

*Instruction Manual*

No. 818-2 9/02



# *VeriFlame CE*

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# *Burner Monitoring System*

*Model VF56*

*Version 2.0*

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# ***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, training, and knowledge with this kind of equipment.

## ***SCOPE***

This manual contains essential information for the proper installation and operation of the Eclipse VeriFlame Single Burner Monitoring System.

Following the instructions in this manual should assure trouble free installation and operation. 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.

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

## ***How To GET HELP***

If you need help, you can contact your local Eclipse Combustion sales office. You can reach Power Equipment Company at:

12011 Williamsburg Road  
Richmond, Virginia 23231 U.S.A.  
Phone: 804-236-3800  
Fax: 804-236-3882  
[www.peconet.com](http://www.peconet.com)

## **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 that 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 that could result in severe personal injury or damage.**

**Act with great care and follow the instructions.**



### **Caution:**

*Indicates hazards or unsafe practices that could result in damage to the machine or minor personal injury.*

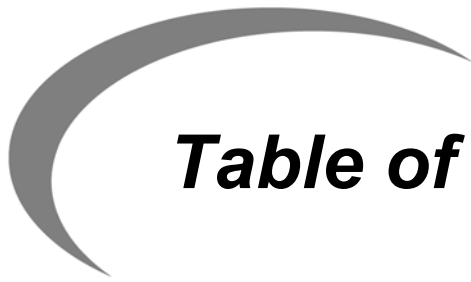
*Act carefully.*



### **Note:**

*Indicates an important part of the text.*

*Read the text thoroughly.*



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# Introduction

# 1

## **PRODUCT DESCRIPTION**

The Eclipse Combustion VeriFlame CE Single Burner Monitoring System consists of a microprocessor based control unit, a wiring base, and a flame sensor.

## **CONTROL UNIT**

The control unit includes all the necessary digital logic and analog measuring circuitry to control the sequence and monitor the flame of single gas, oil or combination gas/oil burners. Three available control sequences are no-purge, purge, and modulation (air damper control). The part number specifies the various features such as the flame sensor type, sequences, and timings; thus the designer has control and protection against field tampering of critical sequences.

## **WIRING BASE**

The wiring base provides a convenient means for connecting field wiring from the burner and valve system to the control unit. There are three styles of bases: an internal terminal base that provides a guarded wiring compartment; an external terminal base for use within a protective control panel; and an expanded external terminal base for use with the modulation sequence control units.

## **SENSOR**

Sensors that may be used with the VeriFlame include flame rod (rectified ionization), ultra-violet (UV) scanners, and self-checking UV scanners. Four types of UV scanners meet the demands of various environmental conditions.

## CE CONFORMITY

This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive, and 90/396/EEC the Gas Appliance Directive based on examination to EN298 “Automatic gas burner control systems for gas burners and gas burning appliances with or without fans”. Conformity of this product with any other “CE Mark” Directive(s) shall not be assumed.

*Product Classification:* Class I: Permanently connected, panel-mounted Industrial Control Equipment with protective earthing (grounding) on metal bases. (EN61010-1).

*Enclosure Rating:* panel-mounted equipment rated IP00, when used with the external terminal wiring bases (the terminals must be enclosed within the panel.) IP30 when used with internal terminal bases. (IEC 529).

*Installation Category (Overvoltage Category):* Category II: Energy-consuming equipment supplied from the fixed installation, local level appliances, and Industrial Control Equipment. (EN61010-1)

*Pollution Degree:* Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (Ref. IEC 664-1)

*EMC Classification:* Group 1, Class A, ISM Equipment (EN55011, emissions), Industrial Equipment (EN50082-2, immunity)

*Method of EMC Assessment:* Technical File (TF)

*Declaration of Conformity:* EC-87/02/57/a

*EC Product Identification Number:* 87BN57

Deviation from the installation conditions specified in this manual may invalidate this product’s conformity with the Low Voltage, EMC, and Gas Appliance Directives.



# EC Type Examination Certificate

Issued by Advantica Certification Services

Certificate No.	EC-87/02/57/a (Page 1 of 3)
Notified Body No.	0087
Project No.	2/31740
Date	13 September 2002
Original/Supplementary	Original
Applicant	Eclipse Inc 1665 Elmwood Road Rockford IL 61103 USA
Normative Reference(s)	BS EN 298:1994 (including amendment 1) BS EN 61010-1:2001
EC Product Identification No.	87BN57
Model Designations	See Appendix

## Declaration

Type samples representative of the product(s) detailed have been tested and examined and found to comply with the Essential Requirements detailed in Annex I of the European Gas Appliance Directive (90/396/EEC).

Signed on behalf of the Advantica Notified Body (No. 0087)

  
\_\_\_\_\_  
**Graham McKay, Manager, Certification Services**  
Advantica Technologies Ltd, Ashby Road, Loughborough, Leicestershire LE11 3GR



**ADVANTICA**



# Specifications

## 2

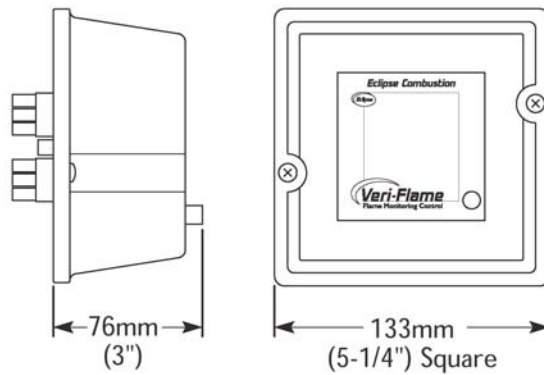
<b>POWER SUPPLY</b>	102-132 VAC, 50/60 Hz
	204-264 VAC, 50/60 Hz
	12 VA internal consumption, excludes externally connected loads

Unit	Model No.	Temperature Range		Weight
VeriFlame	VF56	-40° to +60°C	-40° to 140°F	1.09 kg
90-degree UV Scanner	5600-90A	-20° to +60°C	-4° to 140°F	.25 kg
Straight UV Scanner	5600-91	-20° to +125°C	-4° to 257°F	.30 kg
Straight UV - Sealed	5600-91N4	-20° to +125°C	-4° to 257°F	.20 kg
Self-Check UV Scanner	5602-91	-20° to +60°C	-4° to 140°F	1.20 kg
24VDC Remote Display	5602DB	0° to +50°C	32° to 122°F	.36 kg
120VAC Remote Display	5602DBP	0° to +50°C	32° to 122°F	.50 kg

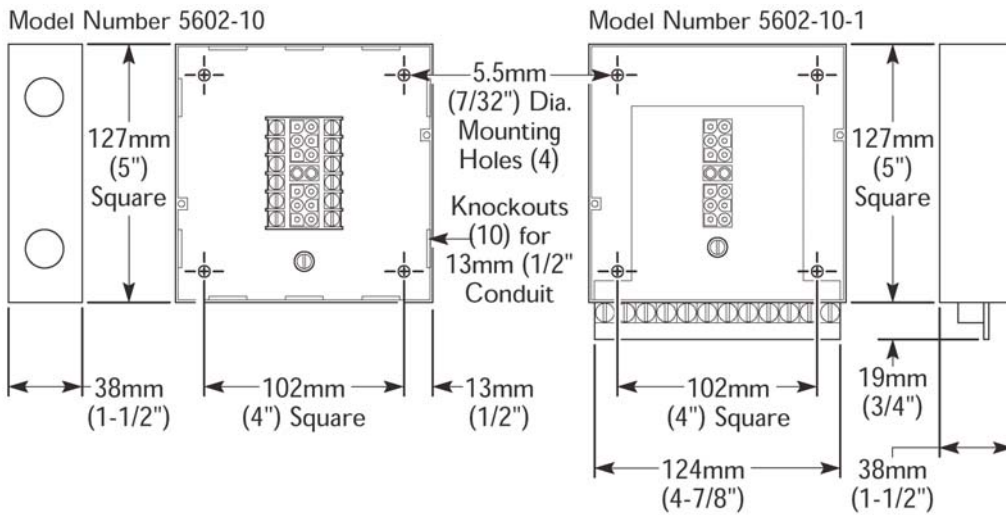
<b>OUTPUT RATINGS</b>	Function	Terminal	Inductive Load
The maximum total connected load must not exceed 15 amps.	Gas Valves	3, 5	175VA
	Ignition Transformer	4	375VA
	Motor or Contactor	8	470VA
	Control	A, 10, 11, 12, 13	175VA

**DIMENSIONS**

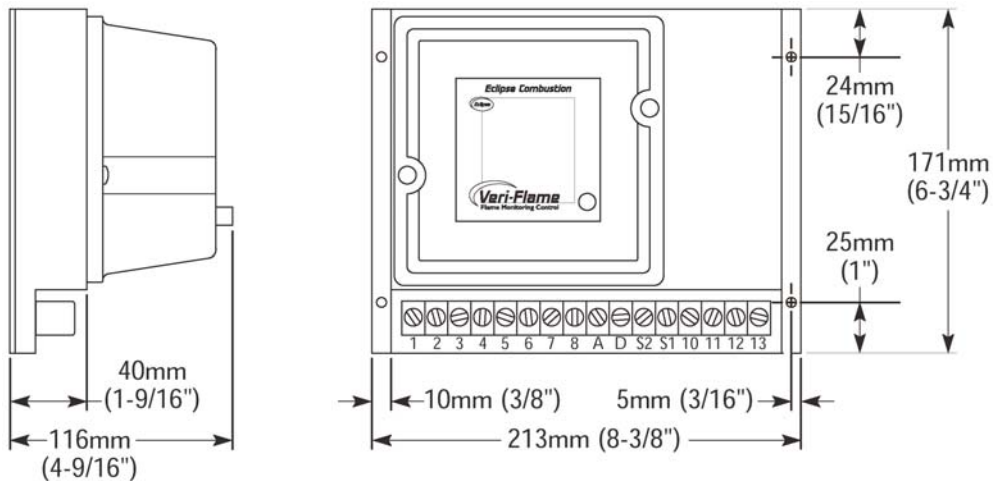
**VeriFlame Control Unit, all models**



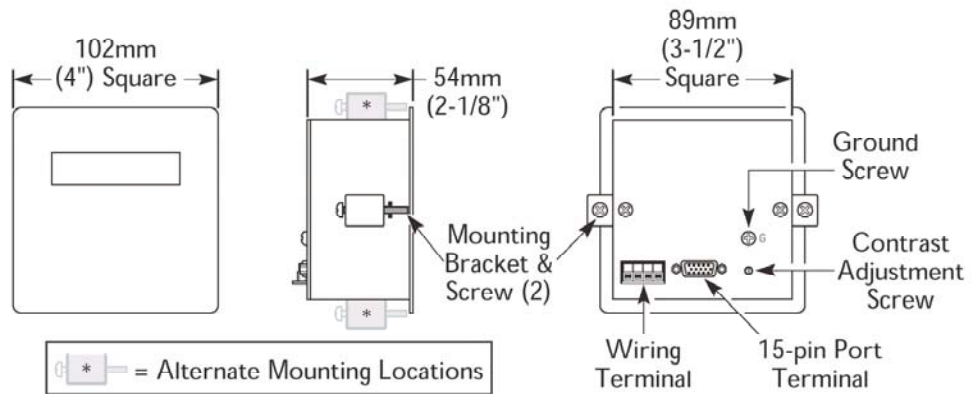
**VeriFlame Bases, NO-PURGE and PURGE sequence models**



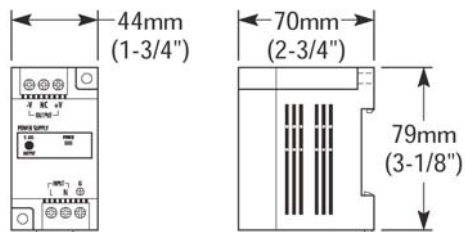
**VeriFlame MODULATION sequence model, Base Model Number 5602-40**



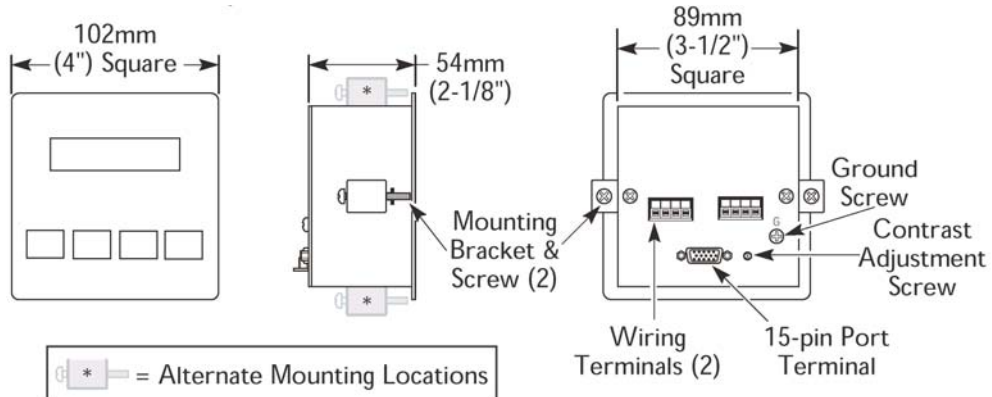
### Remote Display Model Number 5602-DB

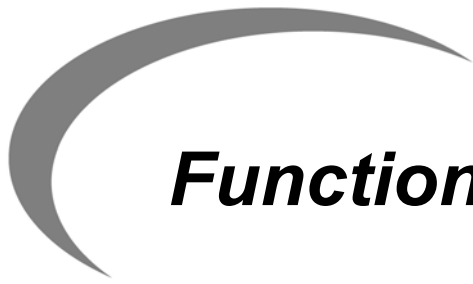


### p.n. 20317: 24VDC Power Supply for Remote Display 5602-DB



### Remote Display Model Number 5602-DBP





# Function Summary

## 3

### **INTRODUCTION**

This section describes the features of the VeriFlame CE. It is presented in three categories: Standard Features, Optional Features, System Errors and Lockout Conditions, and the LED Indicator Lights.

### **STANDARD FEATURES**

The following functions are standard features on the VeriFlame models as noted.

Interlocks and Limit  
Switch Input  
(Terminal 7)

This input is considered the normal operation control or run input to the VeriFlame system. Interlocks are generally pressure or temperature switches that when activated will start the burner. Limit switches are generally pressure, temperature, and other switches that when activated will 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 or lockout condition.

Combustion Air  
Switch Input  
(Terminal 6)

**For PURGE and MODULATION sequence models:** This input is for monitoring the combustion air switch separately from other interlocks and limits. The VeriFlame checks the air flow switch input 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 bypassed. This input has about a 1 second delay to filter out and ignore a momentary interruption.

If the input is improperly powered before the fan output is energized, the system error light will blink. The input must de-energize within 30 seconds or the VeriFlame will alarm and lockout.

After the fan output has energized, the air switch input must be made within 10 seconds. If not proven, then the system will lockout and the alarm output and the air failure light will come on. However, if the unit has the air switch input hold feature, the sequence is held indefinitely without causing a lockout. Then when the air switch input is made, the sequence continues.

If the air switch opens during the main firing cycle, the

Pre-Purge

system will lockout and the alarm output and the air failure light will come on. However, if the unit has the recycle option and the main output has been operating for at least 35 seconds, the VeriFlame will shut-down and restart.

**For PURGE sequence models:** The VeriFlame delays the sequence after the air switch is proven by the specified purge time. Once completed, the sequence continues to the trial for ignition.

**For MODULATION sequence models:** The purge time is doubled into two sequences. The first is a high fire purge for the specified time. The second is a low fire purge allowing the air butterfly valve time to achieve starting position.

Sequence Step	Internal Contacts	Function
Power Off	10 to 11	AUTO
Power On, Limits Open	10 to 12	LOW
Purge to High Fire	10 to 13	HIGH
Purge to Low Fire	10 to 12	LOW
Automatic Modulation	10 to 11	AUTO
Alarm and Lockout	10 to 12	LOW

Main Fuel Valve Closed Switch  
(Terminal V)

**For NO-PURGE and PURGE sequence models:** The VeriFlame can be interlocked with the main valve closed position switch. This feature checks the switch position before start-up and after shutdown to insure proper valve operation when the jumper on the base is cut.

Main Fuel Valve Closed / High Fire Purge Check  
(Terminal D)

**For MODULATION sequence models:** This feature is enabled when the jumper on the base is cut. The system checks that the high fire purge position switch and the main valve closed switch are both made at the end of the high fire purge.

Low Fire Start  
(Terminal 3 - impedance)

**For MODULATION sequence models:** When wired, the system checks for the low fire start position prior to light-off.

Pilot Test Mode



Test Mode (Button In)      Run Mode (Button Out)

In the pilot test mode, the VeriFlame will hold the sequence once the pilot flame is established and prevents energizing the main valve (terminal 5).

Depressing the TEST/RESET button on the front cover enters this mode. When in the pilot test mode, the green "INTERLOCKS CLOSED" light blinks. To exit the pilot test mode, simply push the TEST/RESET button again.

Interrupted or Intermittent Pilot	An interrupted pilot shuts off at the time specified by the part number after the main valve is energized. An intermittent pilot (specified as 00 time) continues during the entire main flame firing cycle.
Spark, Pilot Flame & Main Flame Separation	During the trial for ignition period (TFI), the pilot and ignition outputs remain energized. At the end of the TFI, the pilot output remains on and the ignition output is de-energized. After a five second delay to prove the pilot or start flame, the main gas valve is energized.
Post Purge	<b>For PURGE and MODULATION sequence models:</b> Post purge maintains the combustion air fan output for the time specified after the interlocks and limit switch input have opened.
<b>OPTIONAL FEATURES</b>	The following functions are optional features that must be specified when ordering.
Recycle Mode	With “R” specified, the VeriFlame will restart the sequence after flame or air failure. The recycle mode allows the system to re-initiate the start-up sequence automatically only if the main burner has been operating for at least 35 seconds. If the pilot or start flame fails to light during recycling, the system will alarm and lockout. If the recycle is successful and the main burner is once again operational for at least 35 seconds, the system is enabled for another recycle. At no time will the system recycle in the event of a pilot or starting flame failure.
Air Switch Input Hold	<b>For PURGE and MODULATION sequence models:</b> With “H” specified, the VeriFlame holds the sequence indefinitely until the air switch input is made. Once made, normal functional sequence continues.
Manual Reset on Power Outage	With “B” specified, the TEST/RESET button must be pressed twice (in and out) to start the sequence. The system error light blinks rapidly (about 4 times per second) and a remote display will show “PUSH RESET TO START”.
Remote Display	Two models of remote display are available. The model 5602DB operates on 24VDC and has no keypad. The model 5602DBP operates on 120VAC and has a keypad for reset function. The display is mounted through the panel-door and features a liquid crystal display in a ¼ DIN housing. The unit connects to the VeriFlame by a cable to the flame signal test jack, and receives a serial communication on each sequence state change.

## **SYSTEM ERRORS AND LOCKOUT CONDITIONS**

The display incorporates the following functions:

- 1) Provides status messages for the Veri-Flame sequence, see Section 8 “Remote Display Messages” on page 38.
- 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 the burner’s flame signal strength and run time during main burner operation.

A **system error** (illuminated by the red “System Error” LED on the front cover) prevents gas ignition. The unit will continue its sequence after the error is cleared.

A **lockout condition** energizes the alarm output and de-energizes the gas valve and ignition outputs. The unit must be reset to clear the alarm and start the sequence. To reset, the button must be pressed twice so that the button is in the out position.

The following system errors result in immediate lockout conditions:

- 1) Wiring error that puts external voltage on the output terminals.
- 2) Welded internal contacts or other malfunctions in the VeriFlame.
- 3) Main fuel valve closed position switch is open after cycle shutdown or before start-up. The system error light blinks twice and then remains on. The fan output terminal 8 will energize.
- 4) Low fire fail (for modulation model) – the low fire switch is open prior to trial for ignition.
- 5) High fire fail (for modulating model) – the high fire switch is not closed at the end of high fire purge.

The following situations will result in a lockout condition:

- 6) Air failure (for purge and modulation models) – loss of combustion air anytime during the operational cycle. The Air Failure LED will be on for this condition. (See “Recycle Mode”).
- 7) Pilot flame fail – loss of flame during the trial for pilot ignition period. The Flame Failure LED will be on for this condition.



System Errors and  
Lockout Conditions  
(Continued)

- 8) Main flame fail – loss of flame during the main burner trial for ignition or run period (recycling not selected). The Flame Failure LED will be on for this condition.

The following result in lockout conditions after 30 seconds, the system error light blinks about 14 times and then remains on:

- 9) If a flame is detected out of sequence, which may be caused by:
  - a) a faulty scanner;
  - b) electrical interference on the sensor wiring;
  - c) a flame exists in the burner or in the line of sight of a scanner, due to a gas leak, product fire or other condition.
- 10) Air flow switch closed before start-up (for purge and modulation models).

**STATUS LIGHTS &  
PUSH-BUTTON**

All of the status lights and the TEST/RESET push-button are located on the front cover of the Veri-Flame. This section describes their respective functions.

Interlocks Closed

This green LED illuminates when the operation limits are made.

The limits are wired in series to terminal 7. This input becomes energized to begin the burner sequence. When in the test mode, this LED blinks (see “Pilot Test Mode”).

Air Failure

**For purge and modulation models:** this red LED illuminates whenever combustion air is lost during the operational cycle of the Veri-Flame.

System Error

This red LED illuminates when a system error is detected (see “System Errors & Lockout Conditions”).

Flame Failure

This red LED illuminates when a pilot or main flame fails.

Low Fire

**For modulation models:** this yellow LED illuminates during the low fire period of the purge cycle.

High Fire

**For modulation models:** this red LED illuminates during the high fire period of the purge cycle.

Auto

**For modulation models:** this green LED illuminates during the automatic period which occurs 20 seconds after the main valve is energized.

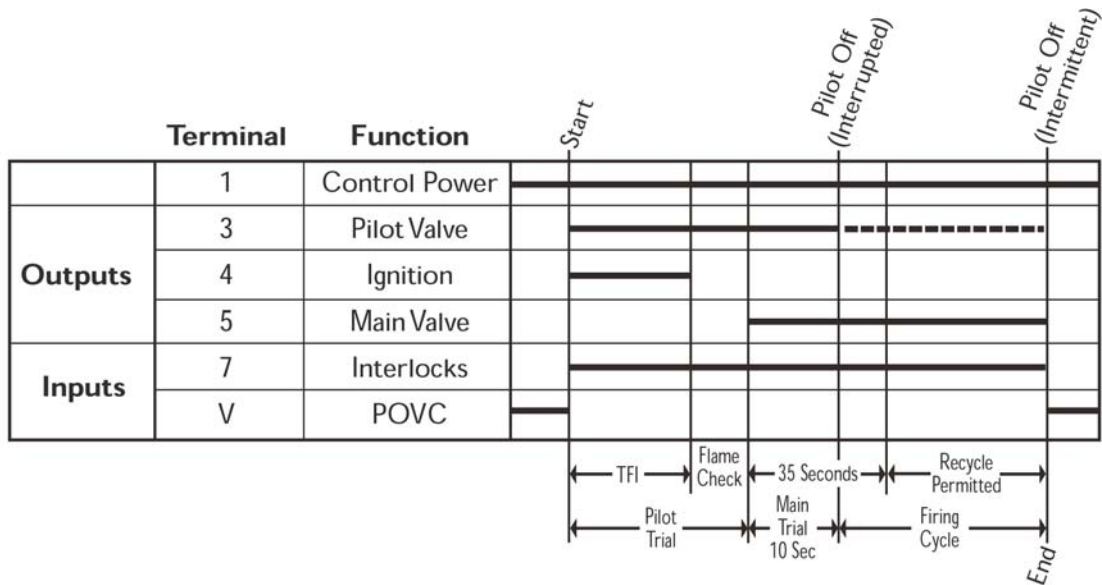
Test/Reset

This push-button is used to activate the pilot test mode or to reset the Veri-Flame unit.

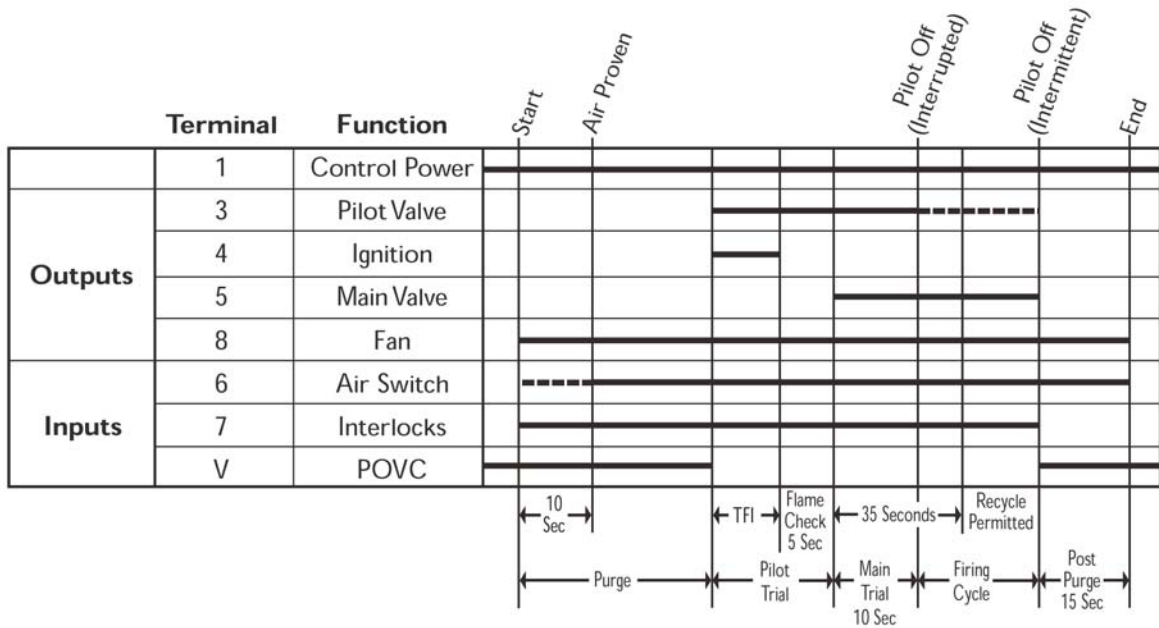
Flame Signal

This red LED is located behind the signal test port and illuminates when a flame signal is present.

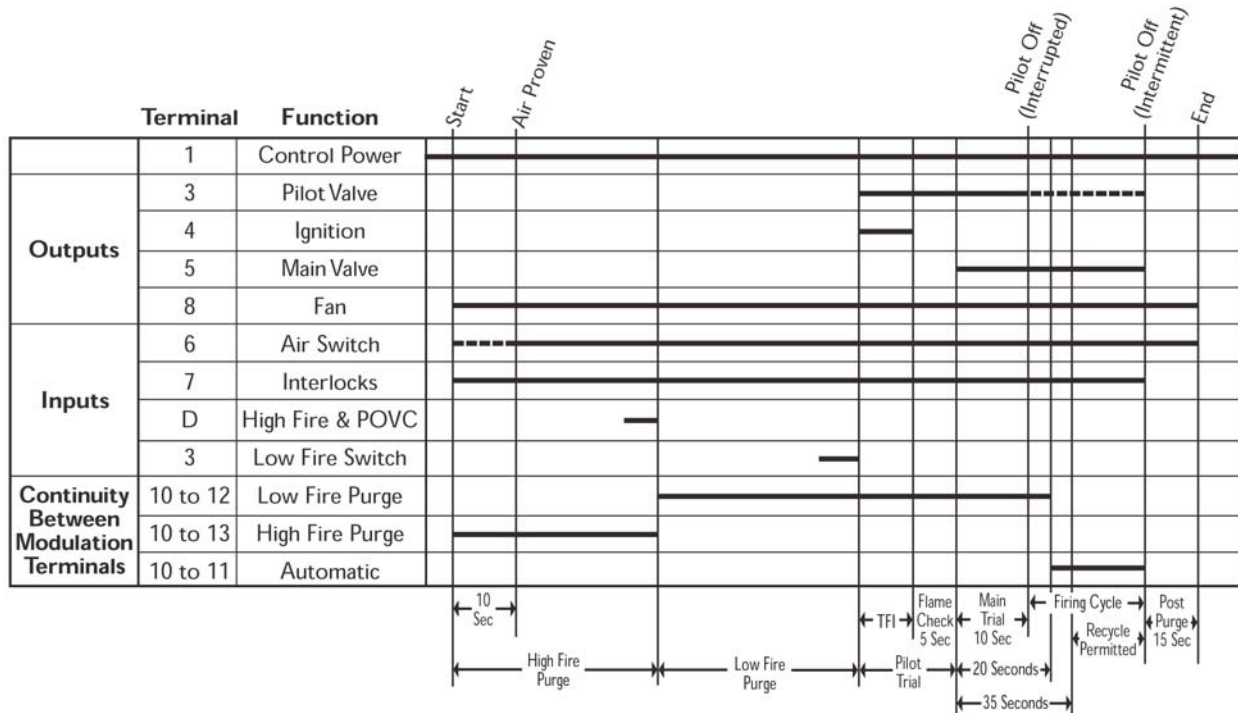
**FIGURE 3 – 1 TYPICAL SEQUENCE FOR NO-PURGE MODELS**



**FIGURE 3 – 2 TYPICAL SEQUENCE FOR PURGE MODELS**



**FIGURE 3 – 3 TYPICAL SEQUENCE FOR MODULATION MODELS**





# System Installation

## 4

### INTRODUCTION

In this section, the necessary procedures are detailed to integrate a VeriFlame into a burner system. Specific wiring directions are given for the various functions described in the previous section.



#### Note:

*Shut off the power supply before the VeriFlame is removed or replaced from the base.*



#### Caution:

*Installation and maintenance must conform with the national and local codes and authorities having jurisdiction. Only qualified technicians with knowledge or training of combustion equipment and safety systems must install and commission flame monitoring systems.*

Interlocks and  
Limit Switch Input  
(Terminal 7)

Wire external interlock, control, and limit switches in series to this input. Guard against induced voltage levels to wiring connected to this input. In some extreme wiring runs, reduction of induced voltages may require a load (relay or light) connected to terminal 7 to avoid system error lockouts. This input is the power source for the valve and ignition output terminals. Be sure all switches wired to this input can handle the current required by the total of all loads connected to terminals 3, 4, and 5.

Combustion Air  
Switch Input  
(Terminal 6)

For purge and modulation models: Wire any switches and contacts in series to this terminal for proving airflow function and relating to the air failure light. Power must not be immediately present at terminal 6 when power is first applied to terminals 1 or 7.

If the combustion air blower is controlled outside of the VeriFlame system, then a three-way solenoid valve must be connected between the air switch port and the blower sensing port. The valve de-energized state should vent the switch to ambient pressure. The energized state then connects the air switch to the blower

Ignition Wiring  
(Terminal 4)

sensing port. Power the valve from the blower output terminal 8. An alternate method if accepted by local codes: the air switch could be wired between the combustion blower output and the air switch input. Connecting the air switch in this manner will satisfy the open contact (air short) check during startup.

If this terminal is not used and the air switch requirement is satisfied by an alternate method accepted by the authority having jurisdiction, then place a jumper between the combustion blower output (terminal 8) and the air switch input (terminal 6) to satisfy the controller function.

The output terminal normally powers a high voltage transformer. Route the high voltage ignition wiring a sufficient distance from all sensors and other low voltage wiring to avoid electrical interference, which may cause erratic operation of the VeriFlame system. Keep the high voltage wire as short as possible. The best condition is to mount the ignition transformer close to the burner and keep a low impedance path from the burner ground to the ground of the transformer. Make sure the high voltage lead and ground return paths do not create a loop antenna around the VeriFlame and sensor wiring.

Low Fire Start  
Switch  
(Terminal 3 –  
resistance through  
valve coil)

**For modulation sequence models:** 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 between terminal 3 and the pilot valve. On direct spark burners, a by-pass contact must be wired around the low fire switch.

Main Valve  
Closed Switch  
Input  
(Terminal V or D)

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

**For purge and no purge models:** The main valve closed switch must be connected to Terminal V and the jumper in the base must be cut.

**For modulation models:** The main valve closed switch must be wired in series between the airflow switch and the high purge damper switch. To use this feature, the jumper in the base must be cut.

High Purge Switch  
Input  
(Terminal D)

**For modulation models:** the system can be wired to check for high purge position for the high fire purge portion of the sequence. To use this feature, the red jumper in the base must be cut and the high purge position switch must be connected from terminal 6 to D. If this feature is not used, the jumper in the base remains intact or a jumper must be installed between terminals 1 and D. (The yellow jumper on the base has no effect whether cut or intact.)

Remote Reset  
(Terminal 1)

This feature permits remote mounting of a switch to reset the VeriFlame. To use this feature, a normally closed remote reset switch must be wired so that power is interrupted to terminal 1. When it is pressed or actuated, the connection to terminal 1 is momentarily interrupted and resets the VeriFlame.

Remote Display

Identify the model of remote display (see page 12) and wire according to Figure 4 –9 or Figure 4 –10. Mount through a ¼ DIN cutout using the two supplied brackets in either the top and bottom or the side slots. Locate the display and wiring to minimize electrical interference. Applying and disconnecting the display power supply should coincide with power to terminal 1 of the VeriFlame. Use the appropriate cable (Eclipse part #20318) to connect to the test jack and to the S2 terminal of the VeriFlame wiring base. Do not attempt to parallel the test jack signal to other devices when using a remote display. The LCD display contrast can be adjusted on the back with a small blade screwdriver.



**Note:**

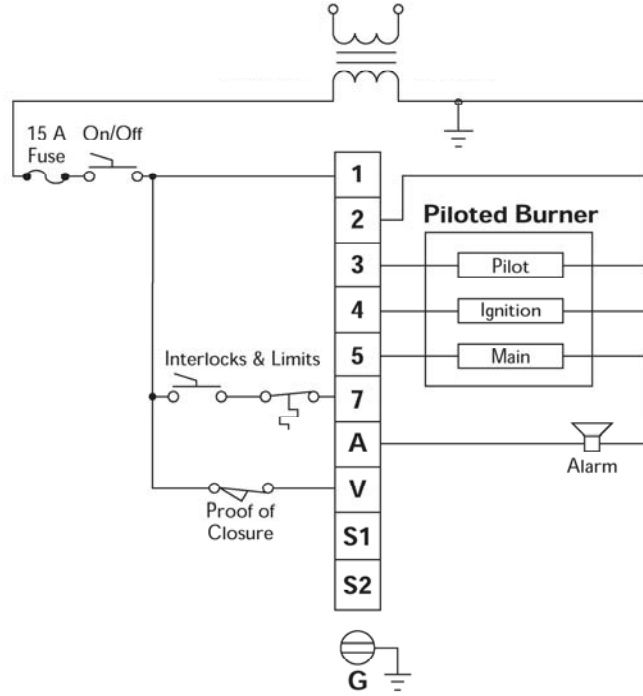
1. *Control circuit wires must meet 90°C (194°F) specification minimum and must be 1.5mm<sup>2</sup> (No. 16 AWG) or larger and in accordance with all applicable codes.*
2. *Flame sensor wires must be individually run in their own separate conduit; multiple unshielded flame sensor wires CANNOT be run together in a common conduit or wire way (See Sensor Installation Section).*
3. *The neutral wire to terminal 2 must be at ground potential (bonded at the supply source). Ground, shielding, and conduit must not be connected to terminal S2, which is internally referenced to terminal 2.*



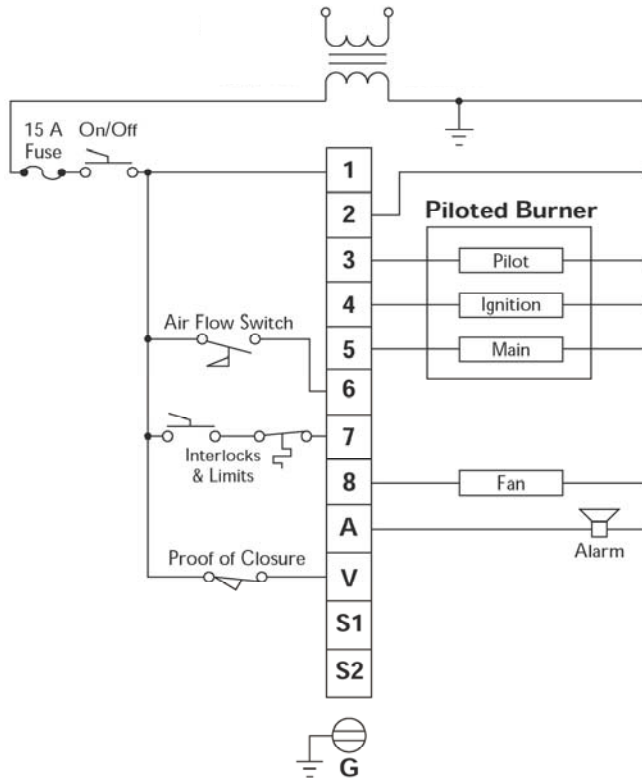
**Warning:**

**Install a modulation sequence model into the modulation style base only; never plug into purge or no-purge bases.**

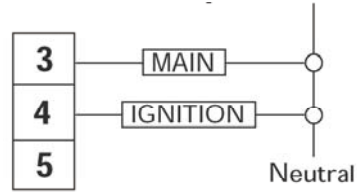
**FIGURE 4-1  
WIRING FOR NO-  
PURGE MODELS**



**FIGURE 4-2  
WIRING FOR PURGE  
MODELS**

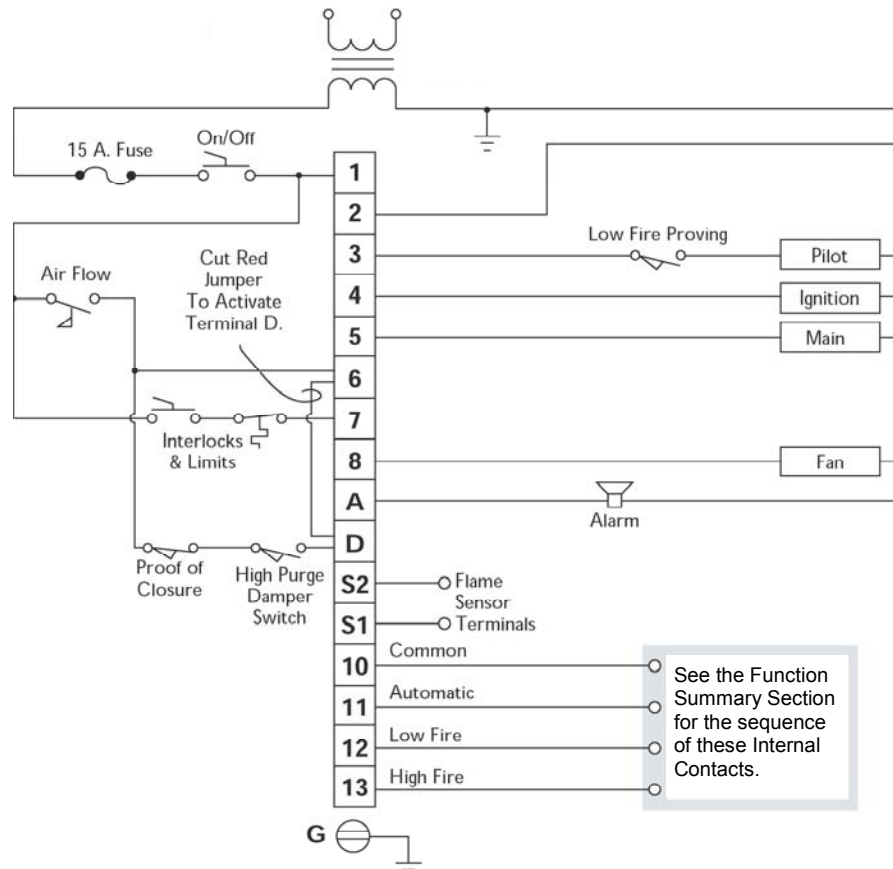


**FIGURE 4-3  
WIRING FOR  
DIRECT SPARK OF  
MAIN FLAME, NO-  
&PURGE MODELS**



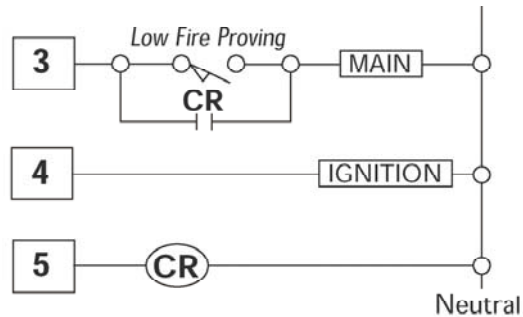
*Unit must be intermittent pilot, not interrupted.*

**FIGURE 4-4  
WIRING FOR  
MODULATION  
MODELS**



See the Function Summary Section for the sequence of these Internal Contacts.

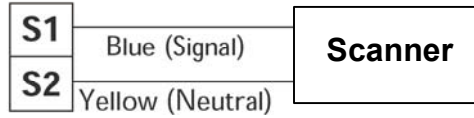
**FIGURE 4-5  
WIRING FOR  
DIRECT SPARK OF  
MAIN FLAME,  
MODULATION  
MODELS**



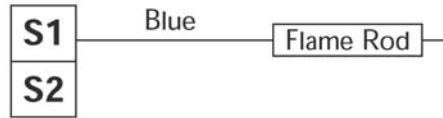
*Unit must be intermittent pilot, not interrupted.  
CR is a control relay used to bypass the low fire switch after the burner is lit.*



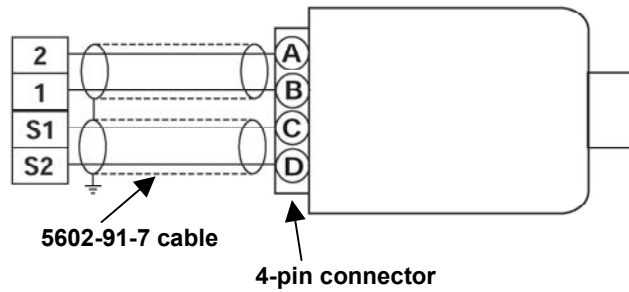
**FIGURE 4-6**  
**WIRING FOR**  
**MODELS 5600-90,**  
**-91, -91N4 UV**  
**SCANNERS**



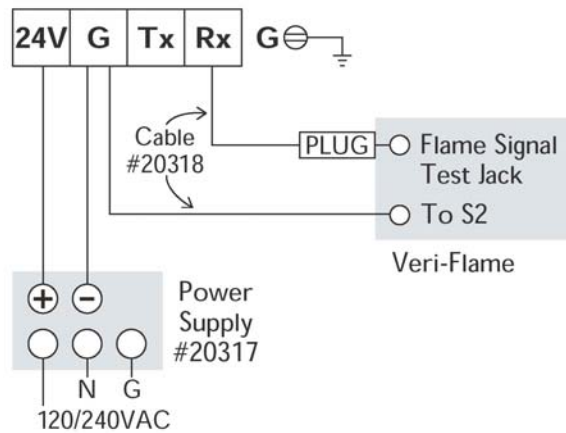
**FIGURE 4-7**  
**WIRING FOR FLAME**  
**ROD**



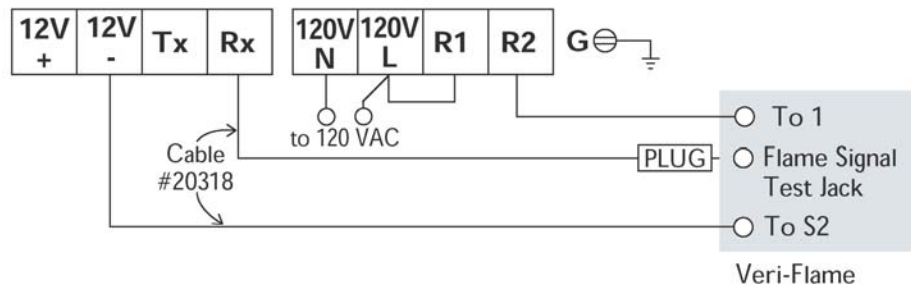
**FIGURE 4-8**  
**WIRING FOR**  
**MODELS 5602-91**  
**SELF-CHECK UV**  
**SCANNER**



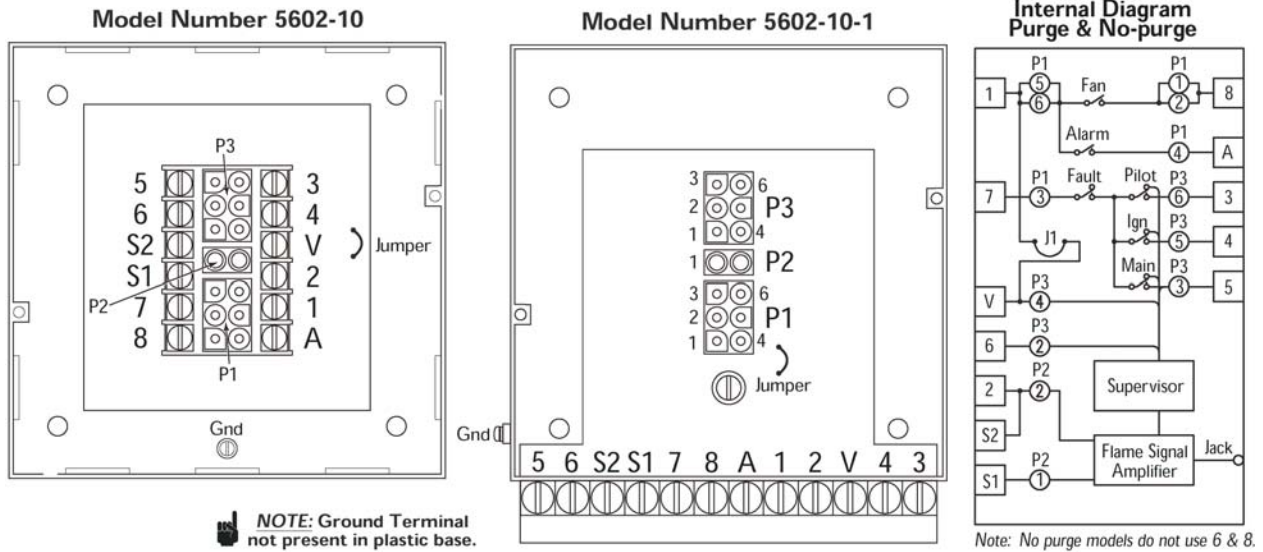
**FIGURE 4-9**  
**WIRING FOR MODEL**  
**5602DB, 24VDC**  
**REMOTE DISPLAY**



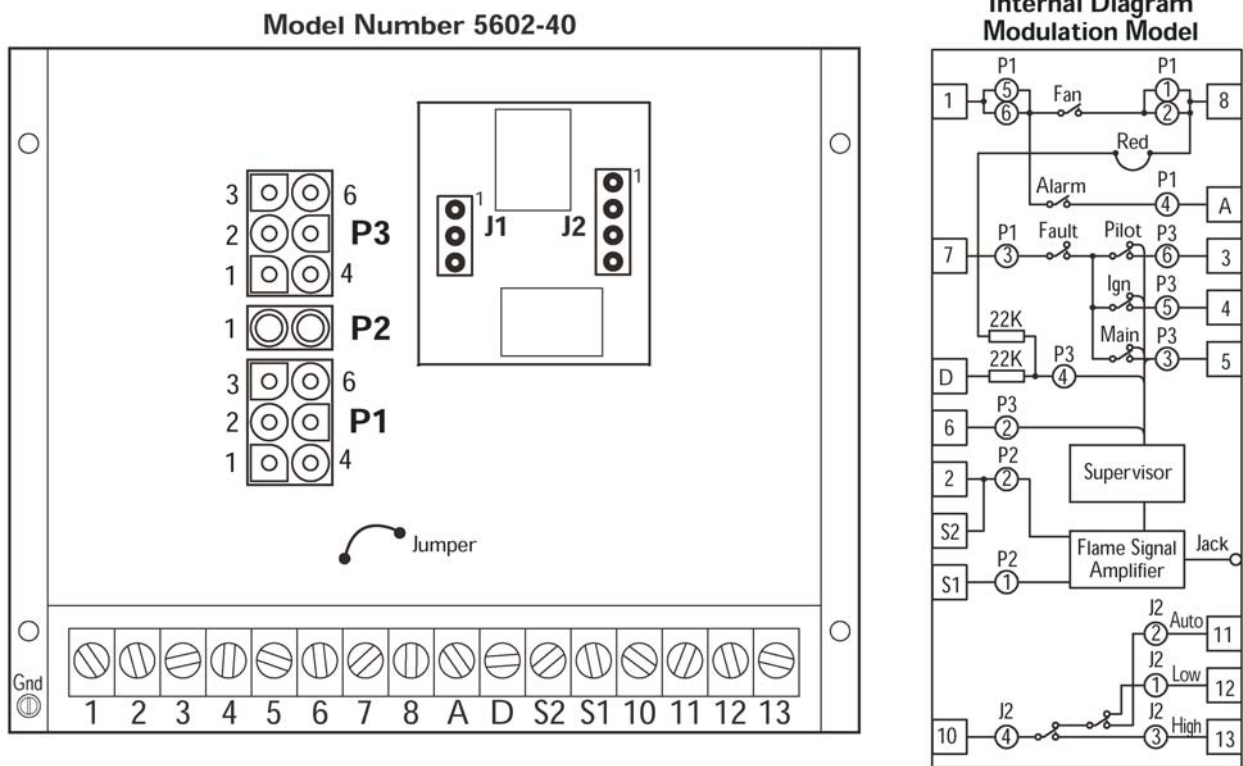
**FIGURE 4-10**  
**WIRING FOR MODEL**  
**5602DBP,**  
**120VAC REMOTE**  
**DISPLAY**



**FIGURE 4-11 BASE LAYOUT FOR NO-PURGE AND PURGE MODELS**



**FIGURE 4-12 BASE LAYOUT FOR MODULATION MODELS**



# Sensor Installation

## 5

### INTRODUCTION

This section describes the proper wiring, installation and sighting considerations for the sensors used with a VeriFlame.



#### **Warning:**

***Incorrect sensor installation may cause the sensor to generate a false flame signal, possibly resulting in the collection of unburned fuel in the combustion chamber. This unburned fuel creates the potential for explosions which can result in injuries, death, and property damage. Be certain that the flame sensor detects acceptable pilot and main flames only.***

### SENSOR WIRING

Route sensor wiring a sufficient distance from ignition and other high voltage or high current wiring to avoid electrical interference. Interference from ground currents, nearby conductors, radio-frequency emitters (wireless devices), and inverter drives (VFD) can induce false flame signals. Shielded cables can help reduce interference with the shield connected to ground at the control end only. Please note that a grounded shield may also decrease the signal due to the cable's internal capacitance. Cable capacitance (picofarads or microfarads) is determined by the wire type and construction. Multiple U.V. tube-type sensor-leads run together without shielding may interfere or "cross talk", so the shield or flexible armor must be grounded to prevent this situation. For flame rod sensor runs approximately 30 meters (100 feet) or greater, use Eclipse part number 21741 coax cable. 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).



Note:

Unshielded sensor wiring must not be run in common with other wires; it must be run in separate conduit. Use 1mm<sup>2</sup> to 2mm<sup>2</sup> (#14 to #18 AWG) wire suitable for 90°C (194°F) and 600 volt insulation. Multiple unshielded flame sensor wiring must not be run together in a common conduit or wire way.

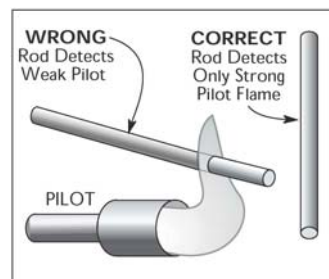
Multiple shielded flame sensor cables can be run in a common conduit.

**FLAME RODS**

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 for reliable detection and at least 13 mm (1/2") away from any refractory.
- 2) Position the rod into the intersection of both the pilot and main flames, preferably at a descending angle to minimize drooping of the flame rod against burner parts. The flame rod position must detect only a pilot flame that is adequate to light the main flame for all normal burner draft conditions. Extend the rod 13 mm (1/2") into non-luminous flames, such as blue flames from pre-mix and nozzle-mix air/gas burners. For partially luminous flames, such as atmospheric air/gas mixtures, place the rod at the edge of the flame.

**FIGURE 5–1 FLAME ROD POSITION**



- 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 to 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 reduce this effect. Changing the spark gap or adding grounding

## SCANNERS



area between the flame rod and spark plug may eliminate the interference.

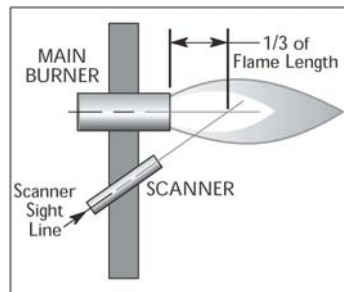
### **Warning:**

***Use only Eclipse scanner models as listed for operation with the VeriFlame.***

When installing scanners, please consider the following:

- 1) Position the scanner within 450 mm (18") of the flame. Consult factory for longer distances.
- 2) Bushing threads are ½-inch F.N.P.T. for all scanner models except 5602-91, which has 1-inch F.N.P.T. bushing threads.
- 3) The ambient temperature limits of each scanner vary; check the literature for the specific scanner model. For higher temperatures, use Eclipse heat block seal 23HBS for ½" N.P.T. scanners and if necessary, add cooling purge air.
- 4) An optional magnifying lens may also be used to increase the flame signal strength and narrow the field of view in difficult sighting situations.

**FIGURE 5–2 SCANNER SIGHTING**



- 5) Aim scanners at the third of the flame closest to the burner nozzle (oil flames typically have less UV radiation in the outer flame). The scanner should view the intersection of the pilot and main flames.
- 6) Sight the scanner away from the ignition spark. If necessary, use a scanner orifice to reduce spark pickup.
- 7) Do not allow the scanner to detect a pilot flame that is too small to ignite the main burner.
- 8) Perform a minimum pilot test when installing or adjusting any pilot or main burner system; see "Minimum Pilot Test" on page 30.



# Test Procedures

## 6

### **INTRODUCTION**

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

### **FLAME SIGNAL STRENGTH**

Insert the positive probe of a 0-15 VDC, digital voltmeter into the test point on the front cover of the VeriFlame; connect the negative probe to S2 or alternately to ground. Good flame signal strength will read between 6 and 11 VDC; anything below 4 VDC is inadequate. Also, the red LED inside the test point illuminates when a flame signal is indicated.

### **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 main burner, but not to the pilot.
- 2) Start the system normally.
- 3) To enter the pilot test mode, depress the test/reset button located in the lower right corner on the front cover, see Pilot Test Mode on page 14.
- 4) The control will hold the operating sequence at the pilot flame step. Measure the flame signal strength.
- 5) Reduce the pilot flame until the flame signal drops towards 4VDC. Increase pilot flame until the flame signal is steady and greater than 4 VDC. This is the minimum pilot. If you don't think this flame will be able to safely light the main burner then realign the sensor so that it requires a larger pilot flame and repeat these steps.
- 6) Push the test/reset button so that it is in the out position to exit the test mode (reset) 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 FAILURE TEST**

pilot flame. Repeat steps 1 through 6 until the main burner lights off smoothly and reliably.

- 1) Manually shut off the fuel supply to the pilot and the main burner.
- 2) Press the test/reset button in for the Pilot Test Mode, see page 14.
- 3) Start the system normally. The controller should go to a lockout condition. If it doesn't, then the controller is detecting a false flame signal, see Section 5. Find the problem and correct it before resuming normal operation.

**MAIN FLAME FAILURE TEST**

This test is for a VeriFlame specified with interrupted pilot.

- 1) Manually shut off the fuel supply to the main burner but not to the pilot.
- 2) Start the system normally. The pilot should ignite and then after pilot interruption, the controller should go to a lockout condition. If not, the controller is detecting a false flame signal, see Section 5. Find the problem and correct it before resuming normal operation.

**SPARK SIGHTING TEST**

- 1) Manually shut off the fuel supply to the pilot and the 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 27.

**LIMITS AND INTERLOCKS TEST**

Periodically check all interlock and limit switches by manually tripping them during burner operation to make sure they cause the system to shut down.



**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.***



# Maintenance and Troubleshooting

## 7

### INTRODUCTION

This section is divided into two parts. The first part describes the maintenance procedures. The second part describes troubleshooting procedures and includes identifying problems and interpreting the operating conditions by the lit LEDs on the front cover.

### 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 harsh or dirty, then the intervals may need to be shorter.*



Caution:

*Turn off power before disconnecting or installing sensors, wiring bases, displays, or control units.*



Warning:

**Individuals working on this equipment should be trained in the design, operation, and maintenance of the complete system. They should recognize when a system is operating outside of its design parameters and be able to safely shut down the system.**



**MONTHLY CHECK LIST**

- 1) Inspect flame-sensing devices for good condition and cleanliness. Keep scanner lenses 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 in "Test Procedures" on page 30: manually make each interlock fail, noting what related equipment closes or stops as specified by the manufacturer.
- 5) Test flame sensor lockout operation by manually shutting off the gas to the burner.

**YEARLY CHECK LIST**

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

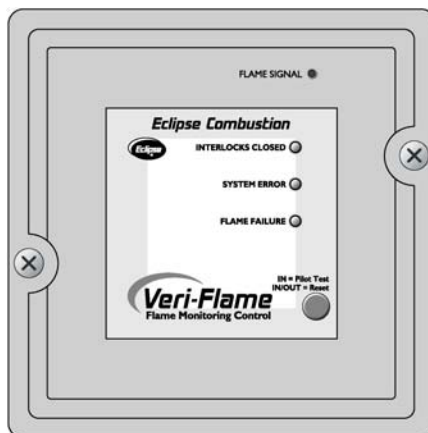
**TROUBLESHOOTING**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REMEDY</b>
Cannot initiate start sequence	No power to control unit.	Check for incoming power to terminals 1-2.
	Unit is in lockout condition.	Push the reset button twice, first in and then to out position.
	High or low gas pressure switches are open; INTERLOCKS CLOSED light is off.	Measure gas pressure; if out of range correct cause (regulator, filter, obstruction). Check for damaged or incorrectly adjusted switch. Check wiring to terminal 7.
	No power to terminal 7; INTERLOCKS CLOSED light is off.	Check all series connected switches feeding 7.
	INTERLOCKS CLOSED light is off; power is present at terminal 7.	Replace with new control unit. Replace wiring base.
	Improper field wiring	Check for interference and induced flame signals, look for flame on light in the test jack and for SYSTEM ERROR light. Check grounding system. Install surge suppressors, separate wiring by voltages and follow guidelines for sensor wiring in Section 5.
Cannot complete purge sequence	Air pressure switch is open or shorted.	Measure air pressure; if out of range then correct cause (filter, blower rotation, obstruction). Check for damaged or incorrectly adjusted switch. Check wiring to terminal 6; voltage to 6 must not make before output on terminal 8.
	Improper field wiring	See improper field wiring above

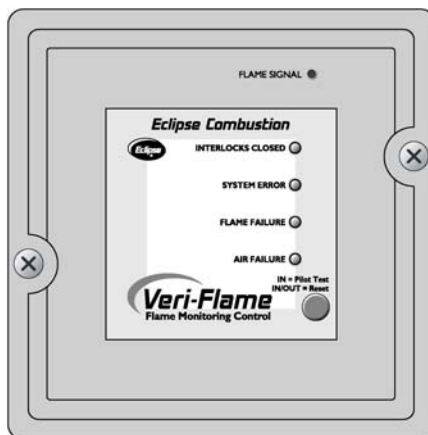
<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REMEDY</b>
	Low fire, high fire, or main valve closed switches are not making.	Check for improperly adjusted or defective position switches and loose wiring.
Cannot initiate full trial for ignition	Ignition circuit interference	Separate and isolate high voltage spark wire. Swap ignition transformer primary lead polarity. Install surge suppressors, separate wiring by voltages and follow guidelines for sensor wiring in Section 5. Relocate ignition transformer; change the ground return path.
Cannot establish pilot flame	FLAME FAILURE	Correct reversed sensor wiring or replace defective flame sensor. Adjust burner settings. Repair defective ignition circuit.
Main Valve never opens	Unit in pilot test mode.	Press the reset button to the out position.
	FLAME FAILURE	See FLAME FAILURE above. Check wiring for direct ignition burners (no pilot).
Does not lockout with a main valve switch open test	Jumper in wiring base is not cut.	Cut the 1 to V or the 8 to D jumper in the base.
Will not recycle	Improper model	Check part number.
	Main flame was not established for 35 seconds.	See FLAME FAILURE above.
Flame Signal Voltage reading greater than 12VDC	Improper grounding	Check grounding of neutral at control power transformer.

<b>LED STATUS</b>	This section describes the status of operating conditions based on the LED or combination of LEDs that are lit on the front cover of the VeriFlame. Some of the listed causes may apply only to a specific model sequence: No-Purge, Purge, or Modulation.
<b>LED(s) ON</b>	<b>POSSIBLE CAUSES</b>
INTERLOCKS CLOSED	The interlocks, limits, and contacts wired to terminal 7 are closed to allow operating the burner.
SYSTEM ERROR	<ol style="list-style-type: none"> <li>1) The flame signal light is on - flame detected is out of sequence; the scanner is defective; inductance is detected on sensor wires.</li> <li>2) Voltage is back-wired into output terminals 3, 4 or 5.</li> <li>3) Internal relay contacts are welded or other internal controller failure.</li> <li>4) Airflow switch is closed before start-up.</li> <li>5) Main fuel valve switch opens after shutdown or before start-up; no power to terminal V.</li> <li>6) High purge damper switch and/or main fuel valve switch opens during start-up; no power to terminal D.</li> <li>7) Low fire switch not made before TFI.</li> </ol>
FLAME FAILURE	<ol style="list-style-type: none"> <li>1) Pilot flame is not established within the trial for ignition period (TFI).</li> <li>2) Main flame is not established within the TFI.</li> <li>3) Flame failed during operation in non-recycle mode, or the main flame fails within 35 seconds of TFI.</li> <li>4) Flame failed 35 seconds after TFI and was not established during the subsequent TFI in recycle mode.</li> </ol>
AIR FAILURE	<ol style="list-style-type: none"> <li>1) Airflow switch not closed within ten seconds of start-up.</li> <li>2) Airflow switch opens during timing cycle.</li> <li>3) Airflow switch opens during firing cycle.</li> </ol>
AUTO	Burner in run mode, firing rate determined by automatic controller.
HIGH FIRE	Purge high sequence.
LOW FIRE	Purge low sequence or interlocks open.

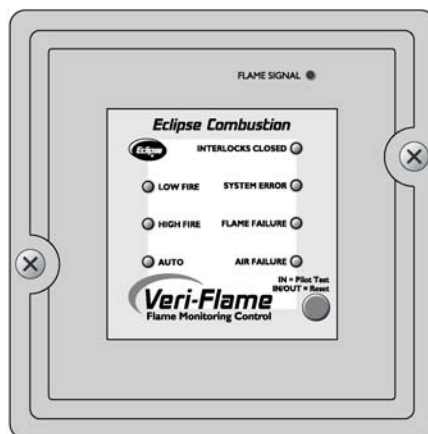
**FIGURE 7 – 1**  
**NO PURGE MODEL**

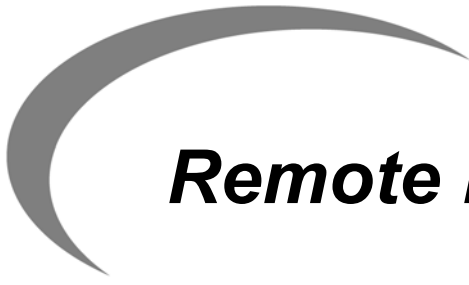


**FIGURE 7 – 2 PURGE MODEL**  
**MODEL**



**FIGURE 7 – 3**  
**MODULATION MODEL**





# Remote Display Messages

## 8

### **INTRODUCTION**

This section covers how the optional remote display shows messages that relate to the sequences of the Veri-Flame.

The remote display provides LCD messages which monitor the status of the VeriFlame's functions as well as any lockout conditions, see "Remote Display" on page 15.

See Figure 4 –9 and Figure 4 –10 on page 25 for wiring information.

This section is divided into two parts:

The first part describes the start-up and shutdown monitoring sequences of the Veri-Flame and how the progress (or halting) of the sequence can be monitored by the messages on the remote display.

The second part alphabetically lists and explains the diagnostic messages which can appear on the remote display.

### **ELAPSED TIME INDICATOR**

The remote display provides running time while the burner is firing. This time is zeroed from the start of the interlocks input. When in a lockout condition, the display alternately shows the current elapsed time and the time when the lockout took place.

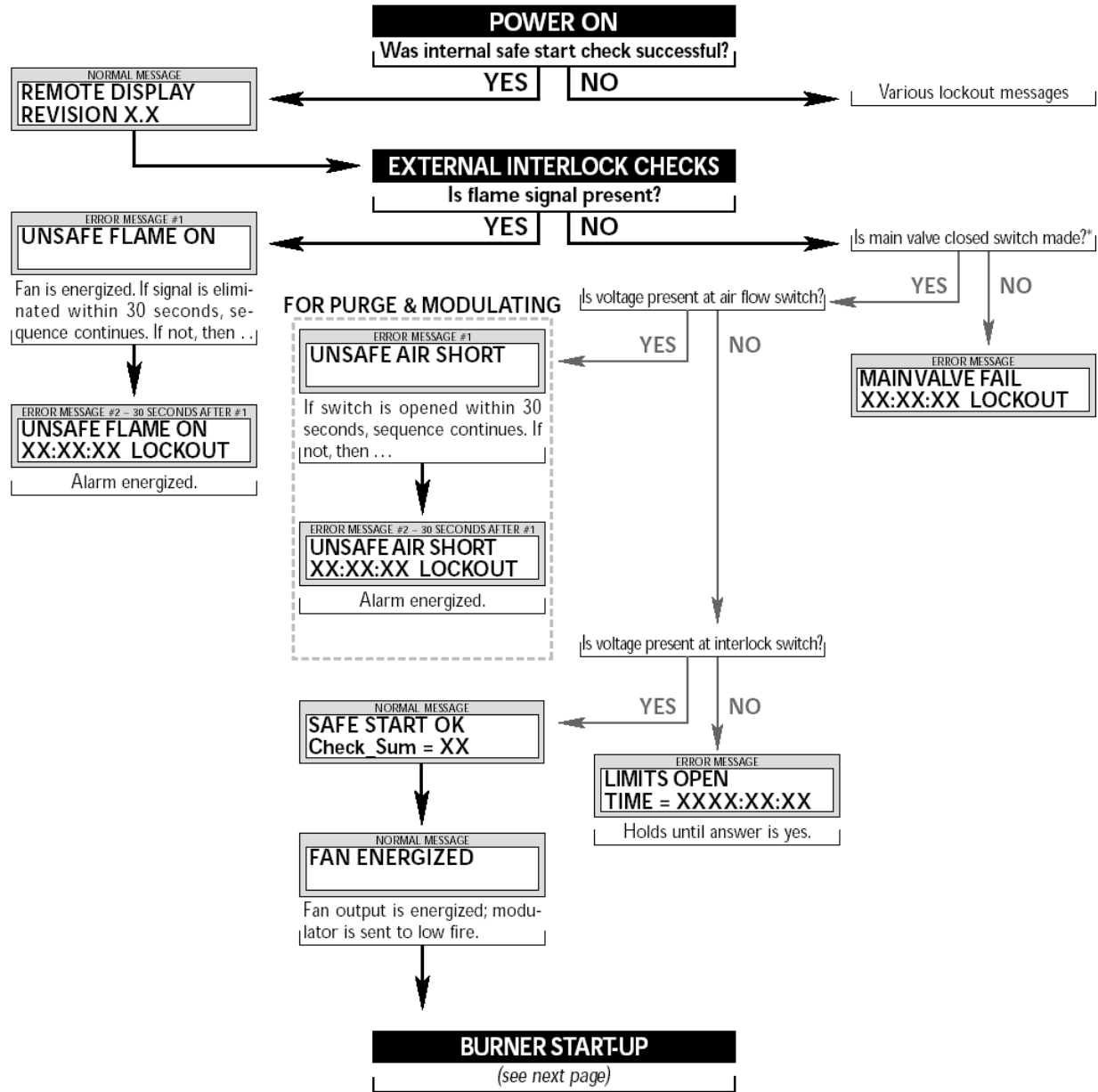
### **FLAME SIGNAL STRENGTH READOUT**

The remote display shows the flame signal strength during the pilot trial for ignition and during the main firing cycle. It is displayed as a voltage reading from 0 to about 12V, corresponding to the output voltage from the test jack.

### **KEYPAD OPERATION REMOTE RESET**

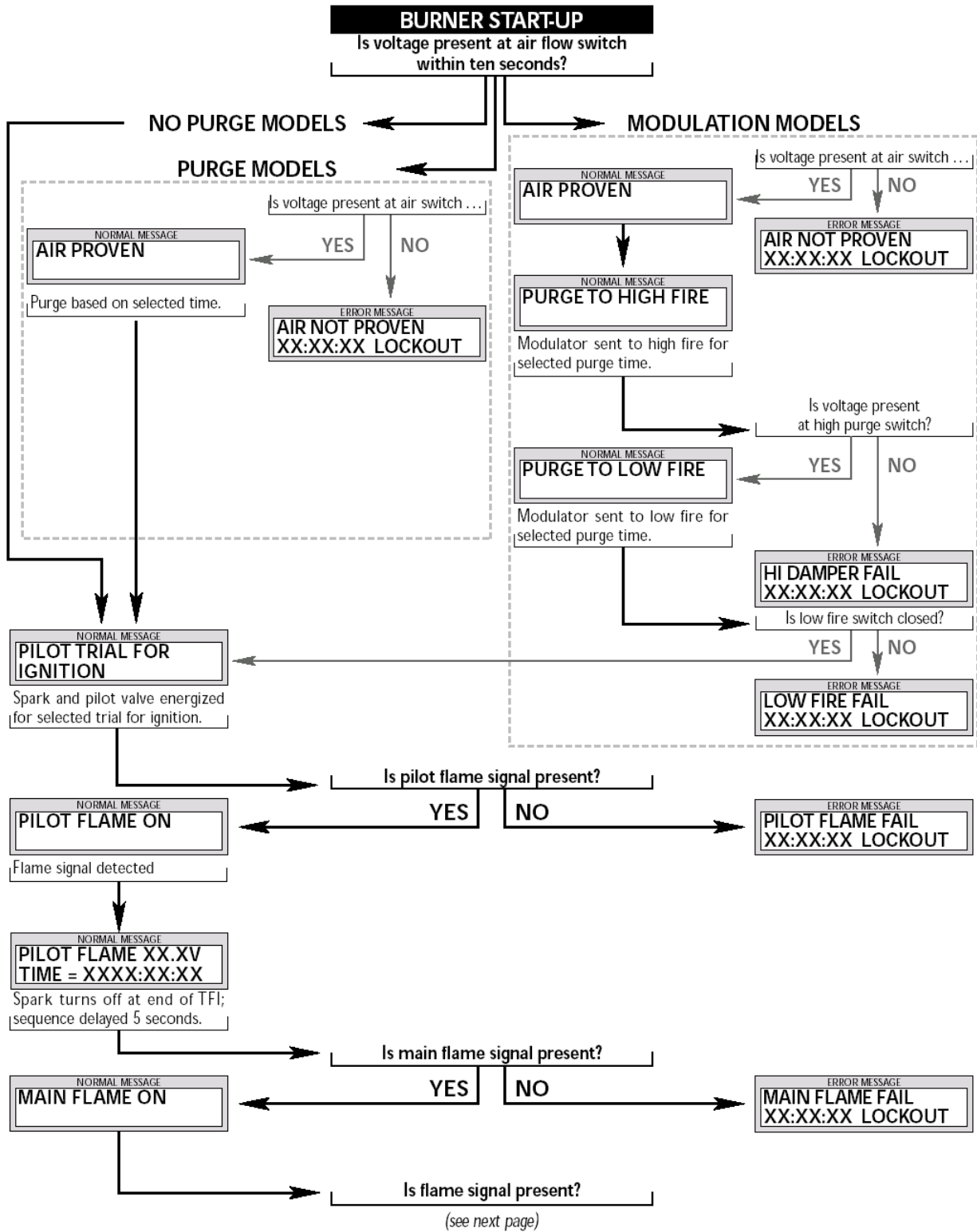
Currently only the RESET button of the model 5602-DBP display functions at this time. Pressing this button opens the internal normally closed contact on terminals R1 and R2, see Figure 4 –10 on page 25, and also resets the internal microprocessor.

**FIGURE 8 – 1 STARTUP**



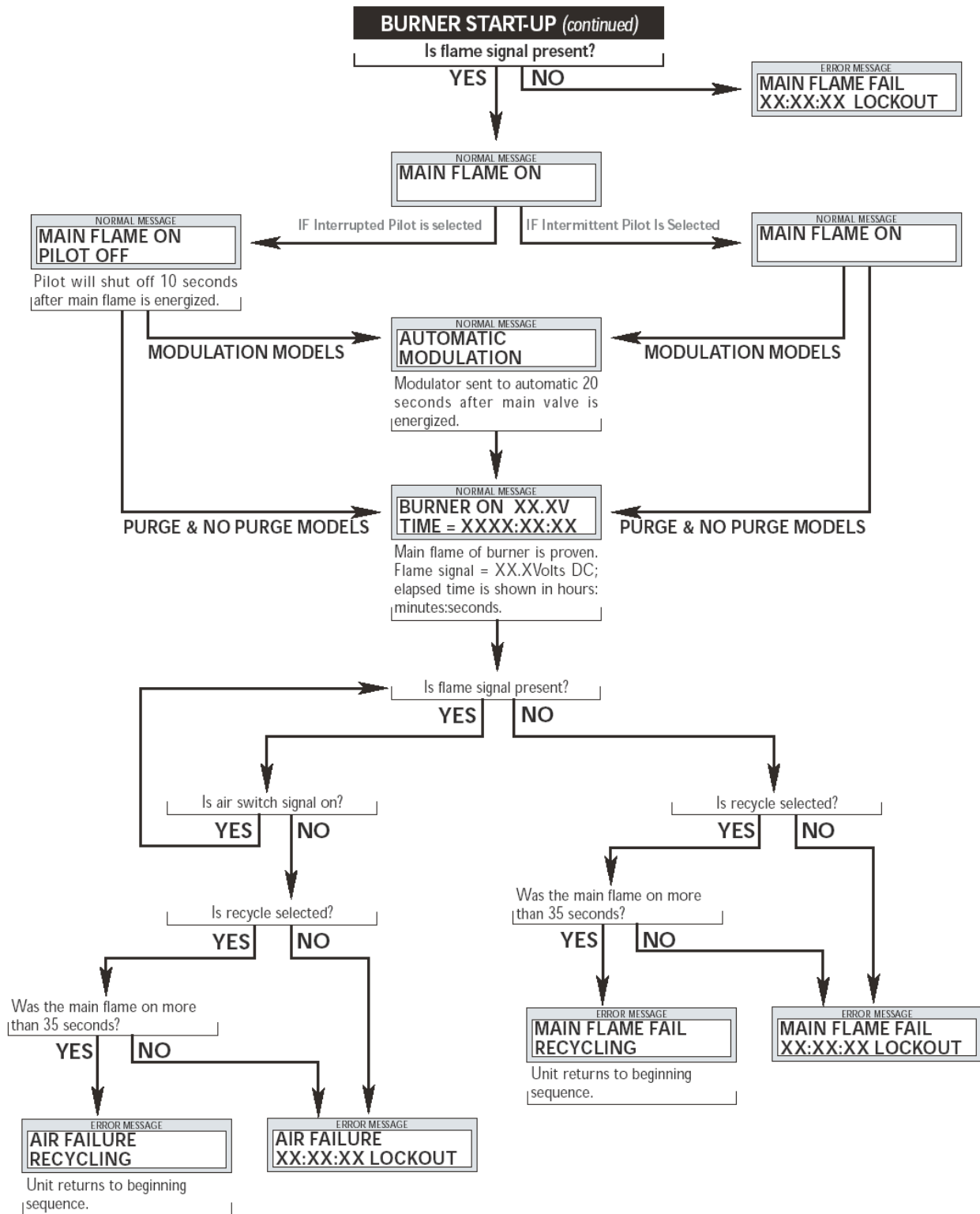
\* Applies to purge and no purge models only.

**FIGURE 8 – 2 PURGE, TFI, AND MAIN**

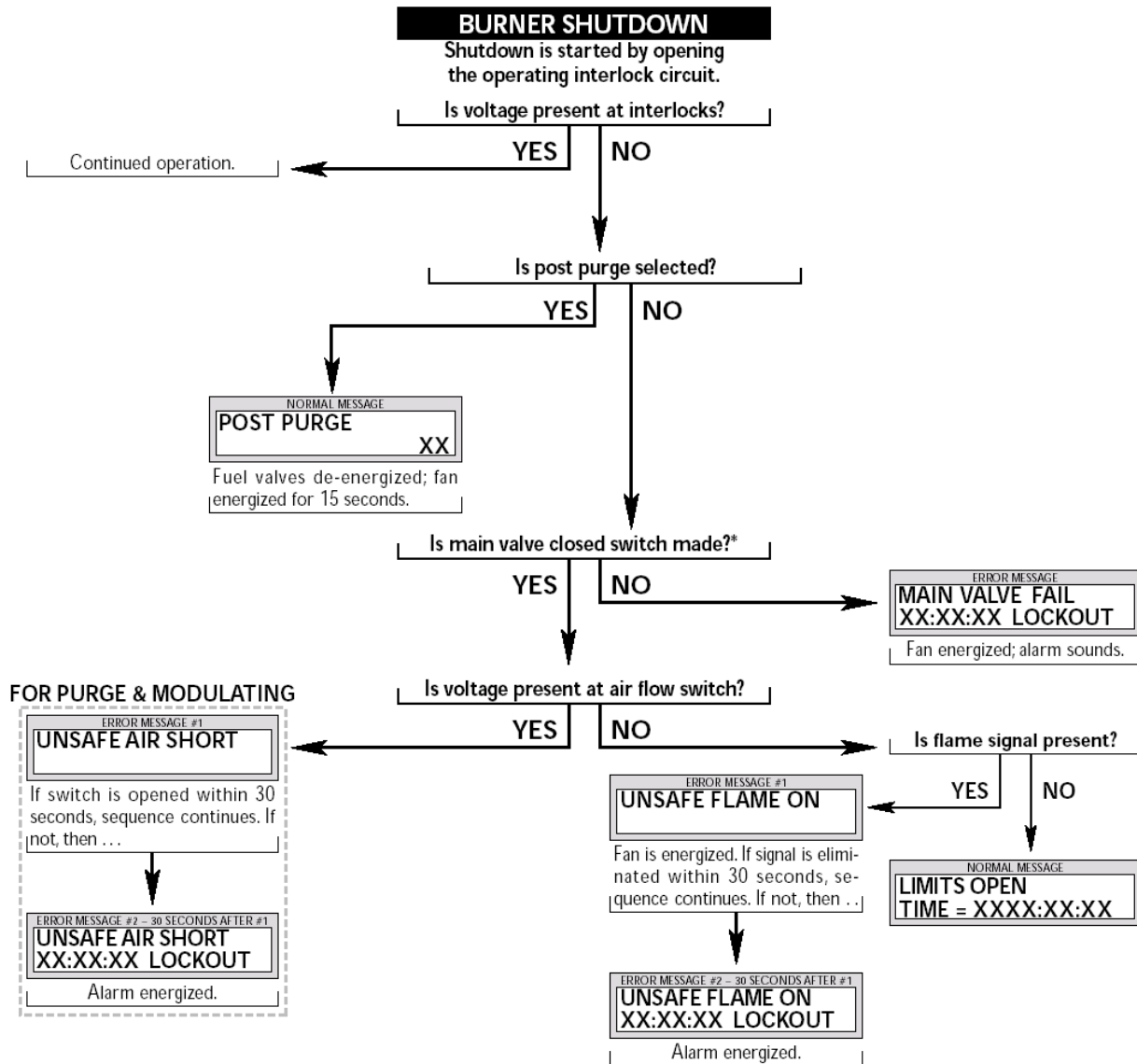




**FIGURE 8 – 3 MAIN FIRING**



**FIGURE 8 – 4 SHUTDOWN**



\* Applies to purge and no purge models only.

<b>REMOTE DISPLAY MESSAGE LISTING</b>	<b>EXPLANATION</b>
AIR FAILURE XX:XX:XX LOCKOUT	The airflow switch input has opened for two or more seconds after the initial proving period, resulting in a lockout.
AIR FAILURE RECYCLING	The airflow switch input has opened after running over 35 seconds in main flame. The burner has shut down and the unit is recycling to the start-up sequence.
AIR NOT PROVEN XX:XX:XX LOCKOUT	The airflow switch input to terminal 6 has not made within ten seconds of the fan output on terminal 8, resulting in lockout.
AIR PROVEN	The airflow switch to terminal 6 has made.
AUTOMATIC MODULATION	The unit no longer controls the damper or modulating motor and enables automatic control by an external controller.
BURNER ON XX.XV TIME=XXXX:XX:XX	The main flame is on and the flame signal is displayed along with the elapsed time in hours:minutes:seconds.
CLOCK FAIL XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
FAN ENERGIZED	Unit has energized terminal 8 just before the purge delay.
FLAME FAILURE XX:XX:XX LOCKOUT	The flame signal was lost resulting in a lockout condition.
HI DAMPER FAIL XX:XX:XX LOCKOUT	The high purge position switch or main valve closed switch input to terminal D was not made during the high purge sequence resulting in a lockout condition.
INTERNAL FAULT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
K-INTERNAL FAULT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
LIMITS OPEN TIME=XXXX:XX:XX	The control has completed its internal safe start check and is standing by for the interlocks to close.
L-INTERNAL FAULT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
LKOUT= XX:XX:XX	Unit is in a lockout condition, shown with the time of lockout.
LOW FIRE FAIL XX:XX:XX LOCKOUT	The low fire switch was not made before trial for ignition, resulting in a lockout condition.
MAIN FLAME FAIL XX:XX:XX LOCKOUT	The main flame signal was lost during the main flame proving period.
MAIN FLAME FAIL	The main flame signal was lost after the required 35

RECYCLING	seconds, and will recycle back to the start-up sequence.
MAIN ON	The main output has energized and the flame proven.
MAIN ON PILOT OFF	The pilot output has de-energized (interrupted) and the main output is on.
MAIN VALVE FAIL XX:XX:XX LOCKOUT	The main valve closed switch was open before start-up or after shut-down.
MISSING HZ XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
PILOT TEST	Control is in the Pilot Test Mode.
POST PURGE	The fan output remains energized after burner shutdown for this timed sequence.
PURGE IN PROGRESS	The fan output is energized and the purge sequence is timing.
PURGE TO HIGH FIRE	The modulation model's first purge sequence has started to drive the damper to the high position for full airflow.
PURGE TO LOW FIRE	The modulation's second purge sequence has started to drive the damper to the low position before trial for ignition.
PUSH RESET TO START	Unit has the manual start option that requires pushing the test/reset button in/out to start after a power interruption.
RAM FAIL XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
RELAY FAIL XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
ROM FAIL XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
SAFE START OK v2.0 CS=	Control has performed and passed internal safe start check. The version and software check-sum are displayed.
S-FAILURE-COMMS XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
S-FAILURE-HDWARE	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
S-FAILURE-IGNIT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
S-FAILURE-MAIN XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
S-FAILURE-PILOT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.

S-FAILURE-PURGE XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
TEST	Control is in the Pilot Test Mode.
TFI FLAME FAIL XX:XX:XX LOCKOUT	Flame was not detected by the end of the trial for ignition, resulting in a lockout condition.
TIME=	Shows the elapsed time since interlocks have completed.
TRIAL FOR IGNITION	Control is starting the trial for ignition sequence.
UNSAFE AIR SHORT	The combustion air switch input is made before the fan output on start-up or after the fan output turns off on shut-down. If the switch opens within 30 seconds the control restores normal operation. The unit will go to a lockout condition if the condition lasts over 30 seconds.
UNSAFE AIR SHORT XX:XX:XX LOCKOUT	The above inappropriate combustion air switch input did not open within 30 seconds, resulting in a lockout condition.
UNSAFE FLAME ON	Unit has detected an inappropriate flame signal (actual, induced, or faulty scanner) before start-up or after shutdown. The fan output will energize and will go to a lockout condition if the condition lasts over 30 seconds. If the cause is corrected within 30 seconds, the control turns off the fan and restores normal operation.
UNSAFE FLAME ON XX:XX:XX LOCKOUT	An inappropriate flame signal lasted longer than 30 seconds, resulting in a lockout condition.
UNSAFE-FLM-PURGE	Unit has detected an inappropriate flame signal (actual, induced, or faulty scanner) during the purge sequence. If the cause is corrected within 30 seconds, the unit will continue sequence; otherwise it will go to a lockout condition.
VALVE ON IGNITION OFF	Control has completed trial for ignition time and is currently in the flame proving sequence.
VALVE ON IGNITION ON	Control is in the trial for ignition sequence.
VERIFLAME 2.0 REVISION #	Normal display of the version and revision screen.
V-INTERNAL FAULT XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.
WATCHDOG FAIL XX:XX:XX LOCKOUT	Internal component may have failed; remove power and retry. If message repeats, then replace controller.



# Appendix

# 9

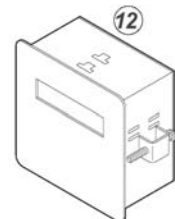
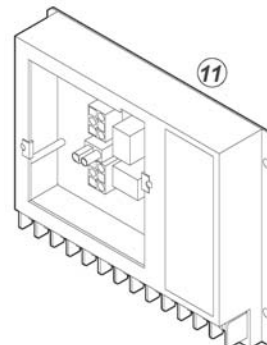
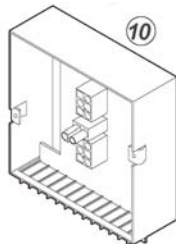
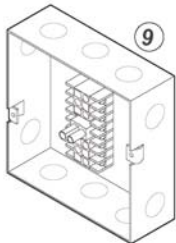
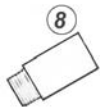
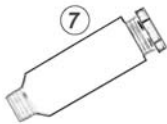
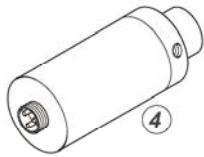
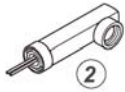
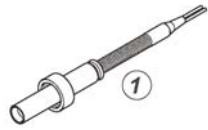
**PRODUCT MODEL  
NUMBER GUIDE**

Make one selection each from Tables I through VIII								
Model	I	II	III	IV	V	VI	VII	VIII
<b>VF56</b>	—	—	—	—	—	—	—	—

TABLE	DESCRIPTION	SELECTION
<b>TABLE I</b> POWER SUPPLY	102-132VAC, 50/60Hz	1
	204-264VAC, 50/60Hz	2
<b>TABLE II</b> SEQUENCE	No-Purge *	N
	Purge	P
	Modulation **	M
<b>TABLE III</b> FLAME FAIL RESPONSE	UV Scanner with 1 second FFRT	1 U
	Flame-rod with 1 second FFRT	1 F
	UV Scanner with 3 second FFRT	3 U
	Flame-rod with 3 second FFRT	3 F
<b>TABLE IV</b> PURGE TIME	Enter TIME in seconds, 0 – 999 * For No-Purge Sequence selection “N”, enter 00; ** For Modulation Sequence “M”, the time is applied to both the high and low cycles, effectively doubling the specified time.	---
<b>TABLE V</b> IGNITION TRIAL	Enter TIME in seconds, 1 – 15	--
<b>TABLE VI</b> PILOT TIME	Enter INTERRUPTED TIME in seconds, 0 – 99 To specify INTERMITTENT pilot, enter 00.	--
<b>TABLE VII</b> POST-PURGE	Enter TIME in seconds, 0 – 99 For no post-purge, enter 00.	--
<b>TABLE VIII</b> RECYCLE	Standard no Recycle	0__
	Recycle	R__
AIR SWITCH	Standard, alarm if switch not made in 10s. Sequence hold until switch makes	_0_ H
RESET	Standard automatic reset on power up	--0
	Manual push button to start on power up	B

## ILLUSTRATED PARTS LIST

CATEGORY	FIG	DESCRIPTION	MODEL NUMBER	PART NUMBER
Sensors	1	Straight UV Scanner	5600-91	49600-91
	2	90 Degree UV Scanner	5600-90A	49600-90
	4	Self-Check UV Scanner	5602-91	49602-91
	-	10-foot Cable for Self-Check UV Scanner	5602-91-7	49602-91-7
	5	Sealed Straight UV Scanner	5600-91N4	20898
	6	Scanner Support Lens Assembly, used with 5600-90A and 5600-91N4	5600-90A-SSH	20722
	7	Magnifying Lens Assembly	5600-98	49600-98
	-	Lens, Magnifying, used with 5600-98 and 5602-91	49600-99	49600-99
	-	Lens, Non-magnifying	18165	18165
	8	Insulated Coupling	5600-99	49099
	-	Cable, coax, RG62A/U for flame rod	21741	21741
	Bases	9	Internal Terminal Base, Metal	5602-10
9		Internal Terminal Base, Plastic	5602-10 P	22194
10		External Terminal Base, Metal	5602-10-1	49602-10-1
11		Modulation Base, Metal	5602-40	49602-40
-		Screw, Mount Control Unit to Plastic Base	22110	22110
-		Screw, Mount Control Unit to Metal Base	22385	22385
Tester	-	Tester for VeriFlame	5602	49602
	-	Relay Module, plugs into above tester for use with modulation models	5602-40-4	49240-2
Display	12	Remote Display, 24VDC	5602-DB	20316
	-	Remote Display, 120VAC with Keypad	5602-DBP	20896
	-	Power Supply, 24VDC, used with 5602-DB	20317	20317
	-	Cable for Remote Display	20318	20318





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