FIREYE®
MB SERIES
MULTI-BURNER CONTROL

DESCRIPTION

The Fireye Multi-Burner Monitoring System controls the start-up sequence and monitors the flame of up to 20 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. Exclusive to the unit is its ability to specifically identify which burner caused the initial flame failure.

The Fireye Multi-Burner Control Monitoring System is a fully integrated control designed for the industrial process market (ovens and furnaces). It meets the operational requirements and safety standards pertaining to the industrial process market and offers many advantages over other systems.

The Fireye Multi-Burner Control System is complete with all functions built into one module, offering the opportunity to greatly reduce cost and space requirements normally required by other non-integrated systems. Plug-in flame sensor modules that can sense UV, UV Self-Check and/or flame rod provide for easy replacement on an individual basis. Start up time is reduced through the use of on board DIP switches that allow quick configuration to meet application requirements.

The MB-600S, by itself, provides for 4 plug-in flame sensor modules. Expansion modules are available that can be easily attached to the MB-600S allowing for a system configuration up to 20 burners. Upon startup, the MB-600S interrogates the expansion modules to learn the number of flame sensor modules installed. Refer to the system diagram shown in Fig. 4.

The microcomputer based system features a plug-in modular design so any of the modules attached to the motherboard can be replaced by shutting down the Multi-Burner Control or the monitored burners. 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 (US and Canada) and FM approved.

MBSERIES SPECIFICATIONS

PARAMETER	DESCRIPTION		
SUPPLY VOLTAGE	120 VAC (+10%, -15%), 50/60 Hz		
POWER COMSUMPTION	25 VA		
TEMPERATURE RANGE	UNIT	MODEL NO	TEMPERATURE RANGE
	MULTI-BURNER	MB-600S	-40° TO +60°C (-40° TO +140°F)
	FLAME SENSOR	MB-600PF	-40° TO +60°C (-40° TO +140°F)
	REMOTE DISPLAY	MB510	0° TO +50°C (-32° TO +122°F)
	UV SCANNER	UV7A4	-40° TO +125°C (-40° TO +257°F)
	90° UV SCANNER	UV7R4	-40° TO +60°C (-40° TO +140°F)
	SELF-CHECK UV	UV7SC	-40° TO +60°C (-40° TO +140°F)
FLAME FAILURE RESPONSE	3 SECONDS (+/-) 0.5 SECONDS)		
PILOT TRIAL FOR IGNITION	5, 10 OR 15 SECOND SELECTABLE		
PILOT PROVING TIME	5 SECONDS		
MAIN TRIAL FOR IGNITION	FOLLOWS PILOT TRIAL FOR IGNITION SELECTION		
PURGE TIME	PURGE: SELECTABLE 0-225 SEC., 15 SEC. INCREMENTS WITH X4 0-15 MIN., 1 MIN. INCREMENTS EXTENDED: SELECTABLE 0-15 MIN., 1 MIN. INCREMENTS WITH X4 0-60 MIN., 4 MIN. INCREMENTS		
CONTACT RATINGS AT 120VAC (MAXIMUM TOTAL CONNECTED LOAD NOT TO EXCEED 15 AMPS	FUNCTION	AFFECTED TERMINALS	INDUCTION LOAD	RESISTIVE LOAD
	FAN MOTOR	J2-3	1/2 HP	15 AMPS
	VALVE RELAYS	J2-4 THROUGH J2-6	1/3 HP	10 AMPS
	LEAK DETECT	J2-7	1/3 HP	10 AMPS
	ALARM RELAY	J2-8	1/3 HP	10 AMPS
	MODULATION	J3-1 THROUGH J3-4	1/3 HP	10 AMPS
APPROVALS	UL RECOGNIZED, US and CANADA (FILE MP1537)		
	FM APPROVED (FILE 3013812)		
SHIPPING WEIGHT	7 KILOGRAMS (15 IBS.)		

ELECTRICAL RATINGS

VA ratings (not specified as pilot duty) permit the connection of transformers and similar devices whose inrush current is approximately the same as their running current.

VA Pilot Duty ratings permit the connection of relays, solenoid valves, lamps, etc. whose total operating load does not exceed the published rating and whose total inrush current does not exceed 10 times the rating.

Running and locked rotor ratings are intended for motors. VA and VA Pilot Duty loads may be added to a motor load provided the total load does not exceed the published rating.

> ⚠ **CAUTION: Published load ratings assume that no contact be required to handle inrush current more often than once in 15 seconds. The use of control switches, solenoid, relays, etc. which chatter will lead to premature failure. It is important to run through a test operation (with fuel shut off) following the tripping of a circuit breaker, a blown fuse, or any known instance of chattering of any external current consuming devices.**

DIMENSION INFORMATION:

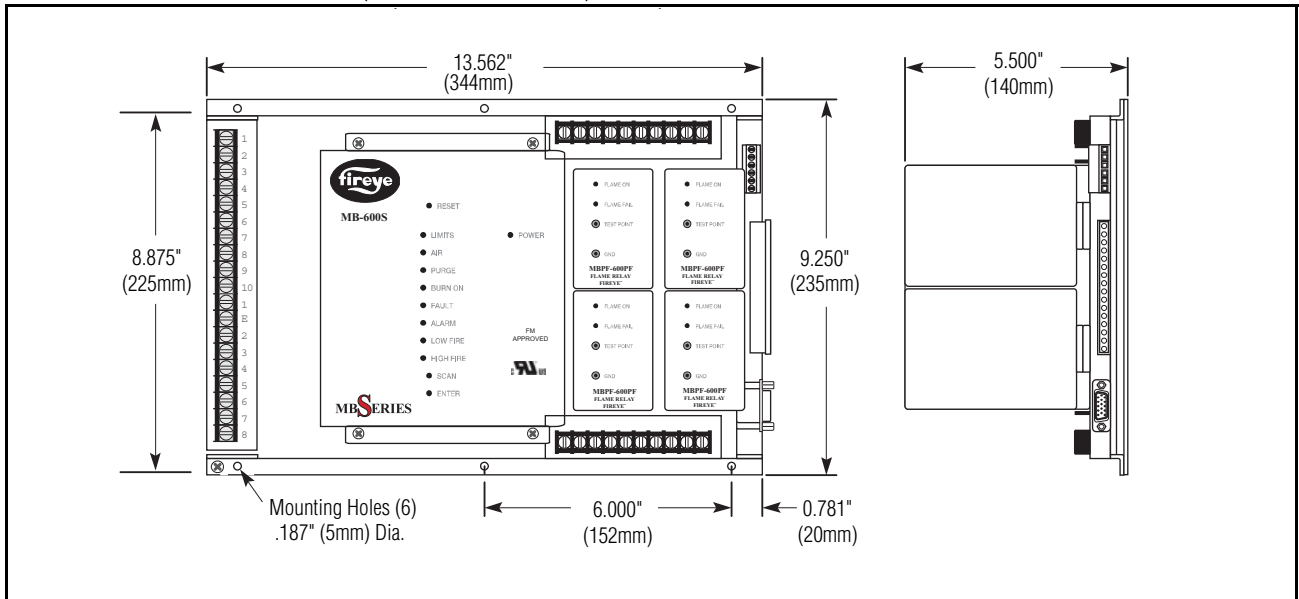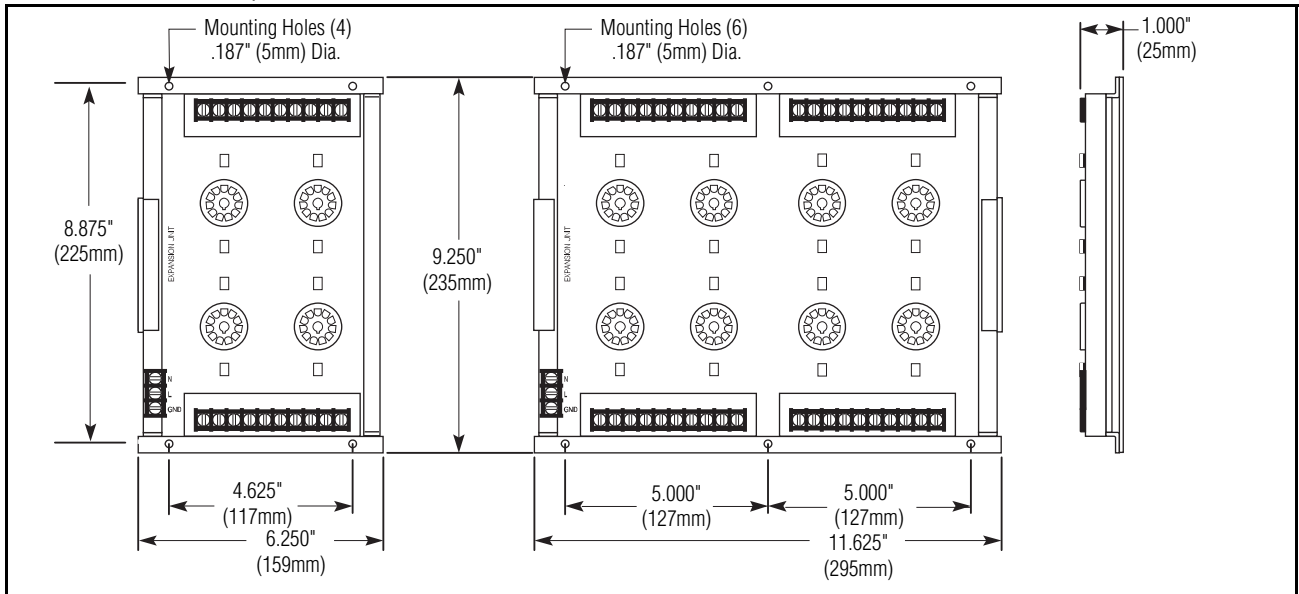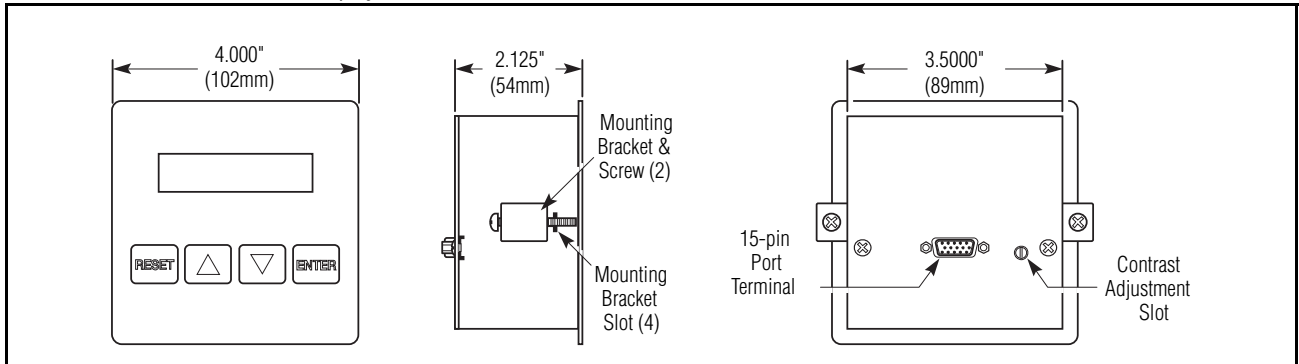**FIGURE 1.** Main Chassis (for two to four burners)

FIGURE 2. Expansion Boards

FIGURE 3. Remote Display

MBSERIES ORDERING INFORMATION

| ITEM	PART NUMBER	DESCRIPTION	BULLETIN
1	MB-600S	MULTI-BURNER CONTROL SYSTEM, 120VAC, 50/60 HZ CONSISTING OF MOTHER BOARD (MB-600M), RELAY BOARD (MB-600R), LOGIC MODULE (MB-600L), AND POWER MODULE (MB-600P), CONTAINS 4 AUXILIARY INPUTS, PURGE MODULATION, VALVE LEAK TESTING	MB-6001
1	MB-632S	SAME AS MB-600S EXCEPT MOTHERBOARD IS MB-632M FOR RS-232 COMMUNICATIONS	
1	MB-685S	SAME AS MB-600S EXCEPT MOTHERBOARD IS MB-685M FOR RS-485 COMMUNICATIONS	
1	MB-600M	REPLACEMENT MODULE, MOTHERBOARD	
2	MB-600R	REPLACEMENT MODULE, RELAY	
3	MB-600L	REPLACEMENT MODULE, LOGIC	
4	MB-600P	REPLACEMENT MODULE, POWER SUPPLY	
5	MB-600PF	PLUG-IN FLAME SENSOR MODULE, UV/FR, PLASTIC CASE WITH MOUNTING SCREWS FOR EXPANSION BOARDS	MBPF-1000
7	MB-604E	EXPANSION BOARD (FOR UP TO 4 BURNERS)	MB-6048
8	MB-608E	EXPANSION BOARD (FOR UP TO 8 BURNERS)	MB-6048
9	59-506-1	152mm (6in) CABLE FOR EXPANSION BOARD	MB-6048
9	59-506-3	914mm (36in) CABLE FOR EXPANSION BOARD	MB-6048
10	59-507-6	CABLE, 6 ft (1830mm) REMOTE DISPLAY	MB-5101
10	59-507-10	CABLE, 10 ft (3050mm) REMOTE DISPLAY	MB-5101
11	MB510	REMOTE DISPLAY WITH KEYPAD	MB-5101

FIGURE 4.
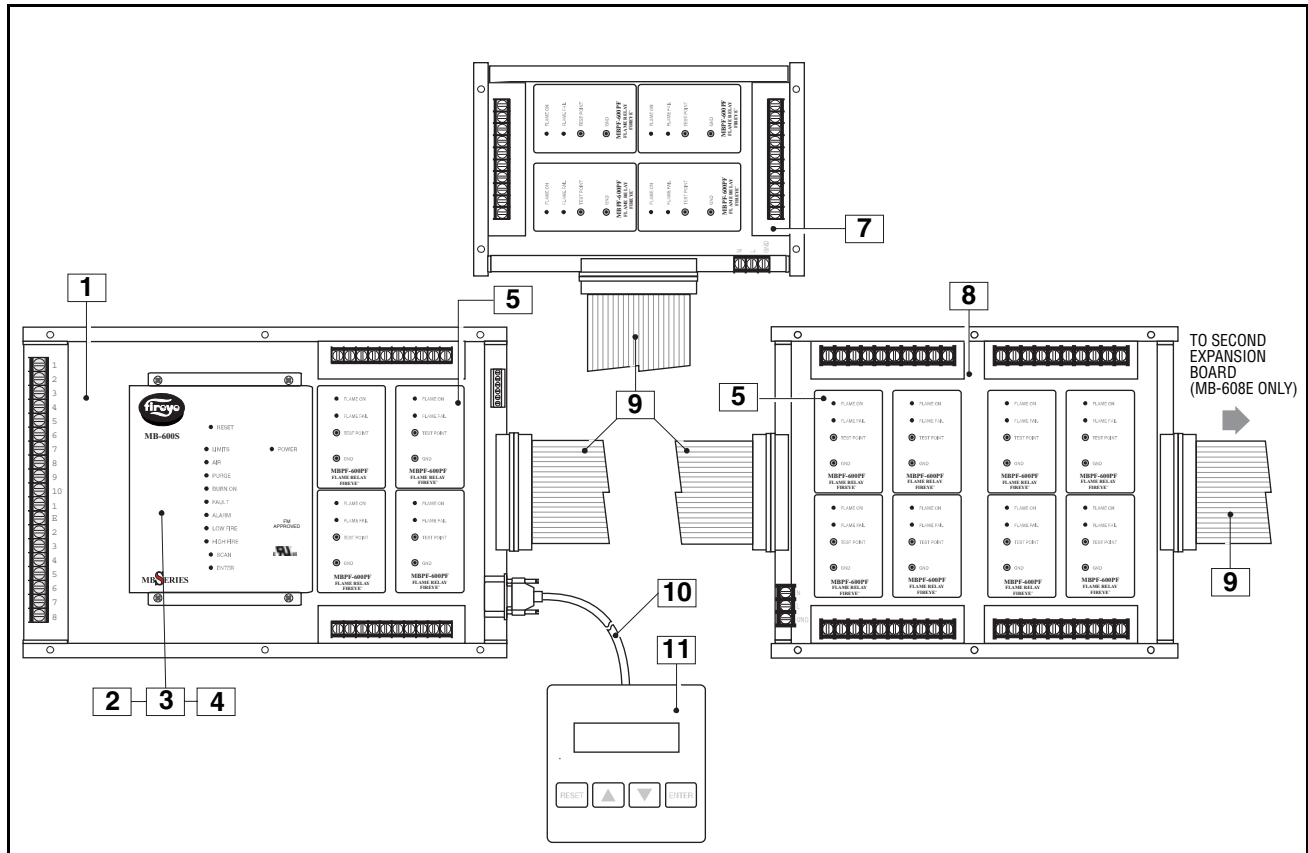
PRODUCT DESCRIPTION

The Fireye Multi-Burner Control System consists of a motherboard and 3 plug in modules. These modules are located under the cover attached to the motherboard by 4 type #6-32 X 1/2 in screws. It will be necessary to remove the cover to access the dip switches located on the logic module.

Relay Module (MB-600R)

The relay module contains the output relays which provide power for operating the ignition coil, pilot valve, main valve, combustion fan and alarm. This module is mounted in the first position on the left of the motherboard closest to the output terminals.

COVER RETAINING SCREWS

RELAY MODULE   LOGIC MODULE   POWER MODULE
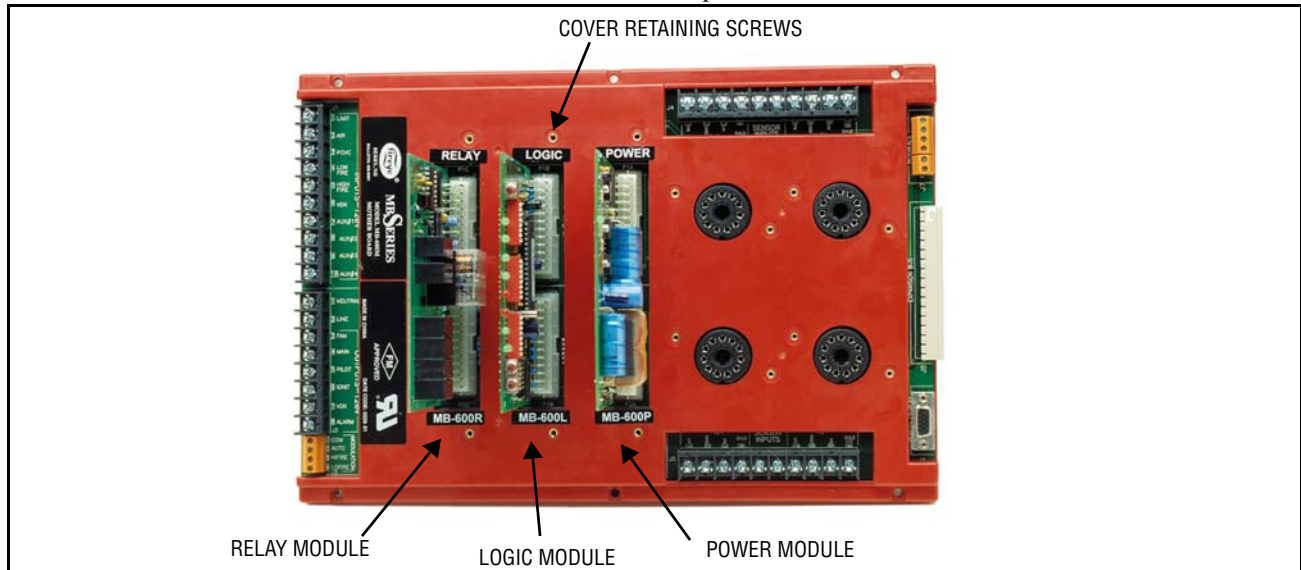
Logic Module (MB-600L)

The logic module houses the microcomputer which provides all the sequential logic and safety start-up and shutdown circuitry. DIP switches are provided to allow for sequence and timing functions as well as system configuration. On the front of this module is the reset, scan and enter push-buttons, and status lights. This module is mounted in the second position from the left of the motherboard next to the relay module.

Power Module (MB-600P)

The power module supplies the power required for the electronic circuitry. It is mounted in the motherboard to the right of the logic module. The green LED on the front indicates that power is on to the Multi-Burner Control.
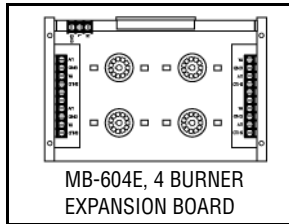
Flame Sensor Module

The Fireye MB-600PF is the flame sensing module of the Multi-Burner Control. One MB-600PF is required for each burner in the system. The MB-600PF modules are installed into the motherboard by carefully inserting them into the round 11-pin sockets.

Each MB-600PF is equipped with 2 X 4-40 x 1/2 in. external mounting screws for securing into the motherboard. On the front of the MB-600PF module is a "Flame On" LED, illuminates when a flame is detected at the corresponding burner. Directly below the "Flame ON" LED is a "Flame Fail" LED, which illuminates on flame failure on a first-out basis, minimizing downtime. The MB-600PF

incorporates test point and ground (GND) connection jacks in the front of the unit. Using these, the flame signal strength of each burner can be measured using a 0-15 VDC, one megohm/volt meter.
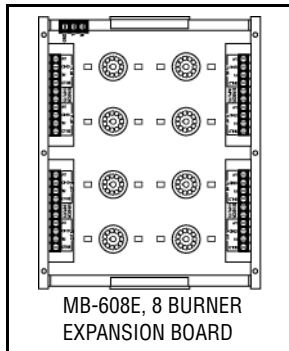
Expansion Module

MB-604E, 4 BURNER EXPANSION BOARD

The expansion board contains the mounting sockets and connection terminals for adding additional MB-600PF flame sensing modules, which is needed for systems having more than four burners.

There are two expansion boards available: one for adding up to four more burners (MB-604E) and one for adding up to eight more burners (MB-608E). For systems monitoring 13 to 20 burners, two of the expansion boards for up to eight more burners are used.

The four burner expansion board CANNOT be used in conjunction with the eight burner expansion board.

MB-608E, 8 BURNER EXPANSION BOARD

A cable, P/N 59-506-1 or 59-506-3, connects either expansion board to the motherboard (J8 on the motherboard to J2 on the expansion board). For greater than 13 burners, two 8 module expansion boards are daisy chained together (J7 on one expansion board to J2 on the other expansion board); see page 16 for terminal strips identification and location.

Remote Display

The MB510 remote display provides alphanumeric messages which indicate burner status as well as annunciate lockout condition in the Multi-Burner Control System. The MB510 also contains a keypad used to provide remote reset and access to lockout history

A cable connects the remote display to the motherboard; this cable is available in 6 feet, 59-507-6 and 10 feet, 59-507-10, lengths.

DIP Switch Selection

The Fireye Multi-Burner Control DIP switches allow for sequence and timing functions as well as system configuration.

DIP Switch Selection

The Fireye Multi-Burner Control Monitoring System provides a series of dip switches that allow for sequence and timing functions that assist in configuring the system to meet the application requirement.

> ⚠ **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.**

The DIP switches are located on the logic module, which is mounted in the second position from the left on the motherboard next to the relay module.

To gain access to the DIP switches, the cover of the logic module must be removed. To do this, remove the four screws which hold the cover onto the motherboard. Then gently pull the logic module towards you to disengage the logic module from its mating connector. Located on the outside of the cover is a label describing the function of the DIP switches.
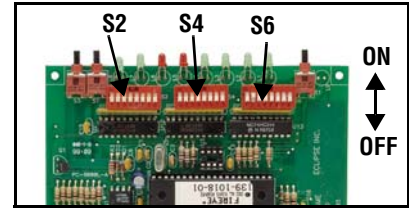
For all dip switches, the ON position is toward the top of the logic board.

⚠️ **WARNING: THE INAPPROPRIATE SELECTION OF DIPSWITCHES COULD RESULT IN AN UNSAFE CONDITION HAZARDOUS TO LIFE AND PROPERTY. Changing the dipswitches modifies the operation of the Multi-Burner Control System. Care should be taken to insure the proper dipswitch settings. Setting the dipswitches for a particular application should be made by a competent professional, such as a Boiler/Burner technician licensed by a state or government agency, engineering personnel of the burner, boiler or furnace manufacturer (OEM) or in the performance of duties based on the information from the OEM.**

S2 DIP Switches

The S2 DIP switches permit programming of timing and sequence functions of the Fireye Multi-Burner Control System.

SW POS	S2 DIP SWITCH POSITION			
	PURGE TIME **SW8 OF S4 = ON**		**EXTENDED PURGE TIME** **SW8 OF S4 = OFF**	
8	**ON**	**OFF**	**ON**	**OFF**
	OFF TO SELECT	**OFF TO SELECT**	**OFF TO SELECT**	**OFF TO SELECT**
7	120 SEC.	8 MINUTES	8 MINUTES	32 MINUTES
6	60 SEC.	4 MINUTES	4 MINUTES	16 MINUTES
5	30 SEC.	2 MINUTES	2 MINUTES	8 MINUTES
4	15 SEC.	1 MINUTE	1 MINUTE	4 MINUTES
	PURGE TIMES ARE ADDITIVE **CAUTION: PURGE TIME IS 0 IF SW4 TO SW8 SET TO ON** **PURGE TIME IS MAXIMUM IF SW4 TO SW8 SET TO OFF**			
3	SEE TFI TIMING CHART			
2	INTERMITTENT PILOT		INTERRUPTED PILOT	
1	RECYCLING		NON-RECYCLING	
POS	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: Pilot Trial for Ignition range selection; see table for proper selection.

SW4 through SW8: Purge time selection (switch settings are additive); see table for exact times.

S4 DIP Switches

SW1 determines fan motor operation:

    OFF = Fan motor remains energized after flame fail

    ON = Fan motor de-energizes with flame fail after 15 second post purge

SW8 determines operational mode:

    ON = PURGE TIME

    OFF =EXTENDED PURGE TIME

SW7 of the S4 DIP switches is used; along with **SW3** of DIP switch S2. TFI timings as shown in table below.

REQUIRED TFI (Sec.)	SW3 OF S2	SW7 OF S4
5	OFF	OFF
10	OFF	ON
15	ON	OFF

SETTING PURGE TIME = 5 MINUTES

METHOD 1
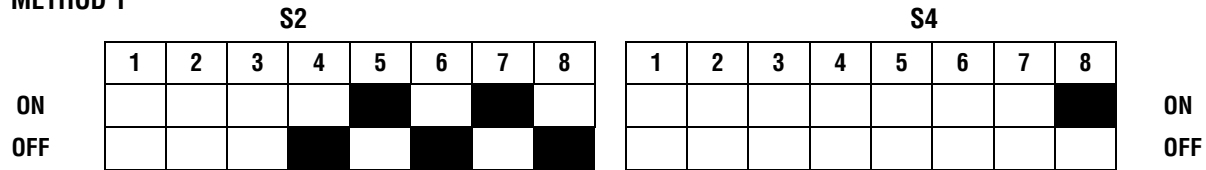
METHOD 2
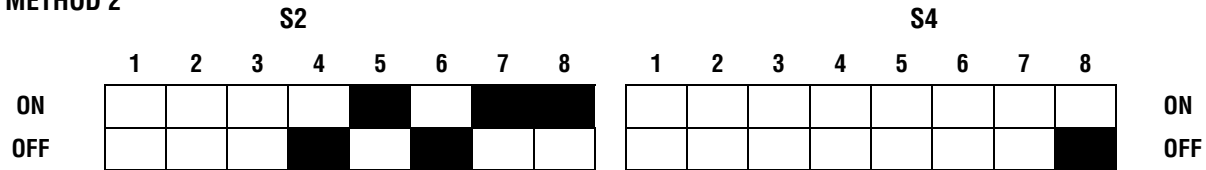
Example:

Set 5 minute purge

METHOD 1		METHOD 2	
S4	SW8 = ON	S4	SW8 = OFF
S2	SW8 = OFF	S2	SW8 = ON
S2	SW7 = ON	S2	SW7 = ON
S2	SW6 = OFF	S2	SW6 = OFF
S2	SW5 = ON	S2	SW5 = ON
S2	SW4 = OFF	S2	SW4 = OFF

S6 Dip Switches

The S6 DIP switches permit selection of the number of burners in the system. The setting of S6 should equal the amount of MB-600PF flame sensing modules connected.

NO. OF BURNERS	SW1	SW2	SW3	SW4	SW5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON

SW6 OF S6 IS NOT USED
SW7 OF S6 MUST BE ON WHEN 8 BURNER EXPANSION BOARD(S) (MB-608E) IS (ARE) USED
SW8 OF S6 IS USED FOR AC LINE FREQUENCY SELECTION: OFF = 60 HZ; 0N = 50 HZ

FACTORY SETTINGS:
PILOT: INTERRUPTED
TFI: 10 SEC.
OPERATIONAL MODE = MODULATION
MODULATION PURGE TIME: 30 SECONDS
NON-RECYCLING
BURNERS SELECTED = 4
AC LINE FREQUNCY: 60 HZ

Note: On burner startup, the Multi-Burner Control units sends a test pulse to all available flame sensor locations and the number of units found must equal to the number configured. If not, a lock-out alarm will occur.

FUNCTION SUMMARY

Combustion Air Flow Check Terminal

The Multi-Burner Control 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 jumped.

Main Fuel Valve Proof-of-Closure Terminal

The Multi-Burner Control 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

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 Multi-Burner Control 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 Multi-Burner Control 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 Multi-Burner Control 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 7). 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 and Main Flame Separation

During the trial for ignition period (TFI), the pilot valve and ignition coil remain 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 to begin the main trial for ignition. The times selected with SW3 of S2 and SW7 of S4 apply to both pilot and main trial for ignition.

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 all burners will shut down. The failed burner will be indicated by the red "Flame Fail" light on the corresponding flame sensor, MB-600PF.

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 flame sensing modules installed (MB-600PF or MBPF-100S) does not match the number selected on the DIP switches (see "S6 DIP Switch Settings" on page 9).

6. Relay fail–failure of Multi-Burner Control 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 7).

11. Wiring error which puts external voltage on any of the output terminals.

12. Welded internal contacts or other malfunctions in the Multi-Burner Control.

13. Auxiliary input fail–loss of input voltage to any of the four "AUX" terminals after the limit input is made.

14. A system fault condition that lasts longer than 30 seconds.

Extended Features

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 start check into the purge sequence. This feature allows the Multi-Burner Control 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 purge time is selectable by means of S2 DIP switches on the logic board (see "S2 DIP Switch Settings" on page 7):

The modulation terminals on J3 terminal strip will sequence as follows:

Sequence Step Internal Contact Connections - see page 19

High Fire Purge.......................... J3,T1 (COMMON) to J3, T3 (HI FIRE)

Low Fire Start............................J3,T1 (COMMON) to J3,T4 (LOW FIRE)

Automatic...................................J3,T1 (COMMON) to J3,T2 (AUTO)

Power Off...................................J3,T1 (COMMON) to J3,T2 (AUTO)

Power On/Limits Off................J3,T1 (COMMON) to J3,T4 (LOW FIRE)

Alarm...J3,T1 (COMMON) to J3,T4 (LOW FIRE)

The Automatic step occurs when the burners are operating and allows the burner firing rate to be controlled by an automatic temperature controller.

Auxiliary Inputs with History Log

This feature provides four auxiliary inputs which are monitored by the Multi-Burner Control 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.

Once activated, a voltage of 120 VAC must be present at the input for the Multi-Burner Control 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 Multi- 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 HH:MM:SS LOCKOUT	AUX.LIM#2 FAIL HH:MM:SS LOCKOUT	AUX.LIM#3 FAIL HH:MM:SS LOCKOUT	AUX.LIM#4 FAIL HH:MM:SS LOCKOUT

Unused auxiliary inputs should be connected to 120 VAC.

Valve Leak Sensing Device (VLSD) Interface

The Multi-Burner Control Valve Leak Sensing Device (VLSD) interface is designed for use with a FIREYE MECHANICAL FMTC410, FMTC310, or FMTC210 Valve Leak Detection device (and is suitable for use with other, third party Valve Leak Sensing devices) 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 VLSD.

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 startup and shutdown of the burners.

When the limits close to the Multi-Burner Control, 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

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

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

Remote Display Units

The MB510 Display unit is available with a keypad and keypad allows remote reset and activation of the history log option. The display module is panel mountable and features a liquid crystal display in a 1/4 DIN housing.

The MB510 display module connects to the Multi-Burner Control by a 6 or 10 foot cable.

The MB510 display incorporates the following features:

1. Provides status messages for the Multi-Burner Control 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.

History Log Activation

The history log is only accessible through an optional remote display unit with remote reset, and when the Multi-Burner Control is in a "LOCKOUT" or "LIMITS OPEN" condition. 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 Multi-Burner Control 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 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. 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).
5. Continued pressing and releasing of the ENTER key in less than seven seconds keeps the history log active and repeats the lockout message list; 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. 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.

RS232/RS485 Communication Interfaces

Terminals 5 and 6 on Multi-Burner Control 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 later section for the types of messages sent by the Multi-Burner Control.

The communications protocol is 8 bit, no parity, 1 stop bit and1200 baud. Multi-Burner Control model MB-632S is provided as a RS232 interface. Multi-Burner Control model MB-685S is provided as a RS485 interface.

Transmission of messages from the Multi-Burner out the RS232/RS485 interface is turned ON by default at power up and at the completion of each burner cycle. Transmission of ALL messages out the RS232/RS485 port can be turned OFF for the remainder of the current burner cycle by sending a space character (<SP>=ASCII Hex 20). Messages can be turned back ON by sending a carriage return (<CR>=ASCII Hex 0D) from the terminal.

Sending a CTRL-E (<ENQ>=ASCII Hex 05) access the optional history log. Each transmission of CTRL-E acts like the pressing of the ENTER key from the remote display, causing one of the 10 records to be transmitted. See "History Log Activation" section for additional details.

LOGIC MODULE STATUS LIGHTS & PUSH-BUTTONS

The logic module provides all the sequential logic, and safety startup 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.

LOGIC MODULE

● RESET

● LIMITS

● AIR

● PURGE

● BURN ON

● FAULT

● ALARM

● LOW FIRE

● HIGH FIRE

● SCAN

● ENTER

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").

Air
This LED illuminates when the air switch is closed and power is thereby applied to the air switch input. The Multi-Burner Control also checks this input for an air switch short (see "Combustion Air Flow Check Terminal").

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").

Alarm
This LED illuminates when an alarm condition causes a system lockout (see "System Lockout Conditions").

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

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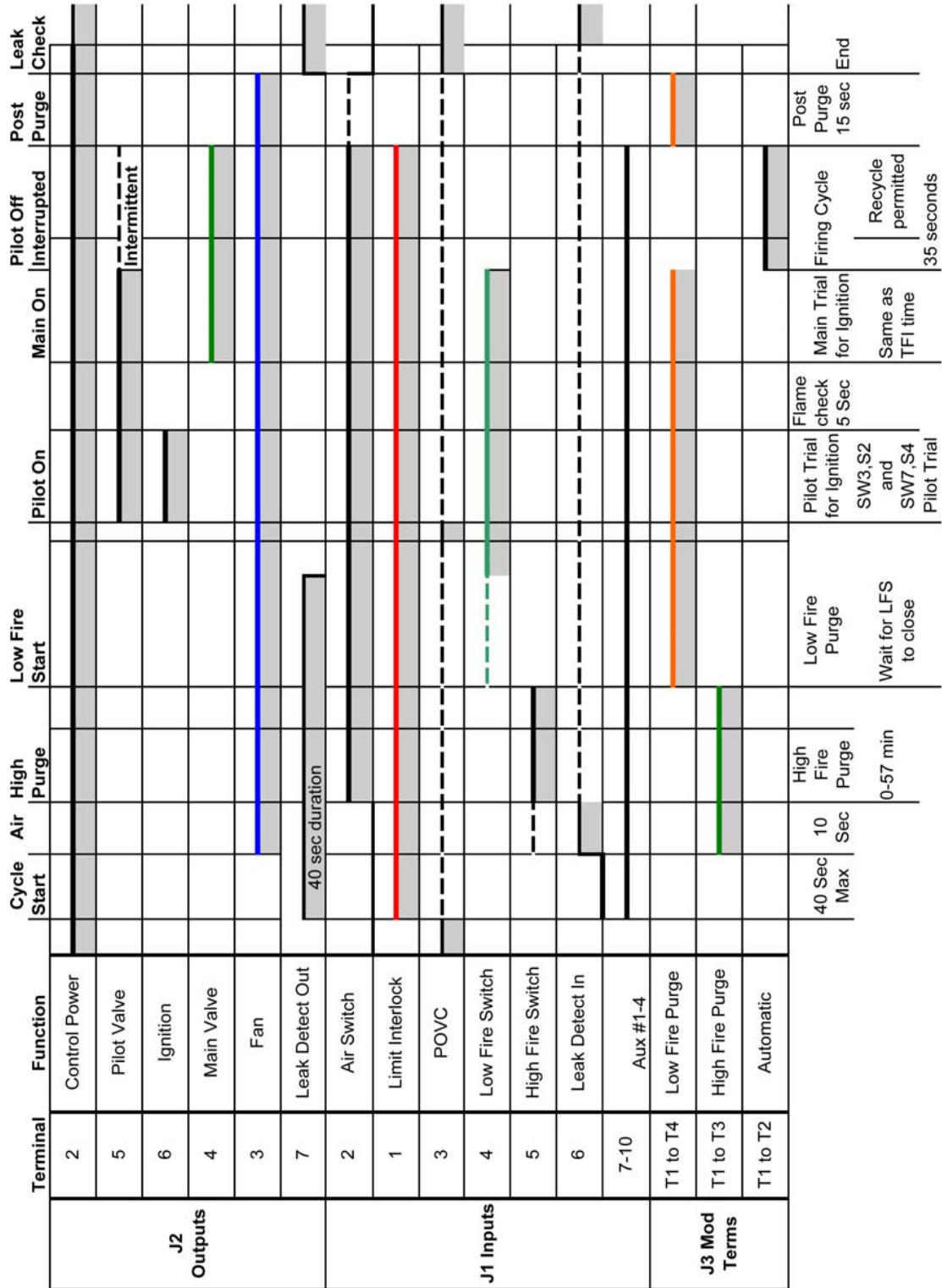This LED illuminates during the high fire period of the purge cycle.

Scan
This push-button is for future use.

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

TIMING SEQUENCE

	Terminal	Function	Cycle Start	Air High Purge	Low Fire Start	Pilot On	Main On	Pilot Off Interrupted / Intermittent	Post Purge	Leak Check
J2 Outputs	2	Control Power								
	5	Pilot Valve						Intermittent		
	6	Ignition								
	4	Main Valve								
	3	Fan								
	7	Leak Detect Out	40 sec duration							
	2	Air Switch								
	1	Limit Interlock								
	3	POVC								
J1 Inputs	4	Low Fire Switch								
	5	High Fire Switch								
	6	Leak Detect In								
	7-10	Aux #1-4								
J3 Mod Terms	T1 to T4	Low Fire Purge								
	T1 to T3	High Fire Purge								
	T1 to T2	Automatic								

Timing notes:
- Cycle Start: 40 Sec Max
- Air: 10 Sec
- High Fire Purge: 0-57 min
- Low Fire Purge: Wait for LFS to close
- Pilot Trial for Ignition: SW3,S2 and SW7,S4 Pilot Trial
- Flame check 5 Sec
- Main Trial for Ignition: Same as TFI time
- Firing Cycle: Recycle permitted 35 seconds
- Post Purge 15 sec

SYSTEM INSTALLATION

In this section, the necessary procedures are detailed to integrate a Multi-Burner Control into a burner system; Figures 5 and 6 illustrate the various terminal strips mentioned followed by suggested wiring diagrams.

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.**

POWER SUPPLY

All input power must be single phase 120 VAC, 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. 120 VAC wiring must be at least 90°C 16 AWG minimum and satisfy all applicable codes.

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 Multi-Burner Control 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 Multi-Burner Control 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.

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.

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 Multi-Burner Control System. Do not connect multiple ignition coils in excess of output relay contact rating.

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.

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.

EXPANSION BOARDS

There are two different expansion boards available: one for up to four additional burners (MB-604E) and one for up to eight additional burners (MB-608E). Either expansion board is mounted on the sub-panel separate from the Multi-Burner Control motherboard. It requires its own power (120 VAC/ 60 Hz) connected to L, N, GND on terminal strip J1 (120 VAC to L, neutral to N and GND to ground).

⚠️ *Note: The four burner expansion board CANNOT be used in conjunction with the eight burner expansion board.*

The connection to the motherboard is made via a cable (59-506-1, -3) which joins two plug connectors at J8 on the motherboard and J2 on the expansion board. The connections between the two plugs are to matching numbers (i.e., pin 1 on J8 connected to pin 1 on J2). The same two-plug connector cable is used in systems for 13 to 20 burners where two expansion boards are linked to the motherboard.

The first expansion board is connected to the motherboard as described above, while J2 of the second expansion board is connected to J7 of the first expansion board. Sensor connections are made to the corresponding flame sensing module at terminals J3 and J4.

REMOTE DISPLAY

When installed, the remote display must be grounded. Panel mounting is through a 1/4 DIN cutout. Use either the 6 or 10 foot cable to connect it to the motherboard.

REMOTE RESET

This feature permits remote mounting of a switch to reset the Multi-Burner Control. To use this feature, a normally **open** remote reset switch must be wired between terminals 1 and 4 of terminal strip J7. When it is depressed or actuated, an internal optically isolated coupler is fired causing the Multi-Burner Control to reset. If neither remote reset nor remote LCD display (MB510) is used, and to improve immunity against possible electrical interface, it is suggested that a jumper be placed between terminals 1 and 4 on terminal strip J7.

⚠️ **The remote reset input 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.**

COMMUNICATION WIRING

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

TERMINAL STRIP IDENTIFICATION AND LOCATION

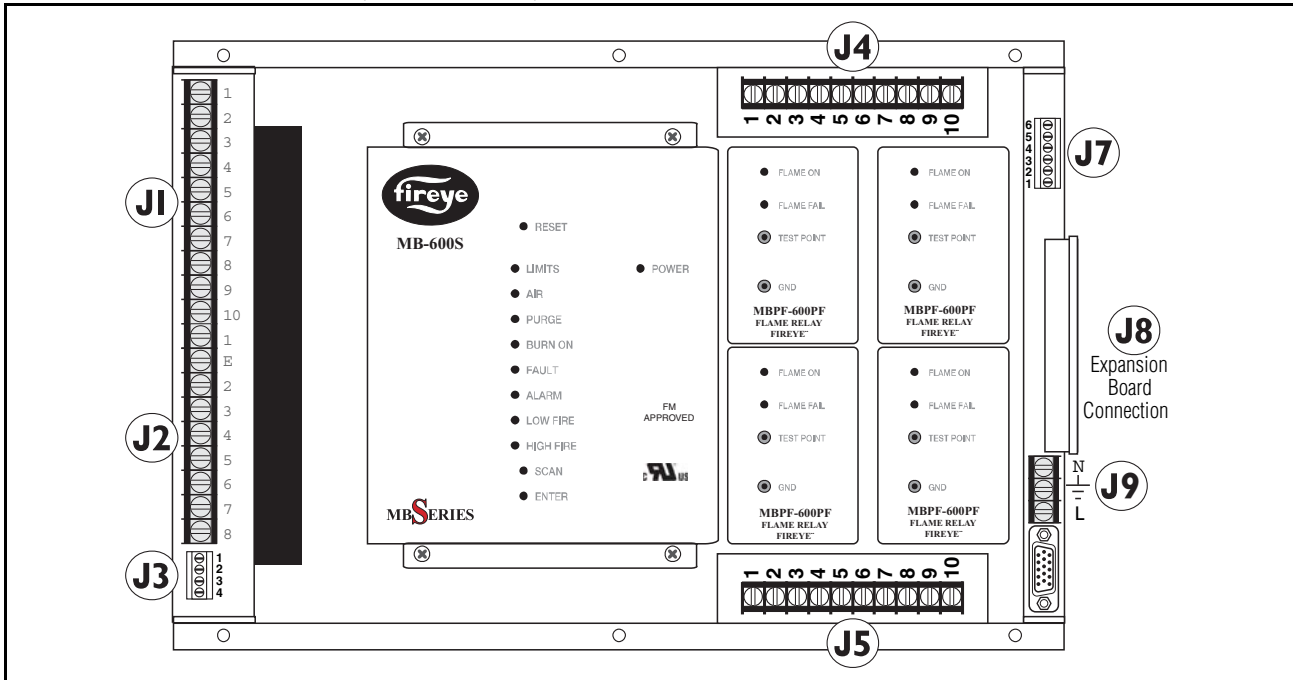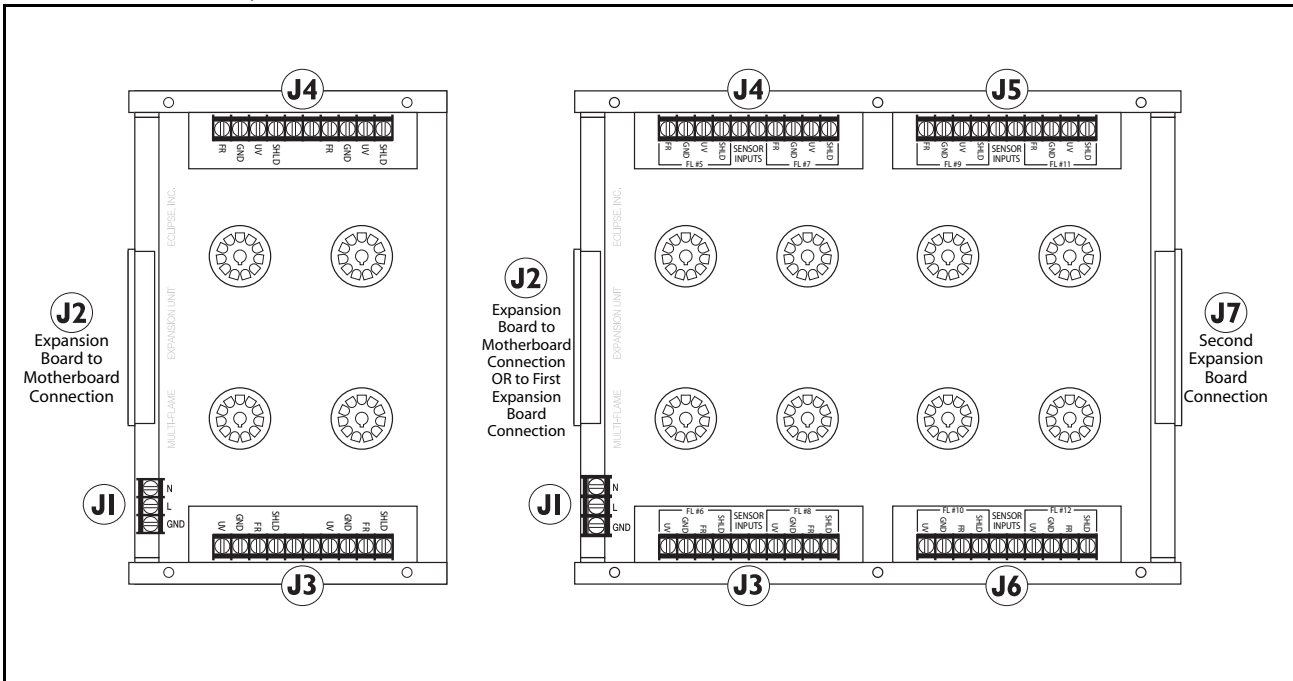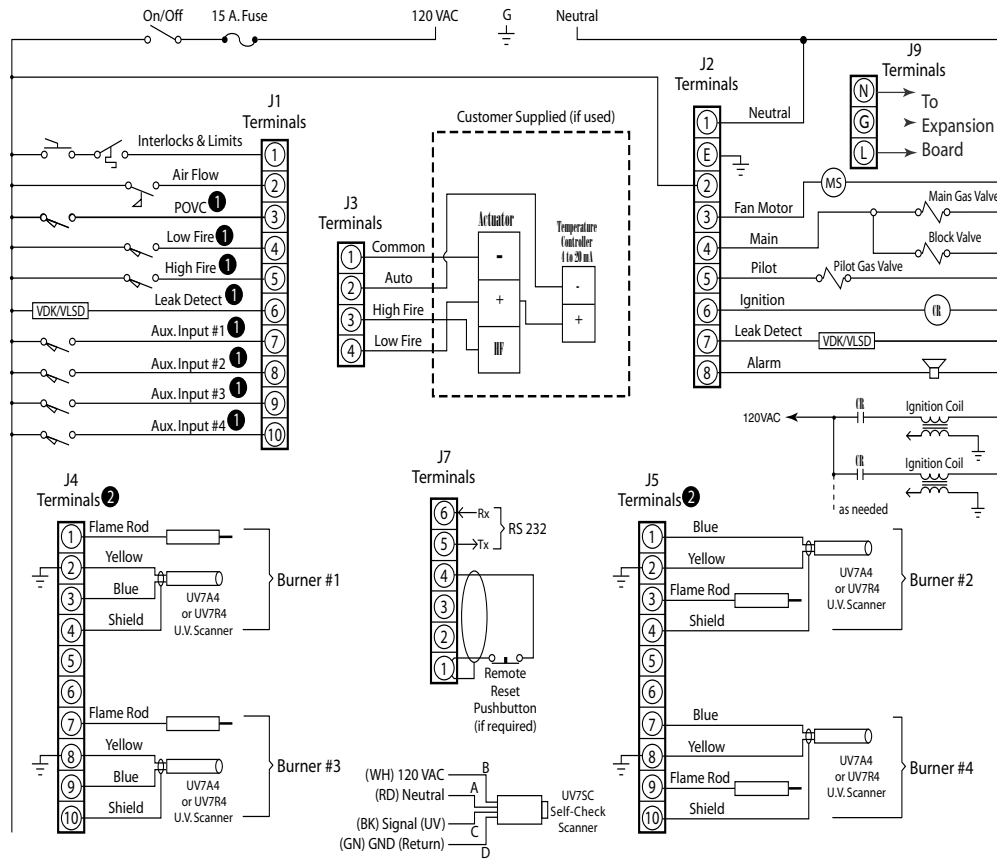**FIGURE 5.** Main Chassis (for 2 to 4 burners)

FIGURE 6. Expansion Boards

WIRING DIAGRAM & CONNECTIONS - MAIN CHASSIS

❶ When not used, must be tied into 120 VAC.

❷ Using both sensors isn't mandatory; you may use a flame rod, or a UV scanner, or both.

❸ Connect all scanner shields together and connect to earth ground.

J1 (Input) Terminals

1 – Limits Input
2 – Air Switch Input
3 – POVC Switch Input ❶
4 – Low Fire Switch Input ❶
5 – High Fire Switch Input ❶
6 – VDK/VLDS Input ❶
7 – Aux. #1 ❶ ⎤
8 – Aux. #2 ❶ ⎟ Auxiliary
9 – Aux. #3 ❶ ⎟ Inputs
10 – Aux. #4 ❶ ⎦

J2 (Output) Terminals

1 – Neutral ⎤
E – Earth Ground ⎟ Multi-Flame
2 – 120 VAC ⎦ Power Inputs
3 – Fan ⎤
4 – Main Gas Valve ⎟
5 – Pilot Gas Valve ⎟
6 – Ignition Transformer ⎟ Outputs
7 – VDK/VLSD ⎟
8 – Alarm ⎦

J3 (Modulation) Terminals

1 – Common ⎤
2 – Auto ⎟ Modulation Motor
3 – Hi Fire ⎟ Connections for High Fire &
4 – Low Fire ⎦ Low Fire Start

J4 (Sensors/Burners 1 & 3) Terminals ❷

1 – Flame Rod ⎤
2 – Ground (Yellow) ⎟
3 – U.V. (Blue) ⎟ Burner #1
4 – Shield Connection ⎟
5 – Not Used ⎦
6 – Not Used
7 – Flame Rod ⎤
8 – Ground (Yellow) ⎟
9 – U.V. (Blue) ⎟ Burner #3
10 – Shield Connection ⎦

J5 (Sensors/Burners 2 & 4) Terminals ❷

1 – U.V. (Blue) ⎤
2 – Ground (Yellow) ⎟
3 – Flame Rod ⎟ Burner #2
4 – Shield Connection ⎟
5 – Not Used ⎦
6 – Not Used
7 – U.V. (Blue) ⎤
8 – Ground (Yellow) ⎟
9 – Flame Rod ⎟ Burner #4
10 – Shield Connection ⎦

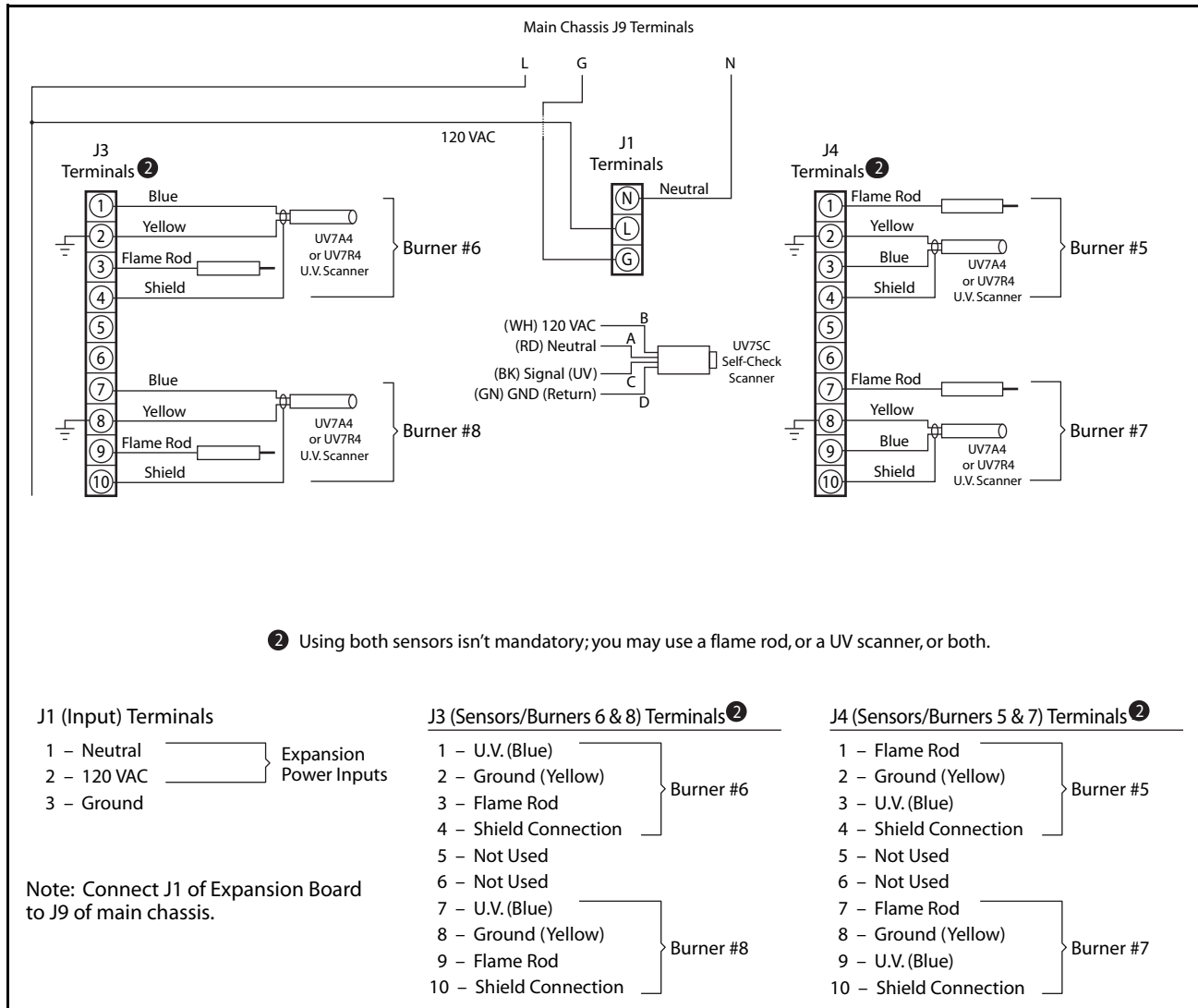## J7 (Interface) Terminals

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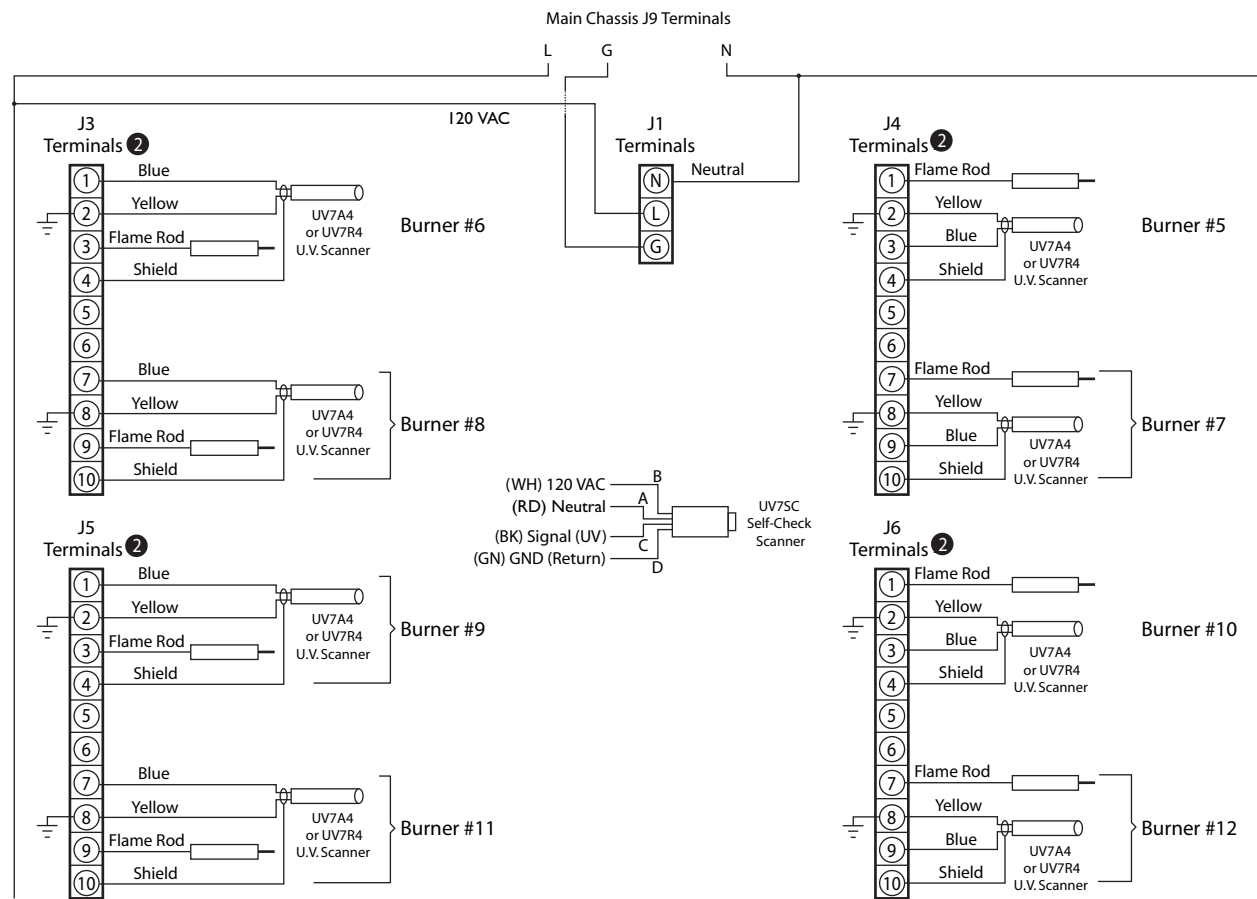5 – RS 232/RS 485 Interface
4 – Reset
3 – Scan
2 – Enter
1 – Ground

J9 Expansion Power

3 – N
2 – G
I – L

WIRING DIAGRAM & CONNECTIONS - EXPANSION BOARD UP TO FOUR BURNERS

Main Chassis J9 Terminals

L   G   N

120 VAC

J3 Terminals ❷
- 1 Blue
- 2 Yellow
- 3 Flame Rod
- 4 Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #6

J1 Terminals
- N Neutral
- L
- G

J4 Terminals ❷
- 1 Flame Rod
- 2 Yellow
- 3 Blue
- 4 Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #5

- 5
- 6
- 7 Blue
- 8 Yellow
- 9 Flame Rod
- 10 Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #8

(WH) 120 VAC — B
(RD) Neutral — A
(BK) Signal (UV) — C
(GN) GND (Return) — D

UV7SC Self-Check Scanner

- 5
- 6
- 7 Flame Rod
- 8 Yellow
- 9 Blue
- 10 Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #7

❷ Using both sensors isn't mandatory; you may use a flame rod, or a UV scanner, or both.

J1 (Input) Terminals

1 – Neutral
2 – 120 VAC   } Expansion Power Inputs
3 – Ground

Note: Connect J1 of Expansion Board to J9 of main chassis.

J3 (Sensors/Burners 6 & 8) Terminals ❷

1 – U.V. (Blue)
2 – Ground (Yellow)
3 – Flame Rod   } Burner #6
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – U.V. (Blue)
8 – Ground (Yellow)
9 – Flame Rod   } Burner #8
10 – Shield Connection

J4 (Sensors/Burners 5 & 7) Terminals ❷

1 – Flame Rod
2 – Ground (Yellow)
3 – U.V. (Blue)   } Burner #5
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – Flame Rod
8 – Ground (Yellow)
9 – U.V. (Blue)   } Burner #7
10 – Shield Connection

WIRING DIAGRAM & CONNECTIONS - EXPANSION BOARD UP TO EIGHT BURNERS

Main Chassis J9 Terminals

L   G   N

120 VAC

J3 Terminals ❷

1	Blue
2	Yellow
3	Flame Rod
4	Shield
5	
6	
7	Blue
8	Yellow
9	Flame Rod
10	Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #6
UV7A4 or UV7R4 U.V. Scanner — Burner #8

J1 Terminals

N — Neutral
L
G

J4 Terminals ❷

1	Flame Rod
2	Yellow
3	Blue
4	Shield
5	
6	
7	Flame Rod
8	Yellow
9	Blue
10	Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #5
UV7A4 or UV7R4 U.V. Scanner — Burner #7

(WH) 120 VAC — B
(RD) Neutral — A
(BK) Signal (UV) — C
(GN) GND (Return) — D

UV7SC Self-Check Scanner

J5 Terminals ❷

1	Blue
2	Yellow
3	Flame Rod
4	Shield
5	
6	
7	Blue
8	Yellow
9	Flame Rod
10	Shield

UV7A4 or UV7R4 U.V. Scanner — Burner #9
UV7A4 or UV7A4 U.V. Scanner — Burner #11

J6 Terminals ❷

1	Flame Rod
2	Yellow
3	Blue
4	Shield
5	
6	
7	Flame Rod
8	Yellow
9	Blue
10	Shield

UV7A4 or UV7A4 U.V. Scanner — Burner #10
UV7A4 or UV7A4 U.V. Scanner — Burner #12

❷ Using both sensors isn't mandatory; you may use a flame rod, or a UV scanner, or both.

J1 (Input) Terminals

1 – Neutral
2 – 120 VAC   } Expansion Power Inputs
3 – Ground

Note: Connect J1 of expansion board to J9 of main chassis.

J3 (Sensors/Burners 6 & 8) Terminals ❷

1 – U.V. (Blue)
2 – Ground (Yellow)   } Burner #6
3 – Flame Rod
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – U.V. (Blue)
8 – Ground (Yellow)   } Burner #8
9 – Flame Rod
10 – Shield Connection

J4 (Sensors/Burners 5 & 7) Terminals ❷

1 – Flame Rod
2 – Ground (Yellow)   } Burner #5
3 – U.V. (Blue)
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – Flame Rod
8 – Ground (Yellow)   } Burner #7
9 – U.V. (Blue)
10 – Shield Connection

J5 (Sensors/Burners 9 & 11) Terminals ❷

1 – U.V. (Blue)
2 – Ground (Yellow)   } Burner #6
3 – Flame Rod
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – U.V. (Blue)
8 – Ground (Yellow)   } Burner #8
9 – Flame Rod
10 – Shield Connection

J6 (Sensors/Burners 10 & 12) Terminals ❷

1 – Flame Rod
2 – Ground (Yellow)   } Burner #5
3 – U.V. (Blue)
4 – Shield Connection
5 – Not Used
6 – Not Used
7 – Flame Rod
8 – Ground (Yellow)   } Burner #7
9 – U.V. (Blue)
10 – Shield Connection

TEST PROCEDURES

INTRODUCTION

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

LIMITS AND INTERLOCK TESTS

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.**

— The burner at which a flame fails will be identified by a red "Flame Failure" LED on the corresponding MB-600PF flame sensing module.

FIGURE 7.
Voltmeter Hookup to Measure

FLAME SIGNAL STRENGTH

Insert the positive probe of a 0-15 VDC, one megohm/volt (minimum) meter into the test point on the MB-600PF as applicable, shown in the photo at left. Connect the negative probe to ground. 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, signaling 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.

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.

3. Start the system normally. The controller should lock out*; if it doesn't, then the controller is detecting a false flame signal. Find the problem and correct it before resuming normal operation.

4. Repeat steps 1 through 4 until all burners have been tested.

MAIN FLAME FAIULRE 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. Locate 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. Refer to Sensor Installation.

SENSOR INSTALLATION

> ⚠ **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 or high current wiring to avoid electrical interference. Interference from ground currents, nearby conductors, radio-frequency emitters (wireless devices), and inverter drives can induce false flame signals. Shielded cables can help reduce interference with the shield connected to ground at the control end only. The wire type and its capacitance (picofarads or microfarads) to ground may cause low signal problems, so a grounded shield may decrease the signal due to the cable's internal capacitance. Multiple UV 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 100 feet (30 meters) or greater, use Belden P/N 8254-RG62 coax cable. To achieve the maximum wiring distance, the shield should not be grounded (keep in mind that an underground shield provides less protection against electrical interference). Depending on field connections, sensor wiring can be up to 200 feet (61 meters).

Do not ground the shield to terminal GND.

Unshielded sensor wiring must not be run in common with other wires; it must be run in separate conduit. Multiple flame sensor wiring must not be run together in a common conduit or wireway. 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.

[*] The burner at which a flame fails will be identified by a flashing red "FLAME FAIL" LED on the corresponding flame sensing module.
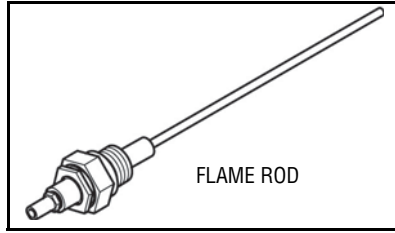
FLAME ROD

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:

WRONG
Rod Detects
Weak Pilot

CORRECT
Rod Detects
Only Strong
Pilot Flame
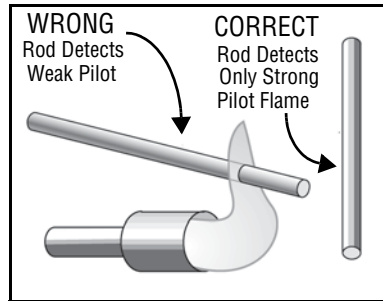
1. Keep the flame rod as short as possible and at least 13 mm (1/2") away from any refractory.

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 at left. 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.

UV SCANNER
(MODEL UV7A4)

90° UV SCANNER
(MODEL UV7R4)

SELF-CHECK UV SCANNER
(MODEL UV7SC)
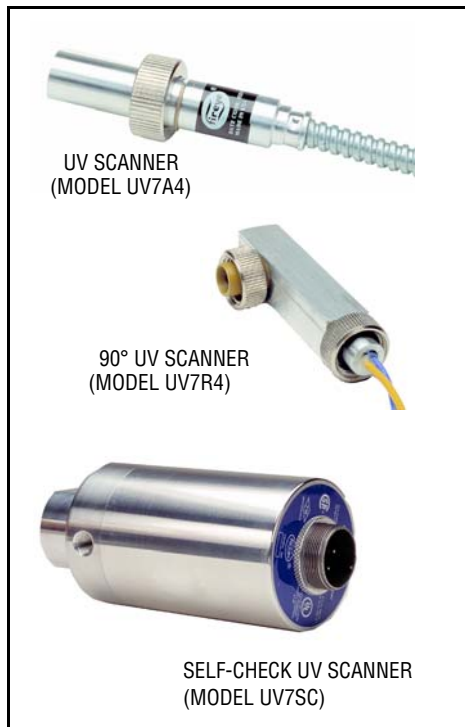
SCANNERS

Use only Fireye scanner models UV7A4, UV7R4 & UV7SC. 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 UV7A4 and UV7R4; model UV7SC 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 Fireye heat insulator part number 35-319. If necessary, also use a purge tee.

4. An optional magnifying lens (Fireye P/N 46-185) may also be used to increase the flame signal strength in difficult sighting situations.

FIGURE 8.
Scanner Sighting

MAIN BURNER

1/3 of FLAME LENGTH

SCANNER SIGHT LINE
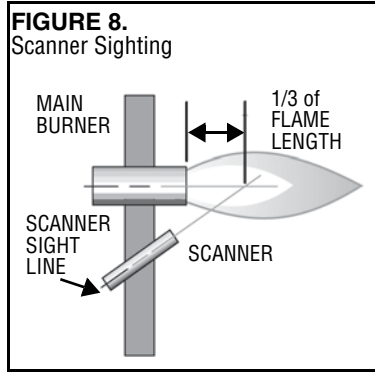
SCANNER

SCANNER SIGHTING CONDITIONS

Aim scanners at the third of the flame closest to the burner nozzle, as shown at left. 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 22.

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" for further details.
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) FAILXX: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.

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	STATUS	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		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		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" further details.
RELAY FAIL XX:XX:XX LOCKOUT	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 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 FLAME ONXX: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 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–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.

MESSAGE	TYPE	EXPLANATION
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.
UNMATCH # XX OF XX LKOUT XX:XX:XX	LOCKOUT	The number of MB-600PF modules installed does not agree with setting of dipswitch S6.

NOTICE

When Fireye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireye products and not to any other equipment or to the combined system or its overall performance.

WARRANTIES