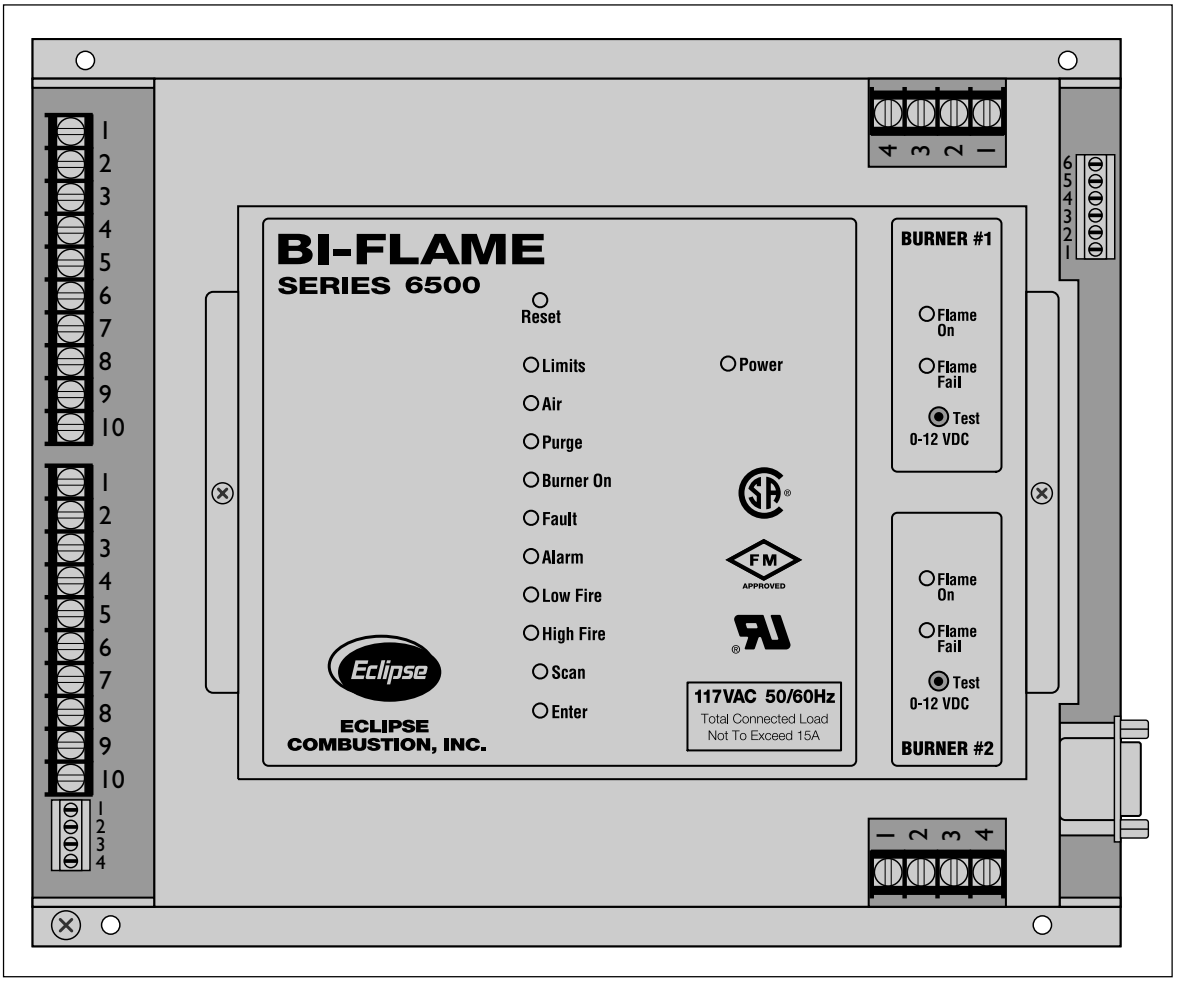
Instruction Manual
No. 826, 10/96

Eclipse Combustion

Bi-Flame

Dual Burner Monitoring System

Model 6500
Version 1.01



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Innovative Thermal Solutions

In accordance with the manufacturer's policy of continual product improvement, the product presented in this brochure is subject to change without notice or obligation.

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We have made every effort to make this manual as accurate and complete as possible. Should you find errors or omissions, please bring them to our attention so that we may correct them. In this way we hope to improve our product documentation for the benefit of our customers. Please send your corrections and comments to our Marketing Communications Manager.

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Eclipse Combustion, Inc., for a period of one year from shipment, warrants each Bi-Flame burner monitoring system to the original purchaser to be free from defects in material and workmanship under normal use as defined hereafter. Any operation expressly prohibited in this Guide, any adjustment or assembly procedures not recommended or authorized in these instructions, shall void the warranty.

About this manual

Audience

This manual has been written for the people who select and install the product and the technicians who work on it. They are expected to have previous experience with this kind of equipment.

Scope

This manual contains essential information for the proper installation and operation of the Eclipse Bi-Flame Burner Monitoring System.

Following the instructions in this manual should assure trouble-free installation and operation of the monitoring system. Read this manual carefully. Make sure that you understand its structure and contents. Obey all the safety instructions.

Do not deviate from any instructions or application limits in this manual without written consent from Eclipse Combustion, Inc.

If you do not understand any part of the information in this manual, do not continue. Contact your Eclipse sales office or Eclipse Combustion, Inc., Rockford, Illinois.

Document Conventions

There are several special symbols in this document. You must know their meaning and importance.

The explanation of these symbols follows. Please read it thoroughly.

Danger:

Indicates hazards or unsafe practices which WILL result in severe personal injury or even death.
Only qualified and well trained personnel are allowed to carry out these instructions or procedures.
Act with great care and follow the instructions.

Warning:
Indicates hazards or unsafe practices which could result in severe personal injury or damage.
Act with great care and follow the instructions.

Caution:
Indicates hazards or unsafe practices which could result in damage to the machine or minor personal injury.
Act carefully.

Note:
Indicates an important part of the text.
Read the text thoroughly.

How to get help

If you need help, you can contact your local Eclipse Combustion sales office. You can also contact Eclipse Combustion, Inc. at:

1665 Elmwood Road
Rockford, Illinois 61103 USA

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E-mail: eclipse@eclipsenet.com
http://www.eclipsenet.com/eci

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Introduction

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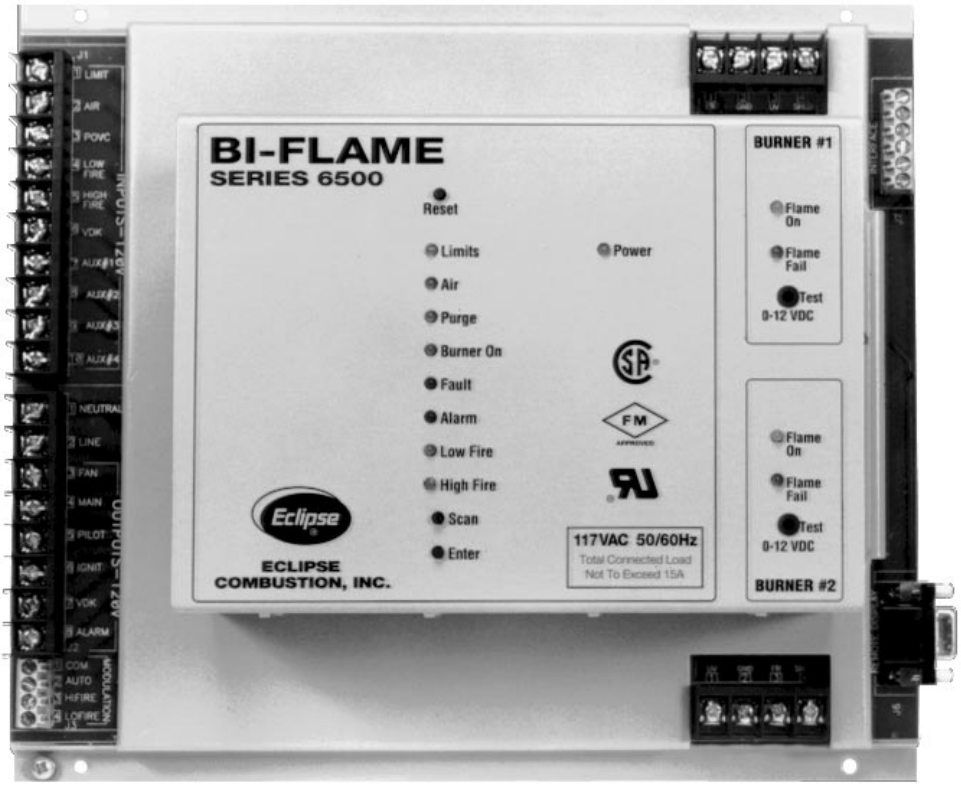
Product Description

The Eclipse Combustion Bi-Flame Burner Monitoring System controls the start-up sequence and monitors the flame of two individual gas, oil, or combination gas/oil burners connected to a common valve train. Its dynamic on-board testing checks for faulty relays, proof of valve closure, high and low fire switch interlocks, and shorted air switch.

Its DIP switches allow sequence and timing functions, as well as system configuration. It is also capable of modulation (high and low fire purging) and monitoring up to four auxiliary inputs, history logging, and interfacing to valve leakage detection devices. It is UL recognized, FM approved and CSA certified.

Figure 1.1 **Bi-Flame Burner Monitoring System**



Specifications

2

Introduction

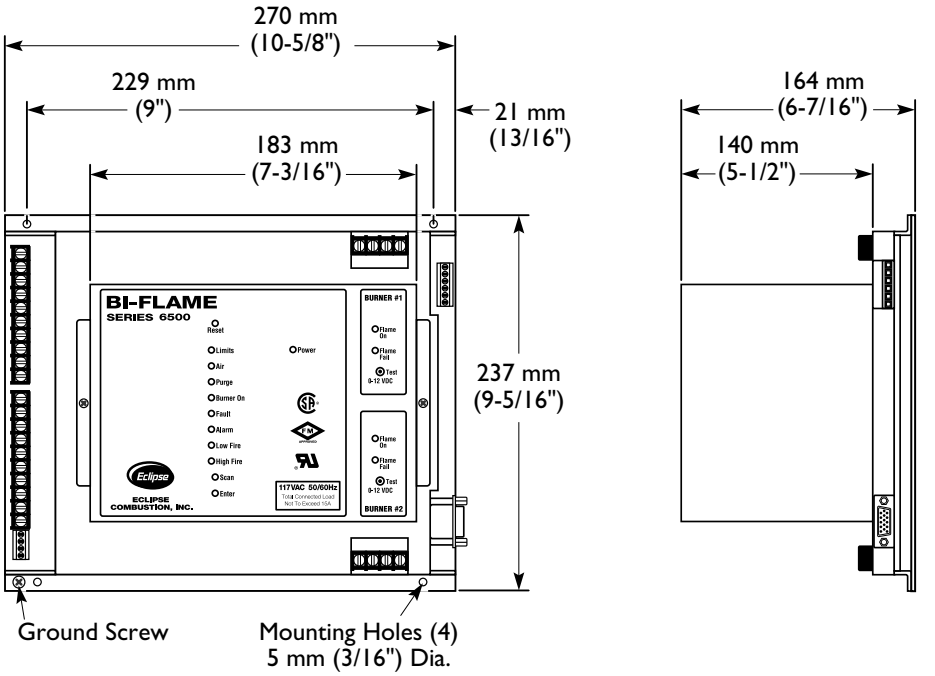
This section gives a detailed overview of Bi-Flame specifications and dimensions.

Specifications

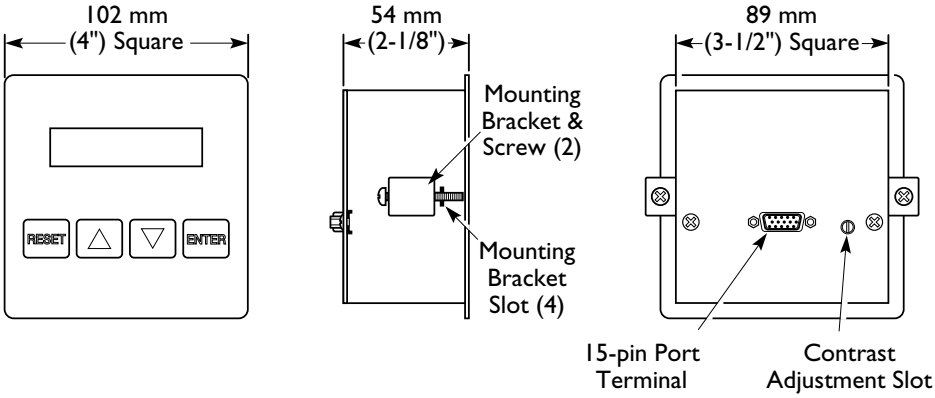
Parameter	Description
Supply	• 120 VAC (+10%, -15%), 50/60 Hz standard.
Temperature Ranges	Unit — Model Nos. — Temperature Range Bi-Flame — 6500 — -40° to +60°C (-40° to +140°F) 90° U.V. Scanner — 5600-90A — -20° to +60°C (0° to 140°F) U.V. Scanner — 5600-91 — -40° to +125°C (-40° to +257°F) Self-Check U.V. — 5602-91 — -40° to +60°C (-40° to +140°F) Remote Display — 6000D — 0° to 50°C (32° to 122°F)
Flame Failure Response	• 3 seconds ±0.5 seconds.
TFI/Pilot Interrupt	• 5, 10 or 15 seconds selectable.
Purge Time	• *Modulating:* selectable from 0-225 seconds in 15 second increments. • *Process:* selectable from 30 seconds to 13.5 minutes in 30 second increments.
Contact Ratings @ 120 VAC *(maximum total connected load not to exceed 15 amps)*	Function — Affected Terminals — Inductive Load — Resistive Load Output Relay — J2-4 through J2-8 — 1/3 HP — 10 amps Output Relay — J2-3 — 1/2 HP — 15 amps Modulation — J3-1 through J3-4 — 1/3 HP — 10 amps
Approvals	• UL Recognized (File – MH12613) • FM Approved (File – JI2Y3A5.AF) • CSA Certified (File – LR37456)
Shipping Weight	• 4 kilograms (9 lbs.)

Dimensions

Bi-Flame



Remote Display *(Shown with remote keypad and reset)*



DIP Switch Selection

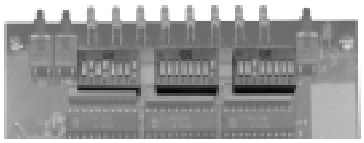
3

Introduction

This section details the location, selection and description of the Bi-Flame DIP switches, which allow for sequence and timing functions as well as system configuration.

Caution
To avoid electric shock, shut off the power supply when installing any control device. Flame monitoring systems must be installed by a qualified, licensed technician.

Switch Location & Access



All of the DIP switches are located in the logic module board, which is the same board that houses all of the LED lights and push-buttons on the cover. To gain access to the DIP switches, the cover of the Bi-Flame must be removed. To do this, remove the two screws which hold the cover to the motherboard. Then gently pull the logic module board towards you to disengage the terminal pins at the module base. The photo to the left shows the DIP switch locations.

S2 DIP Switch Settings

The S2 DIP switches permit programming of timing and sequence functions of the Bi-Flame.

Note:
The S2 DIP switch settings below left are for illustrative purposes only; the actual settings of any of these switches will be determined by your system conditions.

8	0	MODULATION PURGE TIME (ADDITIVE) S4/SW8 = ON	30 SEC.	PROCESS PURGE TIME (ADDITIVE) S4/SW8 = OFF
7	120 SEC.		7 MIN.	
6	60 SEC.		3 MIN.	
5	30 SEC.		2 MIN.	
4	15 SEC.		1 MIN.	
3	10 SEC. TFI = ON 5 SEC. TFI = OFF (S4/SW7 = ON)		10 SEC. TFI = ON 15 SEC. TFI = OFF (S4/SW7 = OFF)	
2	INTERMITTENT PILOT		INTERRUPTED PILOT	
1	RECYCLING		NON-RECYCLING	
ON ↔ OFF				

SW1: Recycling mode selection (On = Recycling; Off = Non-recycling)

SW2: Pilot selection (On = Intermittent, where pilot remains on during burner cycle; Off = Interrupted, where pilot valve closes after main burner is established).

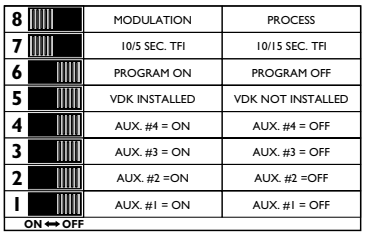
SW3: Trial-for-ignition (TFI) range selection (On = 10 seconds; Off = 5 seconds [with S4-SW7 on] or 15 seconds [with S4-SW7 off]).

SW4 through 8: Purge time selection (switch settings are additive); see illustration at left for exact times.

S4 DIP Switch Settings

The S4 DIP switches enables optional features on select models of the Bi-Flame.

Note:
The S4 DIP switch settings below left are for illustrative purposes only; the actual settings of any of these switches will be determined by your system conditions.



8	MODULATION	PROCESS
7	10/5 SEC. TFI	10/15 SEC. TFI
6	PROGRAM ON	PROGRAM OFF
5	VDK INSTALLED	VDK NOT INSTALLED
4	AUX. #4 = ON	AUX. #4 = OFF
3	AUX. #3 = ON	AUX. #3 = OFF
2	AUX. #2 =ON	AUX. #2 =OFF
1	AUX. #1 = ON	AUX. #1 = OFF
ON ⇔ OFF		

SW1 through 4: Actuation of auxiliary inputs (optional)

SW5: For using a Valve Leak Sensing Device (VLSD) with Bi-Flame

SW6: History logging on/off

SW7: TFI range selection

SW8: Operational mode selection (On=Modulation; Off=Process). This selection activates the purge outputs. It also determines which purge times are used by switches 4 through 8 on S2 dip switch.

S6 DIP Switch Settings

Factory set at two burners; **DO NOT CHANGE**. Changing will result in an "unmatched burner" condition and prevent system operation. Shown below is the actual factory setting:

SW1	SW2	SW3	SW4	SW5 thru 8
Off	On	Off	Off	Off

Function Summary

4

Introduction

This section describes the function features of the Bi-Flame that can be found on the various terminal strips and the circuit boards of the Bi-Flame. It is broken into three categories: Standard features, Optional features and the LED Indicator Lights of the logic module.

Standard features

The following function features are standard on the Bi-Flame:

Combustion Air Flow Check Terminal

The Bi-Flame checks that the combustion air flow switch is open before start-up, closed during operation and open again at burner shutdown, thus preventing operation with an air switch that is defective, maladjusted or jumpered.

Main Fuel Valve Proof-of-Closure Terminal

The Bi-Flame checks that the main fuel valve is closed before start-up and after burner shutdown. This arrangement requires an approved proof-of-closure switch on the main fuel valve.

Low Fire Start Terminal

When selected, the system checks for the low fire start position prior to light-off.

High Fire/High Fire Purge Check Terminal

When selected, the system checks that the air modulation motor reached the high fire position during high fire purge. The modulation motor must be fitted with a high fire position switch, which is then connected to the high fire check terminal. An air flow or pressure switch that is set to prove sufficient purge air may be used instead of the high fire position switch.

Recycle Mode

When selected, the Bi-Flame will restart the sequence after flame or air failure. The recycle mode allows the system to re-initiate the start-up sequence automatically, once the main burners have been operating for at least 35 seconds. If the pilot flame fails to light during recycling, the system will lock out and annunciate a pilot flame fail. If the recycle is successful and the main burners are operational for at least 35 seconds, the system is ready for another recycle. At no time will the system recycle in the event of pilot flame fail.

Pilot Test Mode

This mode is entered by depressing the RESET and the ENTER buttons simultaneously then releasing the RESET button but holding the ENTER button for another 10 seconds. The limits light will flash off and on, indicating that the system is in the test mode.

In the pilot test mode, the Bi-Flame operates normally with the exception that the main valves are not energized, preventing the main burners from igniting.

To exit the pilot test mode, simply press the RESET button and the Bi-Flame will exit the pilot test mode and restart the sequence.

Interrupted or Intermittent Pilot

Pilot mode is selected using the DIP switch (see "S2 DIP Switch Settings" on page 3-1). An interrupted pilot shuts off after the main flame is established. An intermittent pilot continues during the entire main flame firing cycle.

Spark, Pilot Flame & Main Flame Separation

During the trial for ignition period (TFI), the pilot valve and ignition coil remains energized. At the end of the TFI, the pilot flame remains on and the ignition coil is de-energized. After a five second delay to prove the pilot flame, the main gas valve is energized.

Note:
All pilots must light within the specified TFI or a pilot flame failure will occur. If one burner experiences either a pilot or main flame failure, then both burners will shut down. The failed burner will be indicated by the red flashing "Flame Fail" light on the corresponding burner monitoring control.

System Faults

A system fault (illuminated by the fault LED on the logic cards) prevents gas ignition but does not lock out the system. System fault conditions are as follows:

1) If a flame is detected out of sequence, which may be caused by:
   a) a faulty scanner
   b) electrical interference on the sensor leads
   c) a flame exists in the burner due to a gas leak or other condition.
2) Air flow switch closed before start-up.

System Lockout Conditions

A system lockout will occur (illuminated by the alarm LED on the logic card) for any of the following conditions:

1) Air failure–loss of combustion anytime during the operational cycle.
2) Pilot flame fail–loss of flame during the trial for pilot ignition period.
3) Main flame fail–loss of flame during the main burner trial for ignition.
4) Main fuel valve–open after cycle shutdown or before start-up with interlocks closed.
5) Unmatched burners–the number of burners in the system do not match the number selected on the DIP switches (see "S6 DIP Switch Settings" on page 3-2).
6) Relay fail–failure of Bi-Flame internal relays.
7) Low fire fail–low fire switch open prior to trial for ignition.
8) High fire fail–high fire switch is not closed at the end of high fire purge.
9) Flame fail–loss of flame after main flame has been established.
10) If no purge time is set (see "S2 DIP Switch Settings" on page 3-1).
11) Wiring error which puts external voltage on any of the output terminals.
12) Welded internal contacts or other malfunctions in the Bi-Flame.

OPTIONAL FEATURES

The following features are available only on select models, and when the appropriate switches are selected on DIP switch S4:

Auxiliary Inputs with History Log

This feature provides four auxiliary inputs which are monitored by the Bi-Flame as alarm interlocks. This means that when the input voltage is interrupted, the system locks out and will annunciate on the optional remote display unit.

To activate the auxiliary units, set the corresponding switches 1 through 4 of SW4 on the Logic Module to the "On" position (see "S4 DIP Switch Settings" on page 3-2). Once activated, a voltage of 120 VAC must be present at the input for the Bi-Flame system to operate. If an auxiliary input loses its voltage for more than one second while the interlocks and limits input is powered, then a lockout condition will occur. If the Bi-Flame is equipped with an optional remote display unit, then the following message will occur:

Aux. Input #1	Aux. Input #2	Aux. Input #3	Aux. Input #4
AUX.LIM. #1 FAIL	**AUX.LIM. #2 FAIL**	**AUX.LIM. #3 FAIL**	**AUX.LIM. #4 FAIL**
HH:MM:SS LOCKOUT	**HH:MM:SS LOCKOUT**	**HH:MM:SS LOCKOUT**	**HH:MM:SS LOCKOUT**

Note:
Unused auxiliary inputs should be connected to 120 VAC.

History Log Activation

The history log is only accessible through an optional remote display unit with remote reset, and when the Bi-Flame is in a "LOCKOUT" or "LIMITS OPEN" condition. Switch 6 of S4 on the logic module must also be activated (see "S4 DIP Switch Settings" on page 3-2). The history log records the total number of operating cycles, and the last lockout messages up to a maximum of 10.

With a remote display available and the Bi-Flame in one of the two conditions described above, the history log can be accessed as follows:

1) Press and hold the ENTER key on the remote display unit until the following message appears:
   TOTAL OPERATING
   CYCLES = XXXXX *(where X is a digit between 1 and 9).*
   The record number will display as long as the ENTER key is pressed.
2) Release and press the ENTER key a second time. The record number of the most recent lockout message will be displayed:
   RECORD #X *(where X is the number of the most recent lockout)*
3) Release the ENTER key and the most recent lockout message will display for seven seconds.
4) If you wish to see the next lockout message, press and release the ENTER key before the seven second time duration ends of the most recent lockout message display. This will prompt the next lockout message. If desired, continue this procedure until the maximum of ten lockout messages has been displayed (remember that the highest record number is the most recent lockout message).

("History Log Activation" continues onto the next page)

History Log Activation

(continued from previous page)

5) Continued pressing and releasing the ENTER key in less than seven seconds keeps the history log active; waiting longer than seven seconds deactivates the history log mode and the next display is the last sequence message before the history log was activated. For example, if the message "LIMITS OPEN" was displayed when the history log was activated, then that message will appear again after seven seconds.
6) If you wish to erase all of the lockout messages from the history log, press the RESET and ENTER keys simultaneously while the history log is active. Release the RESET key, but hold the ENTER key for another five seconds.

High to Low Fire Purge Modulation Capability with High to Low Fire Position Switch Interlocks

The modulation feature incorporates a high fire purge time and a low fire purge time into the purge sequence. This feature allows the Bi-Flame to sequence internal dry contacts which can be used by the customer requiring a high fire purge of the combustion chamber before ignition.

The high fire and low fire purge times are selectable by means of S2 DIP switches on the logic board (see "S2 DIP Switch Settings" on page 3-1):

S2 SW4 ..... 15 seconds	S2 SW7 ..... 120 seconds
S2 SW5 ..... 30 seconds	S2 SW8 ..... 0 seconds
S2 SW6 ..... 60 seconds	

The selected times are additive and apply to both the high fire and low fire purge times (that is, high and low fire times are always identical).

With this option, the modulation terminals on J3 terminal strip will sequence as follows:

Sequence Step	Internal Contact Connections
High Fire Purge	Terminal 1 (COMMON) to Terminal 3 (HI FIRE)
Low Fire Purge	Terminal 1 (COMMON) to Terminal 4 (LOW FIRE)
Automatic	Terminal 1 (COMMON) to Terminal 2 (AUTO)
Power Off	Terminal 1 (COMMON) to Terminal 2 (AUTO)
Power On/Limits Off	Terminal 1 (COMMON) to Terminal 4 (LOW FIRE)
Alarm	Terminal 1 (COMMON) to Terminal 4 (LOW FIRE)

The Automatic step occurs when the burners are operating (see Table 9.1 on page 9-4) and allows the burner firing rate to be controlled by an automatic temperature controller.

Valve Leak Sensing Device (VLSD) Interface

The Bi-Flame Valve Leak Sensing Device (VLSD) interface is currently designed for use with an Eclipse-Dungs VDK by providing a 120 VAC output which triggers the start of the test period. An input is also provided which receives a 120 VAC signal from the VDK. If the signal is received within the test period (40 seconds), then the test has been successfully completed. This option includes the required sequential software to initiate the valve leak test on start-up and shutdown of the burners.

To enable this option, set switch 5 on S4 DIP switch of the logic board to the ON position (see "S4 DIP Switch Settings" on page 3-2).

When the limits close to the Bi-Flame, the 120 VAC output to the VLSD is activated. If an optional remote display is connected, the following message will appear:

VALVE LEAKAGE
UNDER TEST XX *(where X is the remaining seconds of the test)*.

If the VLSD does not activate the VLSD 120 VAC input within 40 seconds, then an alarm lockout will occur, and the following message will appear on the optional remote display:

VALVE LEAK FAIL
HH:MM:SS LOCKOUT

If a valve leak occurs, then the fan output on the Bi-Flame will be activated to purge the combustion chamber of gases.

Note:
If the VLSD input is not used, then it should be connected to 120 VAC.

Remote Display Units

There are two remote displays available: one with a keypad and one without a keypad. The remote with a keypad allows remote reset and activation of the history log option. Both units are panel mountable and feature a liquid crystal display in a 1/4 DIN housing. Either unit connects to the Bi-Flame by a six or 10 foot cable. The display incorporates the following features:

1) Provides status messages for the Bi-Flame sequence.
2) Indicates lockout conditions when they occur, as well as the amount of time into the sequence when the lockout occurred.
3) Provides continuous monitoring of each burner's flame signal strength during main burner operation. (Pressing ENTER once will lock on a particular burner's status; pressing ENTER a second time will resume scrolling).
4) Incorporates a remote reset key into front membrane of unit (remote with keypad only).
5) Provides the interface required for the History Log option (remote with keypad only).
6) Incorporates ENTER key for pilot test mode.

RS232/RS485 Communication Interfaces

Terminals 5 and 6 on Bi-Flame terminal strip J7 provide a serial output communication interface for remotely monitoring the system sequence and status using a terminal or a modem; refer to Section 10 for the types of messages sent by the Bi-Flame.

The communications protocol is 8 bit, no parity, 1 stop bit and1200 baud. This feature is provided standard as a RS232 interface. The RS485 interface is optional.

Sending a carriage return (<CR> = ASCII Hex 0D) from the terminal causes the Bi-Flame to retransmit the last message. Sending a CTRL-E (<ENQ> = ASCII Hex 05) accesses the optional history log.

Logic Module Status Lights & Push-buttons

The logic module provides all the sequential logic, and safety start-up and shutdown circuitry. On the front of the module is the reset, scan and enter push-buttons, and status lights. This section describes the their respective functions.

Limits

This LED illuminates when the operation limits are made. These limits are wired in series to terminal J1-1. This input becomes energized to begin the burner sequence. When in the test mode, this LED flashes (see "Pilot Test Mode" on page 4-1).

Air

This LED illuminates when the air switch is closed and power is thereby applied to the air switch input. The Bi-Flame also checks this input for an air switch short (see "Combustion Air Flow Check Terminal" on page 4-1).

Purge

This LED illuminates whenever the combustion blower is energized, including the purge period and the main burner period of the sequence. It blinks on and off while the purge is in process and remains constant when the purge process is complete.

Burner On

This LED illuminates when the main gas valve is energized, permitting gas flow to all the burners.

Fault

This LED illuminates when a system fault is detected and during the initial safe start check (see "System Faults" on page 4-2).

Alarm

This LED illuminates when an alarm condition causes a system lockout (see "System Lockout Conditions" on page 4-2).

Low Fire

This LED illuminates during the low fire period of the purge cycle.

High Fire

This LED illuminates during the high fire period of the purge cycle.

Scan

This push-button is for future use.

Enter

This push-button is used with the optional history logging.

System Installation

5

Introduction

In this section, the necessary procedures are detailed to integrate a Bi-Flame into a burner system; Figure 5.1 illustrates the various terminal strips mentioned.

Note:
Shut off the power supply before any module is removed or replaced from the unit, including the remote display.

Caution:
Installation and maintenance must conform with the National Electrical Code and all other national and local codes and authorities having jurisdiction.

Interlocks and Limit Switch Input

Interlocks are generally pressure or temperature switches which, when activated, start the burner. Limit switches are generally pressure, temperature and other switches which, when activated, stop the burner. The interlocks and limit switches are wired in series. A break in this circuit will shut the burner down, but will not produce an alarm. This input is considered the normal operation control input to the Bi-Flame system.

Combustion Air Switch Input

This input is for monitoring the combustion air switch separately from other interlocks and limits. When wired to this input, the air switch will be proven open before start-up and after shutdown. It will also be proven closed 10 seconds after the combustion air blower is energized.

If the air switch opens during the main firing cycle, the system will either lockout or recycle, depending on the DIP switch selection.

If this terminal is not used, place a jumper between the combustion blower output (terminal 3 on terminal strip J2) and the air switch input (terminal 2 on terminal strip J1).

If the combustion air blower is controlled outside of the Bi-Flame system, then the air switch must be wired between the combustion blower output and the air switch input. Connecting the air switch in this manner will prevent the open contact (air short) check on the switch.

Ignition Wiring

Route ignition wiring a sufficient distance from all sensors and other low voltage wiring to avoid electrical interference, which may cause erratic operation of the Bi-Flame system. **Do not connect multiple ignition coils in excess of output relay contact rating.**

Communication Wiring

Route communication wiring a sufficient distance from ignition and other high voltage wiring to avoid electrical interference.

Power Supply

All input power must be single phase 120VAC, 60 Hz. All circuits must have a common 15 amp fuse and disconnect. The neutral must be grounded. **Do not use solid-state triac output devices in any of the input circuits.** 120VAC wiring must be at least 90°C 16 AWG minimum and satisfy all applicable codes.

Low Fire Input

It is possible to wire the system for checking low fire start position prior to pilot ignition. To use this feature, the low fire start switch must be connected to the low fire start input (terminal 4 on terminal strip J1). If this feature is not used, a jumper must be placed between terminals 1 and 4 on terminal strip J1.

Main Valve Proof-of-Closure

The system can be wired to check for the proof of valve closure (POVC) switch on the main gas valve prior to start-up and after the end of the burner cycle.

To use this feature the POVC switch must be connected to the POVC switch input (terminal 3 on terminal strip J1). If this feature is not used, a jumper must be placed between terminals 2 on terminal strip J2 and 3 on terminal strip J1.

High Fire Input

The system can be wired to check for high fire position during the high fire purge portion of the sequence. To use this feature, the high fire position switch must be connected to the high fire input (terminal 5 on terminal strip J1). If this feature is not used, a jumper must be placed between terminals 1 and 5 on terminal strip J1.

Remote Reset

This feature permits remote mounting of a switch to reset the Bi-Flame. To use this feature, a normally closed remote reset switch must be wired between terminals 1 and 4 on terminal strip J7. When it is depressed or actuated, the connection between the aforementioned terminals is momentarily interrupted and resets the Bi-Flame. If neither remote reset nor remote LCD display is used, a jumper must be placed between terminals 1 and 4 on terminal strip J7. This is a low voltage signal circuit that must be routed separately from other control voltage wiring. Use two-conductor shielded cable with the shield connected on one end only to terminal 1 of J7.

Remote Display

When installed, the remote display must be grounded. Panel mounting is through a 1/4 DIN cutout (see page 2-2). Use either the 6 or 10 foot cable to connect it to the Bi-Flame at terminal strip J6.

Figure 5.1 **Bi-Flame Terminal Strips Location & Identification**

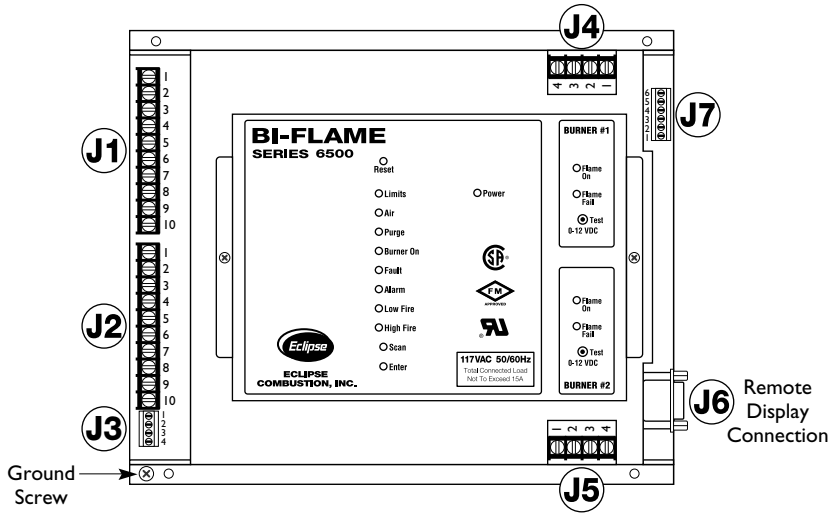
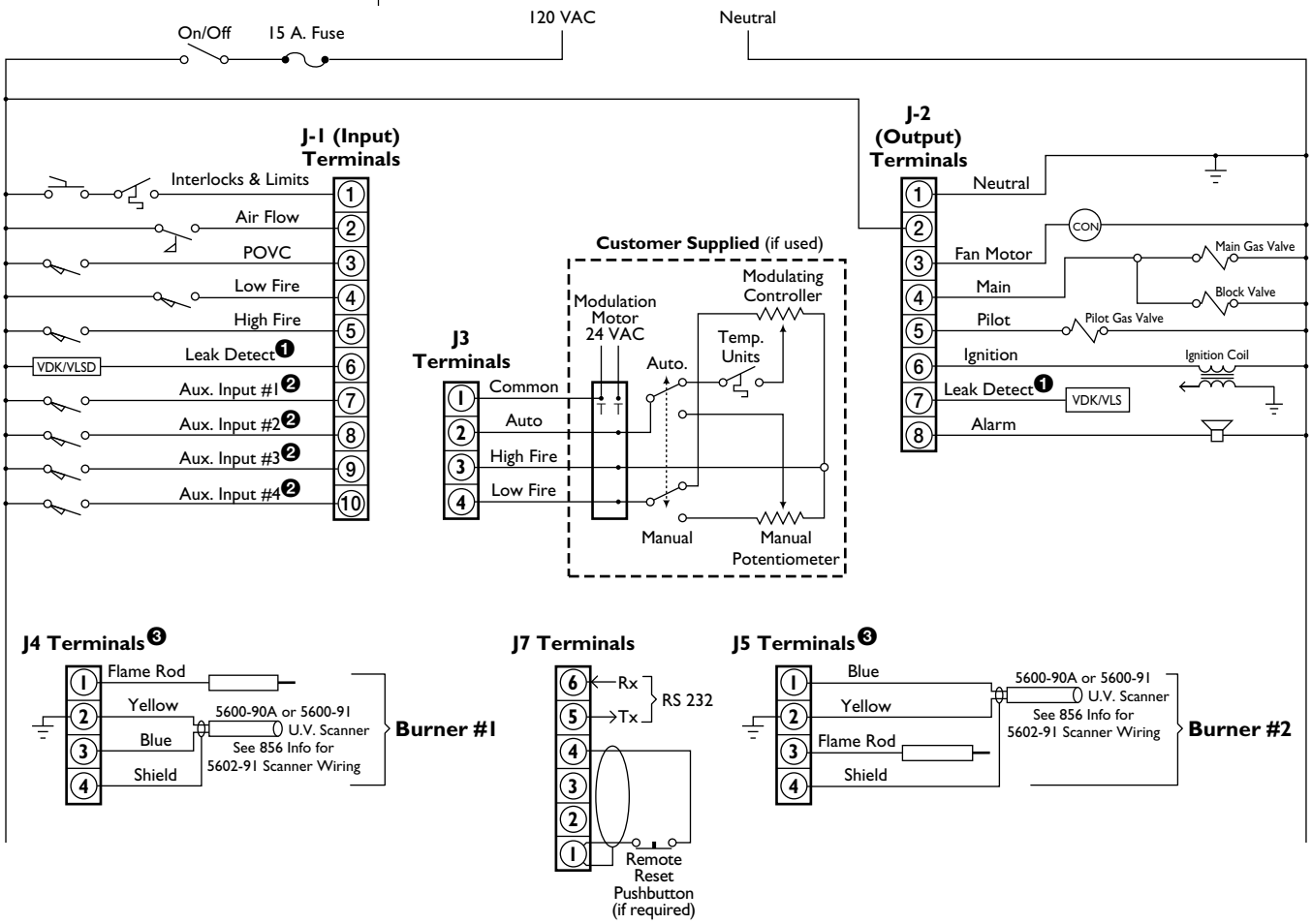


Figure 5.2 Bi-Flame Wiring Diagram & Connections



J-1 (Input) Terminals

1 – Limits Input
2 – Air Switch Input
3 – POVC Switch Input
4 – Low Fire Switch Input
5 – High Fire Switch Input
6 – VDK/VLS Input❶
7 – Aux. #1❷
8 – Aux. #2❷
9 – Aux. #3❷
10 – Aux. #4❷

Auxiliary Inputs

J-2 (Output) Terminals

1 – Neutral
2 – 120 VAC

Bi-Flame Power Inputs

3 – Fan
4 – Main Gas Valve
5 – Pilot Gas Valve
6 – Ignition Transformer
7 – VDK/VLS❶
8 – Alarm

Outputs

J-3 (Modulation) Terminals

1 – Common
2 – Auto
3 – Hi Fire
4 – Low Fire

Modulation Motor Connections for High Fire & Low Fire Start

J-4 (Sensors/Burner 1) Terminals❸

1 – Flame Rod
2 – Ground (Yellow)
3 – U.V. (Blue)
4 – Shield Connection

Burner #1

J-5 (Sensors/Burner 2) Terminals❸

1 – U.V. (Blue)
2 – Ground (Yellow)
3 – Flame Rod
4 – Shield Connection

Burner #2

J-7 (Interface) Terminals

6 – RS 232/RS 485 Interface (Rx)
5 – RS 232/RS 485 Interface (Tx)
4 – Reset
3 – Scan
2 – Enter
1 – Ground

❶ Optional feature.
❷ Optional feature which, when not used, must be tied into 120 VAC.
❸ Using both sensors isn't mandatory; you may use a flame rod, or a UV scanner, or both.

Sensor Installation

6

INTRODUCTION

This section describes the proper wiring, installation and sighting considerations for all sensors that can be used with a Bi-Flame.

Warning

Incorrect sensor installation may cause the sensor to generate a false flame signal, causing unburned fuel to collect in the combustion chamber. The result can be explosions, injuries and property damage. Be certain that the flame sensor detects only pilot and main flames, not glowing refractory, burner or ignition parts.

Sensor Wiring

Route sensor wiring a sufficient distance from ignition and other high voltage wiring to avoid electrical interference. Wherever possible, try to terminate the flexible metal shield surrounding the leads within inches of the Bi-Flame terminals. If the shield must be grounded to reduce interference, ground the shield at the control end to the shield terminal. For self-checking UV scanners, ground both braided shields. To achieve the maximum wiring distance, the shield should not be grounded (keep in mind that an ungrounded shield provides less protection against electrical interference).

Do not ground the shield to terminal GND.

Note:

Unshielded sensor wiring must not be run in common with other wires; it must be run in separate conduit. Use #14 to #18 AWG wire suitable for 90°C (194°F) and 600 volt insulation, and run each pair of leads in its own shielded cable. Multiple shielded cables can be run in a common conduit.

Figure 6.1 **Flame Rod Position**

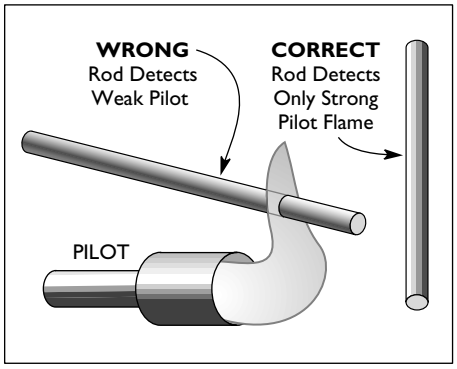
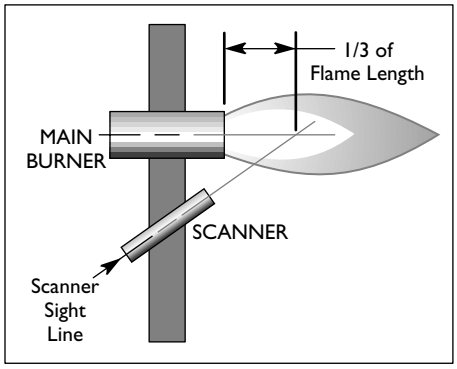
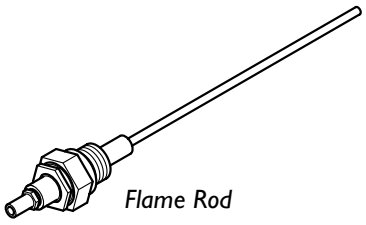


Figure 6.2 **U.V. Scanner Sighting**



Flame Rods



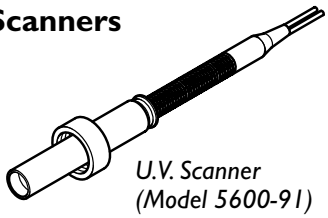
Flame Rod

Flame rods should be used only on gas burners. They accumulate soot on oil burners, causing nuisance shutdowns and unsafe operating conditions.

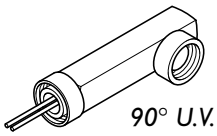
See the burner manufacturer's literature for flame rod mounting location. When installing flame rods, please consider the following:

1) Keep the flame rod as short as possible and at least 13 mm (1/2") away from any refractory.
2) Position the rod into the side of both the pilot and main flames, preferably at a descending angle to minimize drooping of the flame rod against burner parts, as shown in Figure 6.1 on the previous page. Flame rod position must adequately detect the pilot flame at all burner draft conditions. Extend the rod 13 mm (1/2") into nonluminous flames, such as blue flames from burning an air/gas mixture. For partially luminous flames, such as atmospheric air/gas mixtures, place the rod at the edge of the flame.
3) Provide a burner/flame grounding area that is at least four times greater than the flame rod area contacting the flame. The flame rod/burner ground ratio and position of the rod in the flame may need adjustment to yield maximum flame signal strength.
4) Ignition interference from the spark plug may increase or decrease the flame signal strength. Reversing the ignition transformer primary leads may reverse this effect. Reducing the spark gap or adding grounding area between the flame rod and spark plug may eliminate the interference.

Scanners



U.V. Scanner (Model 5600-91)

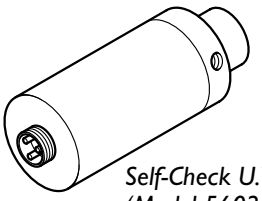


90° U.V. Scanner (Model 5600-90A)

Use only Eclipse scanner models 5600-90A, 5600-91 & 5602-91. Consult the burner manufacturer's instructions for mounting location. When installing scanners, please consider the following:

1) Position the scanner within 457 mm (18") of the flame.
2) Bushing threads are 1/2 inch F.N.P.T. for scanner models 5600-90A and 5600-91; model 5602-91 has 1 inch F.N.P.T. bushing threads.
3) The ambient temperature limits of each scanner varies; check the literature supplied with the scanner. For higher temperatures, use Eclipse heat insulator #15099. If necessary, also use a purge tee.
4) An optional magnifying lens (Eclipse #15076) may also be used to increase the flame signal strength in difficult sighting situations.

Scanner Sighting Considerations



Self-Check U.V. Scanner (Model 5602-91)

Aim scanners at the third of the flame closest to the burner nozzle, as shown in Figure 6.2 on the previous page. This is especially true for oil flames which typically have less UV radiation in the outer flame. The scanner should view the intersection of the pilot and main flames. When sighting scanners, please consider the following:

1) Sight the scanner away from the ignition spark. Sighting the spark or its reflections from burner internals can cause nuisance shutdowns during burner ignition. If necessary, use a scanner orifice to reduce spark pickup.
2) Do not allow the scanner to detect a pilot flame that is too small to ignite the main burner.
3) Perform a minimum pilot test when installing or adjusting any pilot or main burner system; see "Minimum Pilot Test" on page 7-1.

Test Procedures

7

Introduction

This section describes the test procedures that must be performed after installation to insure that the Bi-Flame is operating properly; these procedures are mandatory.

Flame Signal Strength

Insert the positive probe of a 0-15VDC, one megohm/volt meter into the test point on the front cover, as shown in the photo at left. Touch or connect the negative probe to the ground screw (see Figure 5.1 for screw location). A good flame signal strength will read between 6 and 11 VDC; anything below 4 VDC is inadequate.

Minimum Pilot Test

Run the following test procedures to ensure that the sensor will not detect a pilot flame too small to reliably light the main flame:

1) Manually shut off the fuel supply to the burner, but not to the pilot.
2) Start the system normally.
3) To enter the pilot test mode, press the RESET and ENTER buttons simultaneously. Then release the RESET button but keep the ENTER button depressed for another 10 seconds. The Limits LED will blink, signalling that the system is in the pilot test mode.
4) The control will hold the operating sequence at the pilot flame step. Measure signal strength as described above.
5) Reduce pilot fuel until the flame relay drops out. Increase pilot fuel until the flame signal is greater than 4 VDC, and flame relay just manages to pull in. This is the minimum pilot. If you don't think this flame will be able to safely light the main burner, realign the sensor so that it requires a larger pilot flame and repeat steps 2 through 5.
6) Push the RESET button to exit the test mode and begin the normal start-up sequence again.
7) When the sequence reaches the main flame trial for ignition, smoothly restore the fuel supply to the burner. If the main burner does not light within five seconds, immediately shut off the burner supply to shut down the system. Realign the sensor so that it requires a larger pilot flame. Repeat steps 1 through 6 until the main burner lights off smoothly and reliably.

Voltmeter hook-up to a Bi-Flame

Pilot Flame Failure Test

1) Manually shut off the fuel supply to one individual pilot and main burner, or all burners if the system has a single fuel supply.
2) Place system in pilot test mode (please refer to page 4-1).
3) Start the system normally. The controller should lock out*; if it doesn't, then the controller is detecting a false flame signal (see Section 6). Find the problem and correct it before resuming normal operation.
4) Repeat steps 1 through 4 until all burners have been tested.

Main Flame Failure Test

(For Interrupted Pilot Systems)

1) Manually shut off the fuel supply to the main burner, or all burners if the system has a single fuel supply, but not to the pilot.
2) Start the system normally. This should ignite the pilot and lock out* after pilot interruption. If the system does not lock out, the controller is detecting a false flame signal (see Section 6). Find the problem and correct it before resuming normal operation.
3) Repeat steps 1 through 3 until all burners have been tested.

Spark Sighting Test

1) Manually shut off the fuel supply to the pilot and main burner.
2) Start the system normally.
3) Measure the flame signal as described in "Flame Signal Strength" in this section.
4) If a flame signal greater than 4 VDC is measured for more than three seconds during the trial for ignition, then the sensor is picking up a signal from the spark plug; see "Sensor Wiring" on page 6-1.

Limits & Interlock Tests

Periodically check all interlock and limit switches by manually tripping them during burner operation to make sure they cause a system to lock out.

Warning

Never operate a system that is improperly adjusted or has faulty interlocks or limit switches. Always replace faulty equipment with new equipment before resuming operation. Operating a system with defective safety equipment can cause explosions, injuries, and property damage.

* The burner at which a flame fails will be identified by a flashing red "Flame Failure" LED on the Bi-Flame front cover.

Maintenance & Troubleshooting

8

Introduction

This section is divided into two parts:

- The first part describes the maintenance procedures,.
- The second part helps you to identify problems that may occur, and gives advice on how to solve these problems.

Maintenance

Preventative maintenance is the key to a reliable, safe and efficient system. The core of any preventive maintenance program is a list of periodic tasks.

In the paragraphs that follow are suggestions for a monthly list and a yearly list.

Note:
The monthly list and the yearly list are an average interval. If your environment is dirty, then the intervals may be shorter.

Caution:
Turn off power before disconnecting or installing sensors, controls or modules.

Monthly Checklist

1. Inspect flame-sensing devices for good condition and cleanliness. Keep the glass lens of scanners clean with a soft, damp cloth, since small amounts of dust will measurably reduce the flame signal strength. Wash the flame rod electrode and insulator with soap and water, then rinse and dry thoroughly.
2. Test all the alarm systems for proper signals.
3. Check ignition spark electrodes and check proper gap.
4. Test interlock sequence of all safety equipment as described on page 7-2: manually make each interlock fail, noting what related equipment closes or stops as specified by the manufacturer.

   Test flame safeguard by manually shutting off gas to the burner.

Yearly Checklist

1. Test (leak test) safety shut-off valves for tightness of closure.
2. Test pressure switch settings by checking switch movements against pressure setting and comparing with actual impulse pressure.
3. Visually check ignition cable and connectors.
4. Make sure that the following components are not damaged or distorted:
   - the burner nozzle
   - the spark plugs
   - the flame sensors
   - the flame tube or combustion block of the burner

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
Cannot initiate start sequence	• Main valve is not closed.	Check proof-of-valve-closure (POVC) switch.
	• Air pressure switch has not made contact.	Check air pressure switch adjustment. Check air filter. Check blower rotation. Check outlet pressure from blower.
	• High gas pressure switch has tripped.	Check incoming gas pressure; adjust gas pressure if necessary. Check pressure switch setting and operation.
	• Low gas pressure switch has tripped.	Check incoming gas pressure; adjust gas pressure if necessary. Check pressure switch setting and operation.
	• Malfunction of flame safeguard system such as a shorted-out flame sensor or electrical noise in the sensor line.	Have qualified electrician investigate and rectify.
	• Purge cycle not completed.	Check flame safeguard system, or purge timer.
	• Main power is off.	Make sure power is on to control system.
	• No power to control unit.	Call qualified electrician to investigate.
Scrambled messages on remote display.	• Improper grounding in system.	Check grounding in system.
"UNSAFE AIR SHORT" message appears on display.	• Improperly adjusted air switch. • Air switch either shorted or wired wrong.	Check air switch settings. Check wiring to air switch.
Burner flame fails but no flame failure indication occurs.	• A faulty scanner.	Check scanner as explained in checklists in "Maintenance" portion of this Section.
	• Improperly connected sensor wires.	Check wiring diagram on page 5-3 as well as appropriate sensor information in Section 6.
	• Electrical interference from other current carrying wires.	Check Note information on page 6-1 regarding sensor wiring.

Remote Display Messages

9

INTRODUCTION

This section covers how the optional remote display is used with the Bi-Flame. Either remote display (with or without keypad) provides LCD messages which monitor the status of the Bi-Flame's functions as well as any lockout conditions. This section is divided into two parts or tables:

- The first table describes the start-up and shutdown monitoring sequences of the Bi-Flame and how the progress (or halt) of the sequence can be monitored by the messages on the remote display.
- The second table alphabetically lists and explains the diagnostic messages which can appear on the remote display.

Note:
Some of the messages which may appear with some of the options are not shown; refer to Section 4, Function Summary, for details.

Table 9.1 Bi-Flame Operating Sequence as Monitored by Remote

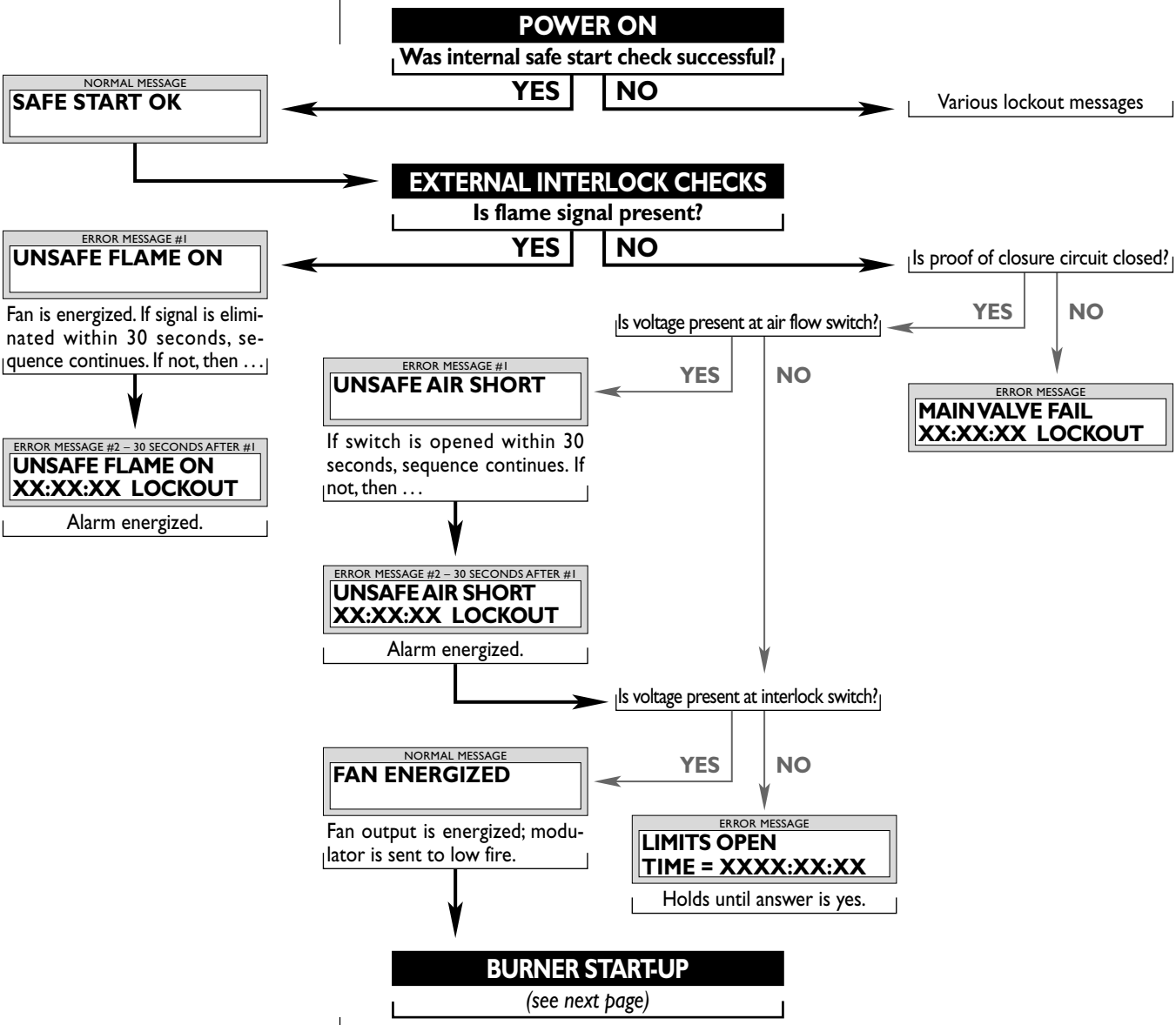


Table 9.1 **Bi-Flame Operating Sequence** (continued)

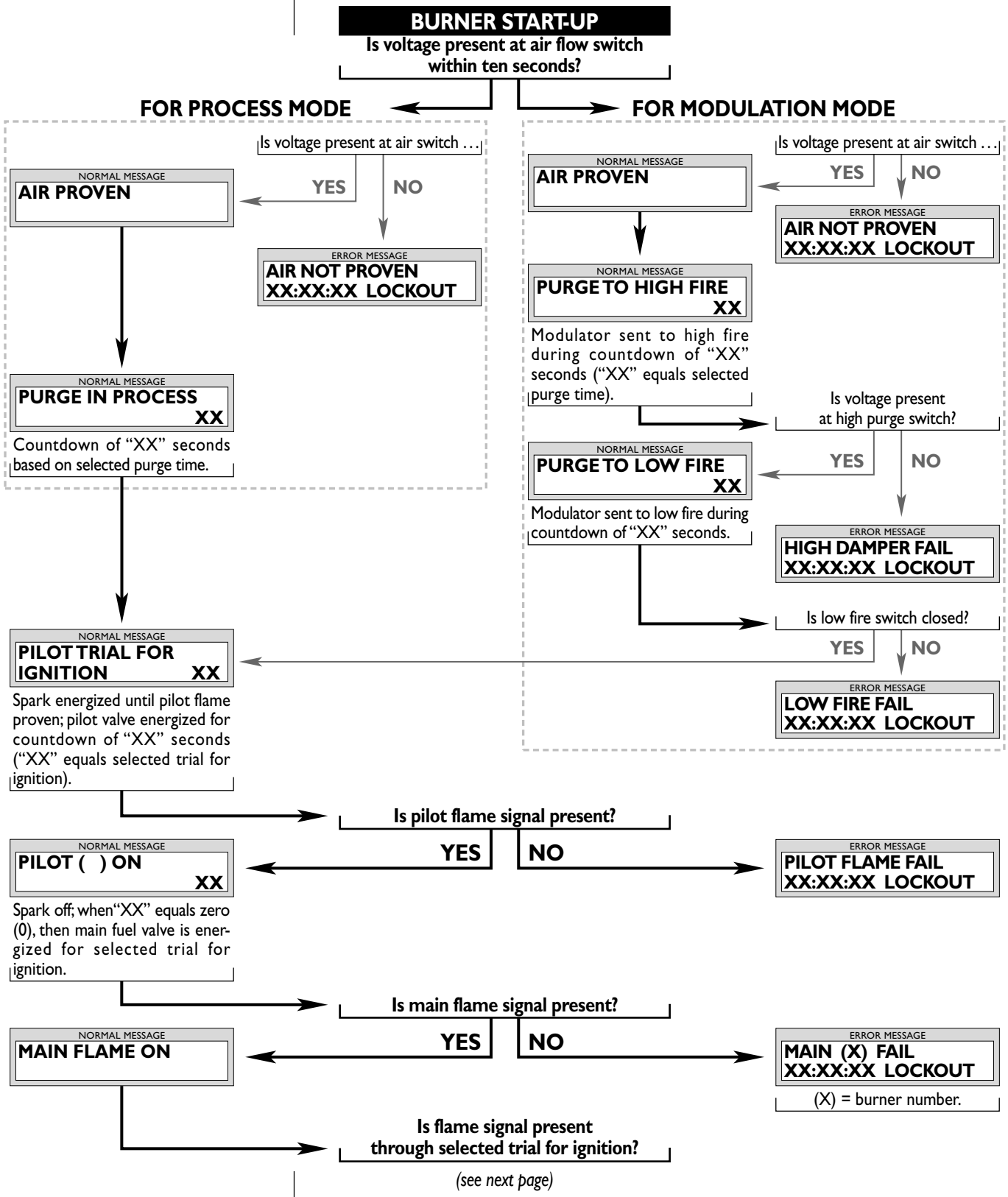


Table 9.1 **Bi-Flame Operating Sequence** (continued)

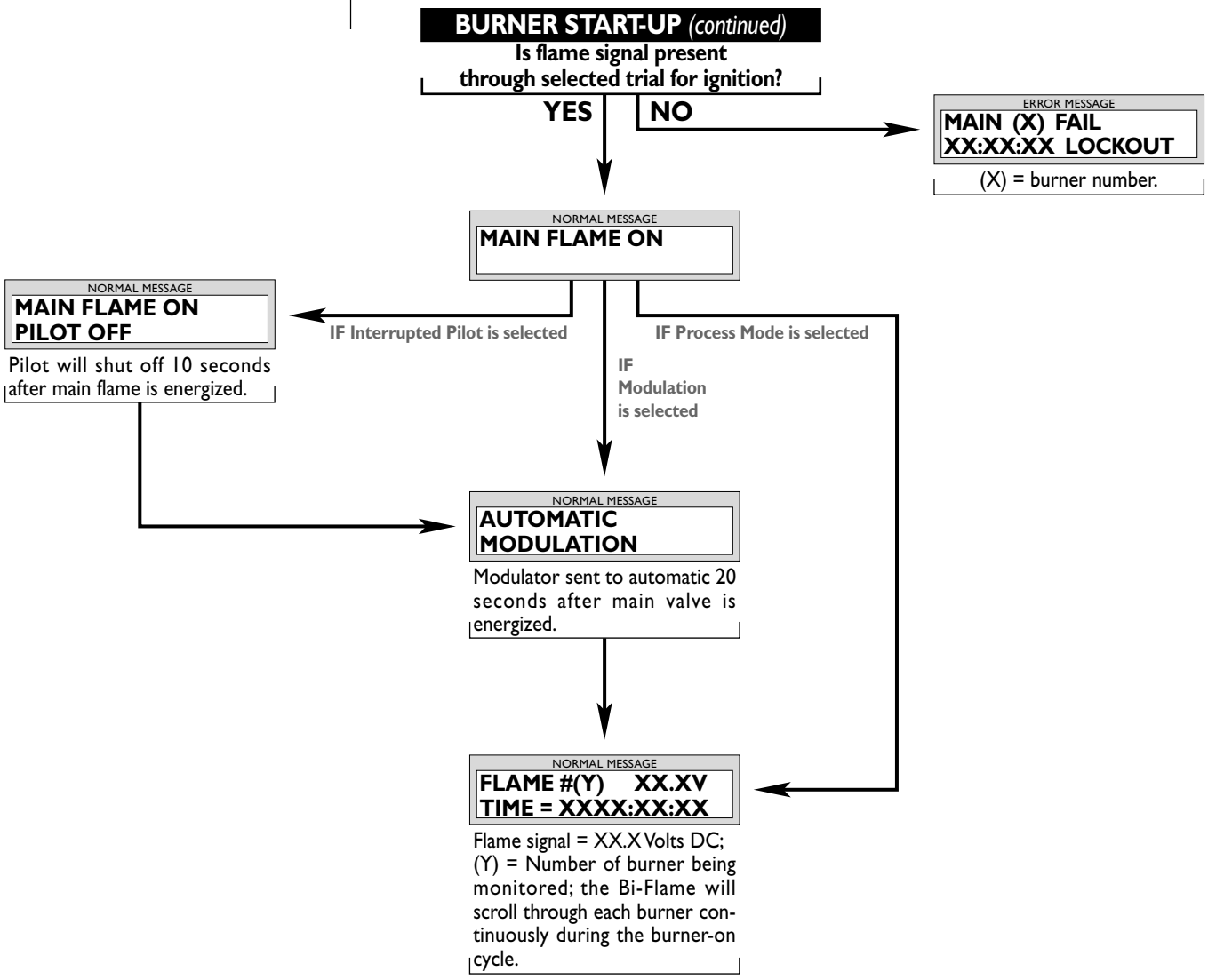


Table 9.1 **Bi-Flame Operating Sequence** (continued)

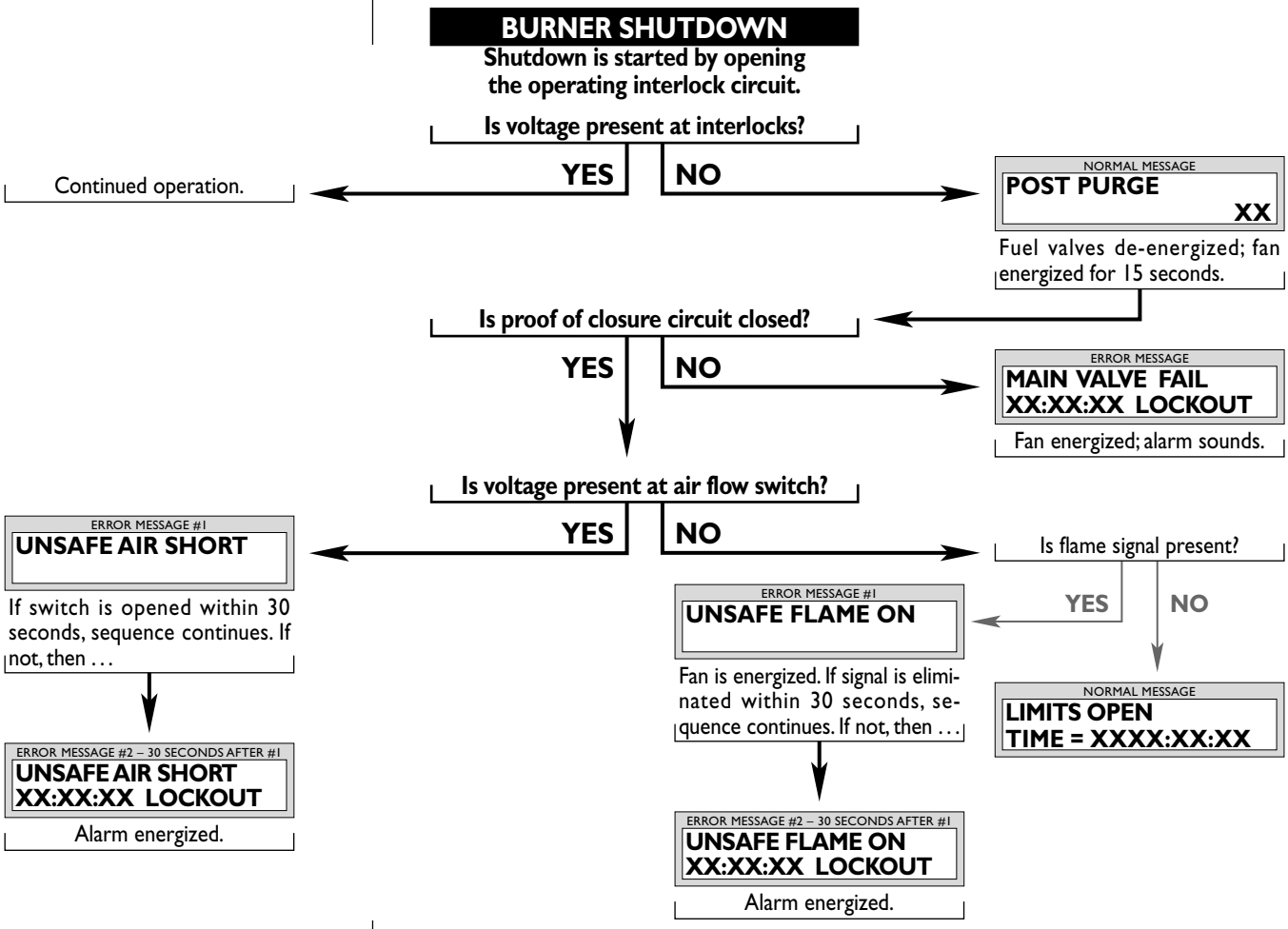


Table 9.2 **Remote Display Diagnostic Messages (Listed Alphabetically)**

MESSAGE	TYPE	EXPLANATION
AIR FAILURE XX:XX:XX LOCKOUT	Lockout	Combustion air flow limit switch (strip J1, terminal 2) opened for more than two seconds once initially proven.
AIR FAILURE RECYCLING	Status	Combustion air flow limit switch (strip J1, terminal 2) opened; control will recycle one if "recycle" has been selected (see "Interrupted or Intermittent Pilot" in Section 2).
AIR NOT PROVEN XX:XX:XX LOCKOUT	Lockout	Combustion air flow limit switch (strip J1, terminal 2) did not make within ten seconds of fan being energized.
AIR PROVEN	Status	Combustion air flow limit switch (strip J1, terminal 2) closed within ten seconds of fan being energized.
AUTOMATIC MODULATION	Status	Modulating motor is sent to automatic operation. Terminal 1 is connected to terminal 2 on terminal strip J3.
AUX.LIM.#1 FAIL HH:MM:SS LOCKOUT	Lockout	Auxiliary input #1 has lost its voltage during system operation, causing a lockout at the indicated time.
AUX.LIM.#2 FAIL HH:MM:SS LOCKOUT	Lockout	Auxiliary input #2 has lost its voltage during system operation, causing a lockout at the indicated time.
AUX.LIM.#3 FAIL HH:MM:SS LOCKOUT	Lockout	Auxiliary input #3 has lost its voltage during system operation, causing a lockout at the indicated time.
AUX.LIM.#4 FAIL HH:MM:SS LOCKOUT	Lockout	Auxiliary input #4 has lost its voltage during system operation, causing a lockout at the indicated time.
D=INTERNAL FAULT XX:XX:XX:XX LOCKOUT	Lockout	Internal control failure; replace controller.
FAN ENERGIZED	Status	Blower motor (strip J2, terminal 3) is energized at the start of pre-purge.
FLAME ( )FAIL RECYCLING	Status	Main flame lost during automatic modulation; control will recycle once if "recycle" has been selected.
FLAME #(X) FAIL XX:XX:XX LOCKOUT	Lockout	Main flame lost during operation in the automatic modulation mode. Burner number (X) given of failed unit.
FLAME (Y) XX.XV TIME=XXXX:XX:XX	Status	Main flame of burner number (Y) is proven in the automatic modulation mode; flame strength is XX.XV (volts DC). Elapsed time is shown in hours:minutes:seconds.
HI DAMPER FAIL XX:XX:XX LOCKOUT	Lockout	High damper or high purge rate switch (terminal "D") did not make at the end of pre-purge to high fire.
K-INTERNAL FAIL XX:XX:XX LOCKOUT	Lockout	Internal control failure; replace controller.
L-INTERNAL FAIL XX:XX:XX LOCKOUT	Lockout	Internal control failure; replace controller.

Table 9.2 **Remote Display Diagnostic Messages** (continued)

MESSAGE	TYPE	EXPLANATION
LIMITS OPEN TIME=XXXX:XX:XX	Status	The controller has completed its internal checks and is standing by for the interlocks (strip J1, terminal 1) to close.
LOW FIRE FAIL XX:XX:XX LOCKOUT	Lockout	Low fire switch (strip J1, terminal 4) is open just prior to pilot trial for ignition.
MAIN ( ) FAIL XX:XX:XX LOCKOUT	Lockout	Main flame was not established during the main burner trial for ignition.
MAIN FLAME ON	Lockout	Main valve has been energized and main flame proven during trial for ignition.
MAIN FLAME ON PILOT OFF	Status	Pilot valve (strip J2, terminal 5) is de-energized and main flame is on.
MAIN VALVE FAIL XX:XX:XX LOCKOUT	Lockout	Main valve proof-of-closure is open before startup or after burner shutdown.
NO PURGE SELECT XX:XX:XX LOCKOUT	Lockout	No purge time was selected; lockout prior to purge to high fire.
PILOT FLAME FAIL XX:XX:XX LOCKOUT	Lockout	Pilot flame was not established during the pilot trial for ignition.
PILOT ( ) ON XX	Status	Pilot flame is proven; transformer is de-energized; remaining countdown for pilot trial for ignition is "XX".
PILOT TRIAL FOR IGNITION XX	Status	Pilot valve and ignition transformer are energized; countdown for pilot trial for ignition begins at "XX".
PLT/MVL ENERGIZ. XX:XX:XX LOCKOUT	Lockout	An external source of voltage is present on the ignition, pilot or main output terminals.
POST PURGE XX	Status	15 second post purge is started on burner shutdown; "XX" shows countdown.
PROGM SWITCH ERR XX:XX:XX LOCKOUT	Lockout	DIP switch improperly set or changed during cycle.
PURGE TO HIGH FIRE XX	Status	Modulating motor is sent to high fire; "XX" shows purge countdown.
PURGE TO LOW FIRE XX	Status	Modulating motor is sent to low fire; "XX" shows purge countdown.
RECORD #X	Status	Part of the optional history log, which records the total number of operating cycles and the last lockout messages up to a maximum of 10; see "History Log Activation" on page 4-3 for further details.

Table 9.2 **Remote Display Diagnostic Messages** (continued)

MESSAGE	TYPE	EXPLANATION
RELAY FAIL XX:XX:XX LOCKOUT	Lockout	Internal relay(s) fail initial check. Check ratings. If lockout still occurs after overload is eliminated, replace control.
SAFE START OK	Status	Control has completed internal safe-start check.
UNSAFE AIR SHORT	Status	Combustion air switch is closed before start-up or after shutdown; control holds start-up until switch re-opens; if interlocks close before switch opens, alarm is energized.
UNSAFE AIR SHORT XX:XX:XX LOCKOUT	Lockout	Same conditions as above, except the interlocks close before the switch re-opens, causing a lockout and the alarm being energized.
UNSAFE FLAME ON	Hold	Flame signal—actual, induced, or runaway scanner—is detected before start-up or after shutdown. The fan is energized. If the cause is corrected within 30 seconds, as in afterburn, the control will turn off the fan and continue the sequence.
UNSAFE FLAME ON XX:XX:XX LOCKOUT	Lockout	Same conditions as above, except the cause has not been corrected within 30 seconds, resulting in a lockout and the alarm being energized.
UNSAFE–FLM–PURGE	Hold	Flame signal—actual, induced, or runaway scanner—is detected during the selected purge time period. The fan is energized. If the cause is corrected within 30 seconds, as in afterburn, the control will turn off the fan and continue the sequence.
UNSAFE–FLM–PURGE XX:XX:XX LOCKOUT	Lockout	Same conditions as above, except the cause has not been corrected within 30 seconds, resulting in a lockout and the alarm being energized.
V–INTERNAL FAULT XX:XX:XX LOCKOUT	Lockout	Internal control failure; replace controller.
VALVE LEAKAGE UNDER TEST XX	Status	Indicates that the optional valve leak sensing device has been activated and the test period (maximum of 35 seconds) has begun.
VALVE LEAK FAIL XX:XX:XX LOCKOUT	Lockout	The test period for valve leak sensing has exceeded 40 seconds and failed; check the gas shut-off valves.
WATCHDOG FAIL XX:XX:XX LOCKOUT	Lockout	Internal control failure; replace controller.
XXXXXXX XXXXXTESTXX	Status	In combination with other messages, shows the control is in the minimum pilot test mode.

Appendix

Conversion Factors

Metric to English.

From	To	Multiply by
cubic meter (m^3)	cubic foot (ft^3)	35.31
cubic meter/hour (m^3/h)	cubic foot/hour (cfh)	35.31
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 1.8) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/hr	3414
meter (m)	foot (ft)	3.28
millibar (mbar)	inches water column ("wc)	0.401
millibar (mbar)	pounds/sq in (psi)	14.5×10^{-3}
millimeter (mm)	inch (in)	3.94×10^{-2}

Metric to Metric.

From	To	Multiply by
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

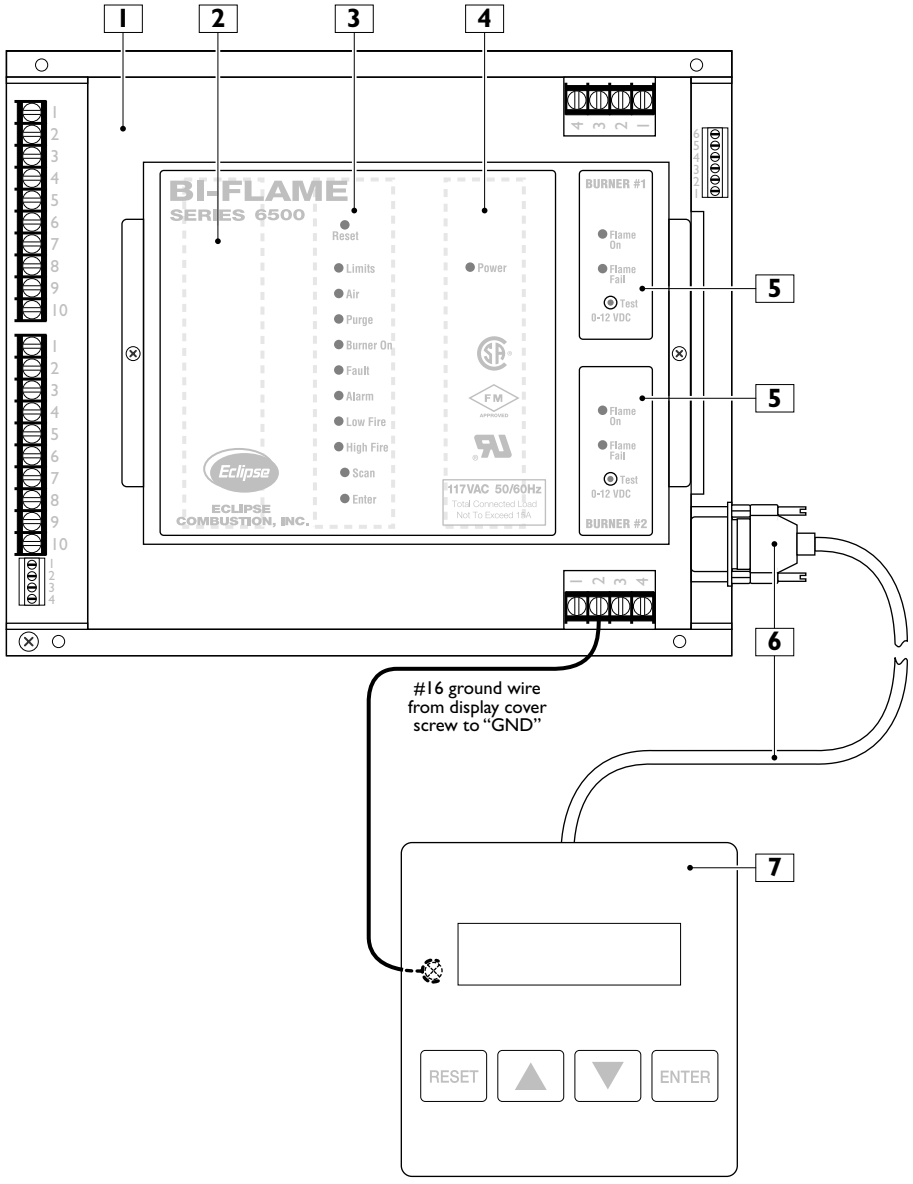
English to Metric.

From	To	Multiply by
Btu/hr	kilowatt (kW)	0.293×10^{-3}
cubic foot (ft^3)	cubic meter (m^3)	2.832×10^{-2}
cubic foot/hour (cfh)	cubic meter/hour (m^3/h)	2.832×10^{-2}
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F − 32) ÷ 1.8
foot (ft)	meter (m)	0.3048
inches (in)	millimeter (mm)	25.4
inches water column ("wc)	millibar (mbar)	2.49
pound (lb)	kilogram (kg)	0.454
pounds/sq in (psi)	millibar (mbar)	68.95

Illustrated Parts List

Pos. no.	Qty.	Part Name	Eclipse Part Number
1	1	Motherboard (6500M)	20315
2	1	Relay module circuit board	15432
3	1	Logic module circuit board	15430
4	1	Power module circuit board	15436
5	1	Sensor circuit board	20314
6	1	183 cm (6 ft) cable for remote display	15426
6	1	305 cm (10 ft) cable for remote display	15426-1
7	1	Remote display without keypad	15420
7	1	Remote display with keypad	15422

To make sure that the downtime of the system is as short as possible in case of a failure, you should keep a stock of spare parts.



Eclipse Combustion
www.eclipsenet.com

Instruction Manual No. 826 10/96

Litho in U.S.A.