



## **FireFly Flame Effect System**

For 4 and 8 channel Controllers with Manual and DMX modes

This page intentionally left blank.

This page intentionally left blank.

## Table of Contents

FireFly Flame Effect System .....	1
<b>1. Introduction .....</b>	<b>5</b>
1.1 Identification.....	5
<b>2. Related Documentation.....</b>	<b>6</b>
2.1 Information Documents.....	6
<b>3. General Overview .....</b>	<b>7</b>
3.1 General operation of Flame Systems .....	7
<b>4. FireFly Overview.....</b>	<b>9</b>
4.1 Equipment provided.....	9
4.1.1 Basic setup .....	9
4.1.2 MANUAL MODE Operation Selected.....	11
4.1.3 DMX MODE Operation Selected.....	12
4.1.4 Safety.....	14
4.1.5 ADDITIONAL SAFETY INFORMATION.....	16
4.1.6 FireFly Flame Control Panel.....	18
4.1.7 FireFly Burner Head.....	19
4.1.8 HOSES .....	19
4.1.9 CABLES.....	20
4.1.10 FUEL SOURCE .....	20
4.1.11 STRIKING THE SYSTEM .....	20
4.1.12 REPAIR and MAINTENANCE.....	20
4.1.13 FireFly SPECIFICATIONS .....	21
4.1.14 4-Channel Flame Control Panel SPECIFICATIONS .....	21
4.1.15 8-Channel Flame Control Panel SPECIFICATIONS .....	21
<b>5 Abbreviations and Acronyms .....</b>	<b>22</b>
<b>6 Flame Effects Plan.....</b>	<b>23</b>
<b>7 Temperature Vs. Pressure Liquid Propane.....</b>	<b>27</b>
<b>8 Related Documentation.....</b>	<b>29</b>

# 1.Introduction

---

## 1.1 Identification

This document contains the general overview of the unit and its operation, safety features, control and specifications

## **2.Related Documentation**

---

### **2.1 Information Documents**

The following documents although not referenced herein and/or not directly applicable, do amplify or clarify the information presented in this document. These documents are not binding on the content of this document. Please see the enclosed documents for further detailed information.

- 4-Channel FireFly Controller Drawing
- 8-Channel Firefly Controller Drawing
- 4-Channel FireFly Connection Drawing
- 8-Channel Firefly Connection Drawing
- Burkert Valve Operation Instructions ( 6013)
- Burkert Valve Operation Instructions ( 5281)
- Honeywell™ Pilot Burner / Igniter Literature
- Honeywell™ Intermittent Pilot Module

# 3. General Overview

---

## 3.1 General operation of Flame Systems

**NOTE: The following information applies to both the 4 channel and 8 channel control systems**

Read this manual completely and understand all of the topics before attempting to operate the FireFly effect system. Extreme caution is to be taken at all times when servicing and operating this device. At no time should any persons orient themselves in direct line with the output of this device. Special care must be taken to prevent accidental discharge of this device. Lock out and tag out procedures must be adhered to at all times when this device is not in show mode.

This manual is intended to provide a basic understanding of the system described. It should not be considered an exhaustive operational detail of this system. On the job training is the only way to learn the subtle nuances of this particular special effects system.

**Operators must:**

- Understand and be familiar with the operating manual and instructions.
- Acquire hands-on experience in the operation of the system.
- Demonstrate competency by experience and training.
- Demonstrate conceptual and operational knowledge of the system's components and their interaction.
- Be responsible for storage, setup, operation and strike of the flame effect equipment and the supervision of any assistants.
- Be at least 21 years of age.
- Never use or handle flame effects while under the influence of any substance that can impair judgment, such as intoxicating beverages, narcotics or controlled substances, prescription or non-prescription drugs.

At no time should any changes be made to the control software, hardware configuration, or wiring without the expressed, written permission of Sigma Services, Inc.

Servicing is to be performed only by Sigma Services, Inc. personnel. Appropriate safety equipment is to be worn at all times when handling or servicing this equipment. Safety

is not a negotiable topic.

**Every effort has been made to provide technical specifications of the various parts and sub-systems used in this device.**

The design of this system and its operating software is proprietary information. No mechanical copying or alteration of the system is allowable.

This manual describes the flame effect system first in an overview, then by breaking down the operational sequence. Lastly, a control system schematic and the components' technical data sheets have been provided.

The responsibility for safe operation of this system is in the hands of the operator. At no time should it be operated in an unsafe manner.

The system must be rendered safe when not in use. Administrative and physical measures must be taken to prevent use of the flame system by unqualified personnel.



## 4.FireFly Overview

---

### 4.1 Equipment provided

This system is intended to provide a special effect flame. As with all potentially dangerous special effects, the operator should be in full view of the burner device at all times during operation.

The system consists of: a burner control panel, a burner head, and the interconnecting hose and cables. Each of these parts will be discussed in detail on following pages.

#### 4.1.1 Basic setup

- Inspect the entire system to make sure that no damage has occurred since its last use
- Place the control panel at the operator firing position
- Place the burner head(s) in its desired location

**NOTE: 4 channel controllers can have from 1 to 4 burner heads while 8 channel controllers can have from 1 to 8 burner heads.**

- Place the propane tank(s) in its desired location

**NOTE: Typical installations require one propane tank for each burner head installed. For 4 channel controllers, this can be up to 4 tanks while for 8 channel controllers this can be up to 8 tanks.**

**NOTE: Custom installations can reduce the number of propane tanks required through the use of an accumulator tank and manifold; If your installation requires consolidation of the propane fuel tank sources, please contact Sigma Services for assistance.**

- Connect the control cable(s) from the control panel to the burner head (7-pin Male connects to Controller and 7-pin Female connects to the Burner Head).

**NOTE: When connecting the burner head to the controller, make note of the channel the burner head is connected to; i.e. CH#1, Ch#2, Ch3. The channel corresponds to the manual and DMX control commands that are used by the operator to control each burner head.**

**NOTE: There is one 7-pin control cable for each burner head installed. For 4 channel controllers, this can be up to 4 control cables while for 8 channel controllers this can be up to 8 control cables.**

- Connect the ESTOP valve cable to the control panel (4-pin Male connector)

**NOTE: When connecting the ESTOP control cable to the controller, make note of the channel of the burner head to which the propane tank/ESTOP valve is connected to; i.e. CH#1, Ch#2, Ch3. The channel to which the Burner Head is connected should also be the channel to which the ESTOP cable is connected.**

**NOTE: There is one 4-pin ESTOP valve control cable required for each propane tank installed. For 4 channel controllers, this can be up to 4 tanks while for 8 channel controllers this can be up to 8 tanks.**

- Connect the regulator to the propane tank fitting (NOTE: propane tanks use left-handed threads)

**NOTE: There is one regulator required for each propane tank. The regulator is included as part of the standard Sigma Services ESTOP control cable assembly.**

- Connect the gas hose from the burner head to the ESTOP valve assembly.

**NOTE: A small ball valve located on the quick-connect fitting prevents the hose from being attached or detached while the valve is open. Close valve to attach the hose.)**

- At each installed propane tank, open the supply valve.
- At each installed ESTOP valve assembly, open the manual isolation valve.

**WARNING: Using an approved leak detection method, verify no gas leaks are detected between each propane tank and connected ESTOP valve assembly before proceeding!!!!**

- At each Installed Burner Head, Open the manual isolation valve.
- At the flame control panel, connect a 120Vac, 60Hz power source.
- At the flame control panel, use the Sigma Services provided key to place the MODE switch in desired operational mode (MANUAL, OFF, or DMX are the available modes).
- At the flame control panel, use the Sigma Services provided key to release the ESTOP Switch; Verify the ESTOP valve assembly is energized.

**WARNING: Using an approved leak detection method, verify no gas leaks are detected between each ESTOP valve assembly and connected Burner Head assembly before proceeding!!!!**

- At the ESTOP valve assembly, check the pressure regulator is set to the desired operating pressure (20psi is the nominal factory setting); adjust the

Firefly Manual with Four Channel Control\_Revision 00\_05\_16\_2017

Sigma Services, Inc. 813-737-1904

[www.sigmaservices.com](http://www.sigmaservices.com)

pressure as needed to meet the requirements of the installation.

#### 4.1.2 MANUAL MODE Operation Selected



**4- Channel Flame Control Panel – Manual Controls (Left), Cable Connections (Center), (DMX Relay Board (Right)**



**8- Channel Flame Control Panel – Manual Controls (Left), Cable Connections (Center), (DMX Relay Boards (Right)**

- At the flame control panel, determine which Burner Head(s) is to be operated.
- At the control panel, locate the ARM switch for each connected Burner Head to be operated and then press and release the switch; i.e for a Burner Head connected to CH #2 and CH #3 on the control panel, press and release the ARM CH #2 and ARM CH #3 switches to attempt to generate a pilot flame at each Burner Head.
- At each ARM switch, the YELLOW led will be illuminated indicating the power is being delivered to the burner head connected to that channel.
- At each Burner Head being ARMED, the flame safeguard control will begin a Trial For Ignition (TFI) sequence. A spark will be generated across the igniter and pilot gas will be released through the igniter orifice.
- If pilot gas is not ignited or the presence of a flame is not detected by the flame safeguard within 15s, the TFI fails and the flame safeguard shut off for several seconds. After a short rest, the flame safeguard will restart the TFI. The TFI is set to retry 3 times before lockout occurs.
  - Resetting of a TFI lockout is performed by removing power to the Burner Head; press and release the ARM switch to remove power and then press and release the ARM switch again to reapply power.
- When the flame safeguard detects a valid pilot flame, the main effect valve power is returned to the control panel causing the GREEN led (ARMED

light) on the FIRE button to illuminate.

**WARNING: Check for leaks again before proceeding!!!**

- At the control panel, locate the FIRE switch for each connected Burner Head to be operated and then press and hold the switch; i.e for a Burner Head connected to CH #2 and CH #3 on the control panel, press and release the FIRE CH #2 and FIRE CH #3 switches to attempt to generate a main effect flame at each Burner Head. Release the switch to stop FIRE.
- At the ESTOP valve assembly, check the pressure regulator setting is still close to the desired operating pressure; adjust the pressure as needed.

#### 4.1.3 DMX MODE Operation Selected



**4- Channel Flame Control Panel – Manual Controls (Left), Cable Connections (Center), (DMX Relay Board (Right)**



**8- Channel Flame Control Panel – Manual Controls (Left), Cable Connections (Center), (DMX Relay Boards (Right)**

- Verify a master DMX Controller and DMX cable are connected to the DMX IN port of the flame control panel.
- If the flame control panel is the last piece of equipment in the DMX daisy chain, verify a proper End Of Line (EOL) termination resistor is installed on the DMX OUT port of the flame control panel.

**NOTE: The flame control panel uses a 3-pin XLR style connector for DMX IN and DMX OUT. When using 5-pin DMX cables, a XLR turn-around adaptor is required.**

- The flame controller includes one or more Logic Systems DMX Relay boards. These boards use a base – 1 configuration for the DMX address dipswitch setting; i.e. the dipswitch setting value is ALWAYS 1 LESS than the actual DMX address value.
- Dipswitch binary to decimal values are as follows:
  - SW1 = 1; SW2 = 2; SW3 = 4; SW4 = 8; SW5 = 16

- SW6 = 32; SW7 = 64; SW8 = 128; SW9 = 256
  - SW10 = ALWAYS KEEP OFF!!! (NOT USED for binary address)
  - Example: Decimal value 185 becomes binary '010111001'
  - NOTE: The DMX address is ALWAYS +1 higher than the binary address setting (the DMX address would be 186 using the binary 185 setting from the previous example above).
- For the 4-Channel controller, the default DMX start address is set to 1 (dipswitch set to binary 0 '0000000000').
    - DMX Channel #1 = FIRE CH #1
    - DMX Channel #2 = FIRE CH #2
    - DMX Channel #3 = FIRE CH #3
    - DMX Channel #4 = FIRE CH #4
    - DMX Channel #5 = ARM CH #1
    - DMX Channel #6 = ARM CH #2
    - DMX Channel #7 = ARM CH #3
    - DMX Channel #8 = ARM CH #4
  - For the 8-Channel controller, the default DMX start address for board #1 is set to 1 (dipswitch set to binary 0 '0000000000') and the DMX start address for board #2 is set to 9 (dipswitch set to binary 8 '0000001000').
    - DMX Channel #1 = FIRE CH #1
    - DMX Channel #2 = FIRE CH #2
    - DMX Channel #3 = FIRE CH #3
    - DMX Channel #4 = FIRE CH #4
    - DMX Channel #5 = FIRE CH #5
    - DMX Channel #6 = FIRE CH #6
    - DMX Channel #7 = FIRE CH #7
    - DMX Channel #8 = FIRE CH #8
    - DMX Channel #9 = ARM CH #1
    - DMX Channel #10 = ARM CH #2
    - DMX Channel #11 = ARM CH #3
    - DMX Channel #12 = ARM CH #4
    - DMX Channel #13 = ARM CH #5

- DMX Channel #14 = ARM CH #6
  - DMX Channel #15 = ARM CH #7
  - DMX Channel #16 = ARM CH #8
- At the flame control panel, determine which Burner Head(s) is to be operated.
  - Determine what DMX address that corresponds to the ARM ON/OFF control for each connected Burner Head to be operated (**NOTE: The address dipswitch of the DMX Relay board inside the control panel MUST be set to match the master DMX controller settings**); i.e. for a Burner Head connected to CH #2 and CH #3 on the control panel, from the Master DMX controller, command ARM ON #2 (DMX Channel #10) and ARM ON #3 (DMX Channel #11) to attempt to generate a pilot flame at each Burner Head.
  - At each control panel ARM switch, the YELLOW led will be illuminated indicating the power is being delivered to the burner head connected to that channel.
  - At each Burner Head being ARMed, the flame safeguard control will begin a Trial For Ignition (TFI) sequence. A spark will be generated across the igniter and pilot gas will be released through the igniter orifice.
  - If pilot gas is not ignited or the presence of a flame is not detected by the flame safeguard within 15s, the TFI fails and the flame safeguard shut off for several seconds. After a short rest, the flame safeguard will restart the TFI. The TFI is set to retry 3 times before lockout occurs.
    - Resetting of a TFI lockout is performed by removing power to the Burner Head; command a ARM OFF to remove power and then command a ARM ON to reapply power.
  - When the flame safeguard detects a valid pilot flame, the main effect valve power is returned to the control panel causing the GREEN led (ARMED light) on the control panel FIRE button to illuminate.

**WARNING: Check for leaks again before proceeding!!!**

- Determine the DMX address that corresponds to the FIRE ON/OFF control for each connected Burner Head to be operated; i.e for a Burner Head connected to CH #2 and CH #3 on the control panel, from the master DMX controller command FIRE ON #2 (DMX Channel #2) and FIRE ON #3 (DMX Channel #3) to attempt to generate a main effect flame at each Burner Head. Command a FIRE OFF #2 and FIRE OFF #3 to stop the generation of the main effect.
- At the ESTOP valve assembly, check the pressure regulator setting is still close to the desired operating pressure; adjust the pressure as needed

#### 4.1.4 Safety

Every effort must be made to prevent propane gas leakage. Leaks can be detected by several means. A rich soap-and-water solution can be sprayed directly on the gas connections; any bubbles or foam creation indicates a leak. Also, commercially available electronic leak detectors can be used. Any leaks must be repaired immediately. For assistance, please contact Sigma Services, Inc.

***WARNING Fire or explosion hazard can cause property damage, severe injury, or death. If you smell gas or suspect a leak, turn off the gas at the manual supply valve. Do not introduce a source of ignition or touch any electrical switch or telephone until you are sure that no spilled gas remains present.***

In all applications, you should insure that any materials in close proximity to the burner head do not reach high temperature from the radiant heat. This is most easily achieved through the use of a non-contact infrared temperature probe. These are available from many commercial supply stores.

An approved fire extinguisher must be present at all times when fuel gas is present.

This system is designed to provide short duration flame effects. The most frequently used effects are “bursts” of 1-second duration. While longer burn times are possible, the FireFly should never be fired for more than 10 minutes without a cool-down period.

The FireFly System can be used indoors or outdoors. Special care must be taken to prevent the control panel and burner head from getting wet. If these components get wet, disconnect them from electrical power and the propane tank. The control panel should then be opened and allowed to dry before use. If the Intermittent Pilot Module (in the burner head) gets wet, it **MUST** be replaced.

**CAUTION:** Burner head will be very HOT!!! Allow it to cool before handling, packaging or placing in close proximity to flammable materials.

**WARNING**    **Electrocution hazard can cause serious injury or death. Do NOT touch the spark terminal. The ignition circuit generates over 10,000 volts and electrical shock can result.**

#### **4.1.5 ADDITIONAL SAFETY INFORMATION**

- Only use an outdoor extension cord having a 3-prong and receptacle that accepts the Flame Control Panel plug. The Flame Control Panel has a 3-conductor cord and a 3-prong grounding type plug to fit a properly grounded outlet. Replace damaged cords.
- The electrical rating of the extension cord must be greater than or equal to the electrical rating of the Flame Control Panel. Use an extension cord with 14 gauge or thicker wire and that has a label stating it is suitable for outdoor use when used in a outdoors application.
- Do not abuse any electrical cord. Never yank it to disconnect from the receptacle. Keep all cords away from heat, flammable substances and sharp objects.
- Devices for retaining the extension cord connection to the power supply cord are available where ever fine extension cords are sold.
- The connection between the Flame Control Panel and the extension cord must always remain dry and kept off of the ground.
- Disconnect the Flame Control Panel from the power supply when not in use, changing propane tanks, before servicing, cleaning, etc.
- Do not insert foreign objects in this product.
- To avoid electric shock, **DO NOT** clean the Flame Control Panel or the FireFly Burner Head by spraying water or immersing in water.



- All repairs to the Flame Control Panel and the FireFly Burner Head must be performed only by qualified service personnel.
- Read and follow all instructions affixed to the propane tank
- All personnel should be carefully supervised when they are in the area of the FireFly Burner Head.
- Clothing or other flammable materials should not be hung from the FireFly Burner Head or placed on or near the FireFly System.
- Any guard or other protective device removed from servicing the Flame Control Panel or the FireFly Burner Head must be replaced prior to operating.
- It is imperative that the FireFly Burner Head be kept clean at all times.
- The LP-Gas cylinder must be provided with a shutoff valve terminating in an LP Gas supply cylinder valve outlet specified for in the Standard for Compressed Gas Cylinder Valve outlet and inlet connections.
- The LP Gas cylinder supply system must be arranged for vapor withdrawal and cylinder must include a collar to protect the cylinder valve.
- The LP Gas cylinder used shall be constructed and marked in accordance with the specifications for LP Gas cylinders of the U.S. Department of Transportation (DOT).
- The FireFly Burner Head shall be used only in a well ventilated space and shall not be used in any enclosed area.
- The Flame Control Panel and FireFly Burner Head should be stored indoors when not in use and kept away from children.
- The LP-Gas Cylinder must be disconnected and removed from the FireFly System, if the appliance is stored indoors.

- LP Gas cylinder must be stored outdoors in a well ventilated area out of the reach of children. Disconnected cylinders must have a plastic cap installed and must not be stored in a building, garage or any other enclosed area.
- The pressure regulator and hose assembly supplied with the FireFly Burner Head must be used for connection to the LP-Gas cylinder. Replacement pressure regulators and hose assemblies must be purchased from Sigma Services Inc.
- Keep the area around the FireFly Burner Head clear and free from combustible materials, gasoline, and any other flammable vapors and liquid.

#### **4.1.6 FireFly Flame Control Panel**

NOTE: A clean, stable source of sine wave AC is needed. Some Ground Fault Interrupter (GFI) outlets will trip when this system is in the ignition sequence. Some small generators supply abnormal waveforms that will not work with this system.

The flame control panel MODE Switch allows an operator to select the method used to control the FireFly Burner Heads. MANUAL MODE allows operation from the 22mm pushbuttons located on the panels door. DMX MODE allows operation from a operator provided remote DMX Master Controller.

The flame control panel ARM light (AMBER indicator lamp on each ARM switch) indicates 24Vac is being provided to the Burner Head Honeywell™ Intermittent Pilot Module and its related parts located inside the Burner Head. The Honeywell™ module monitors system status and proves a solid pilot before arming the main flame firing circuit. It receives feedback from the igniter via a rectification sensor to determine whether or not it is safe to proceed with the effect.

The flame control panel ARMED light (GREEN indicator lamp on each FIRE switch) indicates the Honeywell™ has detected a flame at the burner head and has armed the main flame firing circuit.

The flame control panel EMERGENCY STOP (E-STOP) button provides the operator with a means to stop the entire flame effect system in the event of an emergency. Pushing this button will disconnect the electrical power from the tank mounted E-STOP valve and the flame circuits including the ignition, pilot and main flame gas valves. A key is required to disengage the Emergency Stop switch. This provides a means to “lock” the system when not in use. To disengage the Emergency Stop switch, insert the key and turn it, then pull the button out; this will return the system to a ready state.

**WARNING!!!: Hazardous live voltage is still accessible inside the control panel when the Emergency Stop button is pressed.**

**NOTE: All indicators should be checked periodically to insure proper working order. The system will still fire the effect with a defective indicator. A defective indicator should be replaced immediately.**

#### **4.1.7 FireFly Burner Head**

The burner head houses the Honeywell™ Intermittent Pilot Module, the pilot valve, the main flame valve, the pilot assembly, and the rectification flame detector.

During the arming sequence, the Honeywell™ creates a high voltage spark on the pilot assembly. The pilot valve is energized and a solid pilot flame should be established. The rectification sensor will detect the pilot flame and report back to the Honeywell™ that a solid pilot has been established. Upon detection of a solid pilot flame, the main flame firing circuit is armed. Only then can main flame fuel be issued.

The burner head is supplied with a basic flame effect nozzle. Other types of flame burners are available, depending on your application. Contact Sigma Services, Inc. to discuss your requirements.

#### **4.1.8 HOSES**

These are specialized gas hoses and must not be used for anything else. Periodic inspection of the hoses and replacement of defective units is mandatory. Care must be taken to protect the hoses from physical, thermal or chemical damage. Integral to the hose system, is the pressure regulator. The setting of this regulator determines the operating pressure of the entire system, with a maximum of 100 psi. In general, more pressure makes bigger and hotter flame effects. At about 70 psi, the system will produce the largest flame it is capable of producing. Increasing pressure beyond 70 psi will not necessarily increase the flame height. You should use the lowest pressure setting that will achieve the desired effect. For operation beyond the aforementioned pressure range, or for additional or replacement hoses please contact Sigma Services, Inc.

#### **4.1.9 CABLES**

The multi-pin cables connect the burner head and the E-STOP valves to the control panel. They are keyed so they can only be plugged in correctly. Take precautions to prevent these cables from getting damaged. Any damaged cables must be repaired or replaced immediately. For replacement cables or extension cables, please contact Sigma Services, Inc.

#### **4.1.10 FUEL SOURCE**

The fuel source for the FireFly system is propane vapor. This can be drawn from many different sizes of propane tanks. The most common tank size is a 20-pound tank most frequently used in residential barbecue grills. Other sizes will work, however. Some venues will request that you limit the propane supply inside the building to 5 pounds. For this usage, a 5-pound tank can be obtained from many sources, including camping supply stores. Keep the propane tank away from sources of heat. As the tank heats up, the vapor pressure of the propane inside rises. The relationship between temperature and pressure is illustrated on a graph in the technical section of this manual.

#### **4.1.11 STRIKING THE SYSTEM**

After using the system, you must render it safe before packing it or leaving it unattended:

- First, the hoses and valve train must be drained of the remaining fuel. At each propane tank, turn off the tank valve. At the flame control panel, ARM each Burner Head and FIRE the main effect until the flame has consumed all of the remaining gas.
- Second, disable the system electrically. At the flame control panel, press the ESTOP button and remove the key. Disconnect the system from electrical power. Disconnect the cables from the control panel.
- Third, remove the fuel source. Disconnect the hoses and the propane tanks and store in an approved location.

**CAUTION:** The Burner head(s) will be very HOT!!! Allow it to cool before handling, packaging or placing in close proximity to flammable materials.

#### **4.1.12 REPAIR and MAINTENANCE**

This system should only be repaired by Sigma Services, Inc. personnel. No repair services can be affected by non-qualified personnel. The only maintenance that is required is a periodic cleaning of the system components. A soft cloth and mild cleaner can be used for this purpose.

#### **4.1.13 FireFly SPECIFICATIONS**

- Power requirement per unit: 24 Vac, 50/60 Hz. @2.5A
- 120 Btu/sec @ 60 psi
- Weight: 7 lbs.
- Dimensions: 7" long x 9" tall x 5" deep
- Fully adjustable flame height from 6 inches to 8 feet
- All components are UL rated.
- Relight in 8 seconds (during arming, effects valve cannot open)
- All valves close when power is removed.

#### **4.1.14 4-Channel Flame Control Panel SPECIFICATIONS**

- Power Input: 120 Vac, 50/60 Hz. Fused @ 2.5A
- Power Output: 24Vac, 50/60Hz Fused @ 10A
- Communication: DMX512 Standard Protocol

#### **4.1.15 8-Channel Flame Control Panel SPECIFICATIONS**

- Power Input: 120 Vac, 50/60 Hz. Fused @ 5A
- Power Output: 24Vac, 50/60Hz Fused @ 20A
- Communication: DMX512 Standard Protocol

## 5 Abbreviations and Acronyms

---

The following is a list of abbreviations and acronyms that are typically used in a Flame Effects System. These abbreviations and acronyms in this list may or may not be used in this document to describe an element of the attraction.

AC	Alternating Current
BAT	Batteries
BOB	Break Out Box
CSS	Control System Specification
DC	Direct Current
DMX	Digital Multi-Plex Communication
E-STOP	E-STOP
FCC	Flame Control Cabinet
HOA	Hand off Auto
I/O	Inputs and Outputs
NA	Not Applicable
OCC	Operational Control Console
PLC	Programmable Logical Controller
N/C	Normally Closed
N/O	Normally Open

# 6 Flame Effects Plan

---

## Flame Effect Plan Worksheet

*to comply with the approval requirements of NFPA 160 Chapter 3, Section 3.3*

3.3.1 (1) The name of the person, group, or organization responsible for the production:

3.3.1 (2) Production dates and times:

3.3.1 (3) Production location:

3.3.1 (4) Design criteria.

This section is not a part of the requirements of the NFPA document, but is included for information only.

### Appendix B.1

#### (a) Location

##### (1) Outdoor flame effects

- a. Weather Monitoring of conditions is by the operator. Effects must not be used when wind speeds exceed 20 mph. Automated detection is available from Sigma Services if needed.
- b. Intrusion Intrusion detection is by security and operational personnel. Automated detection is available from Sigma Services, if needed.
- c. Egress
- d. Clearance to combustibles
- e. Fire protection Fire extinguishers to be provided by operator.

(2) Indoor flame effects

- a. Ventilation Ventilation air is not directly used to exhaust the products of combustion.
- b. Clearance to combustibles
- c. Egress
- d. Environment
- d. Environment
- e. Fire Protection
- f. Life safety provisions
- g. Intrusion Intrusion detection is by security and operational personnel. Automated detection is available from Sigma Services, if needed.

(b) Flame Effect Operator Participation

(1) Attended effects

- a. Controlled by the operator during operation
- b. Operation in attendance during effect
- c. Training of operators

(2) Unattended effects

- a. Designed for unattended operation
- b. Supervision by automatic systems
- c. Audience proximity & intrusion prevention Automated detection is available from Sigma Services, if needed.
- d. Control type-Automatic
  - 1. Events cued by show control system
  - 2. Different levels of automatic operation
  - 3. Requirements to be developed for flame effect control systems



e. Control type-Manual

1. Operator supervision with flame effect in open view

f. Control location

1. Local control: effect controlled by operator with effect in open view
2. Remote control

g. Fuel supply and fuel additives

1. Portable
2. Fixed

3.3.1 (5) Flame effect classification:

Usually, this will be Class III

3.3.1 (6) Site Plan:

:

- a. Narrative description of the flame effect
- b. Location of flame effects, controls and control sequence.
- c. Area affected by the flame effect
- d. Location of the audience
- e. Fuels used and their estimated consumption
- f. Air for combustion and ventilation for indoor effects
- g. Flammable materials piping.
- h. Storage and holding areas and their capabilities.
- i. Supplemental fire protection features.
- j. Emergency response procedures.
- k. Means of egress.

3.3.1 (7) MSDS sheets for consumable fuels and materials:

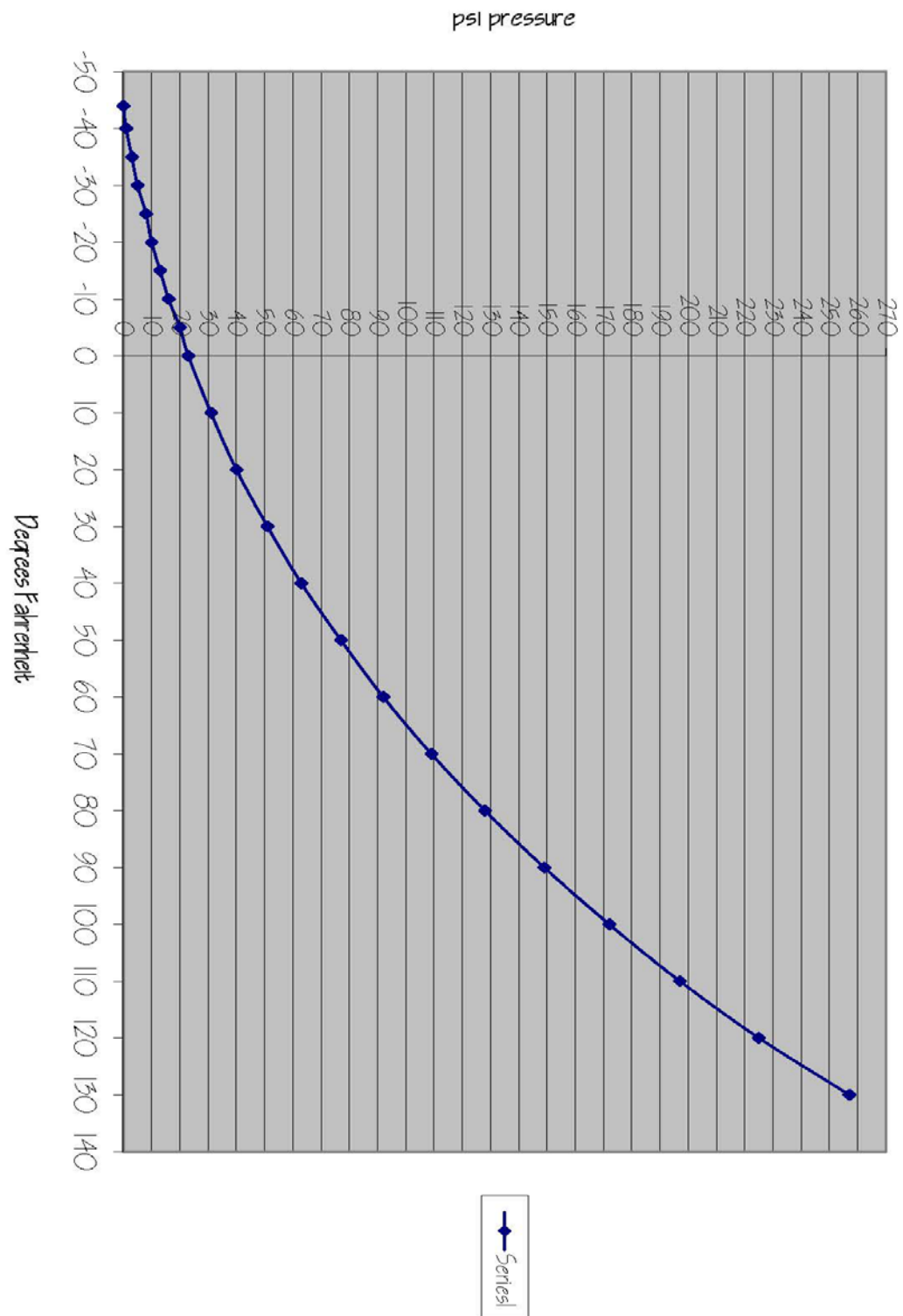
3.3.1 (8) Documentation that the combustible materials used for the construction of the flame effects have been rendered flame retardant:

The flame effect units are primarily constructed of aluminum, bras and stainless steel.  
By nature, these materials are flame retardant.

3.3.1 (9) Name of the flame effect operator:

## **7 Temperature Vs. Pressure Liquid Propane**

LP Vapor Pressure vs. Temperature

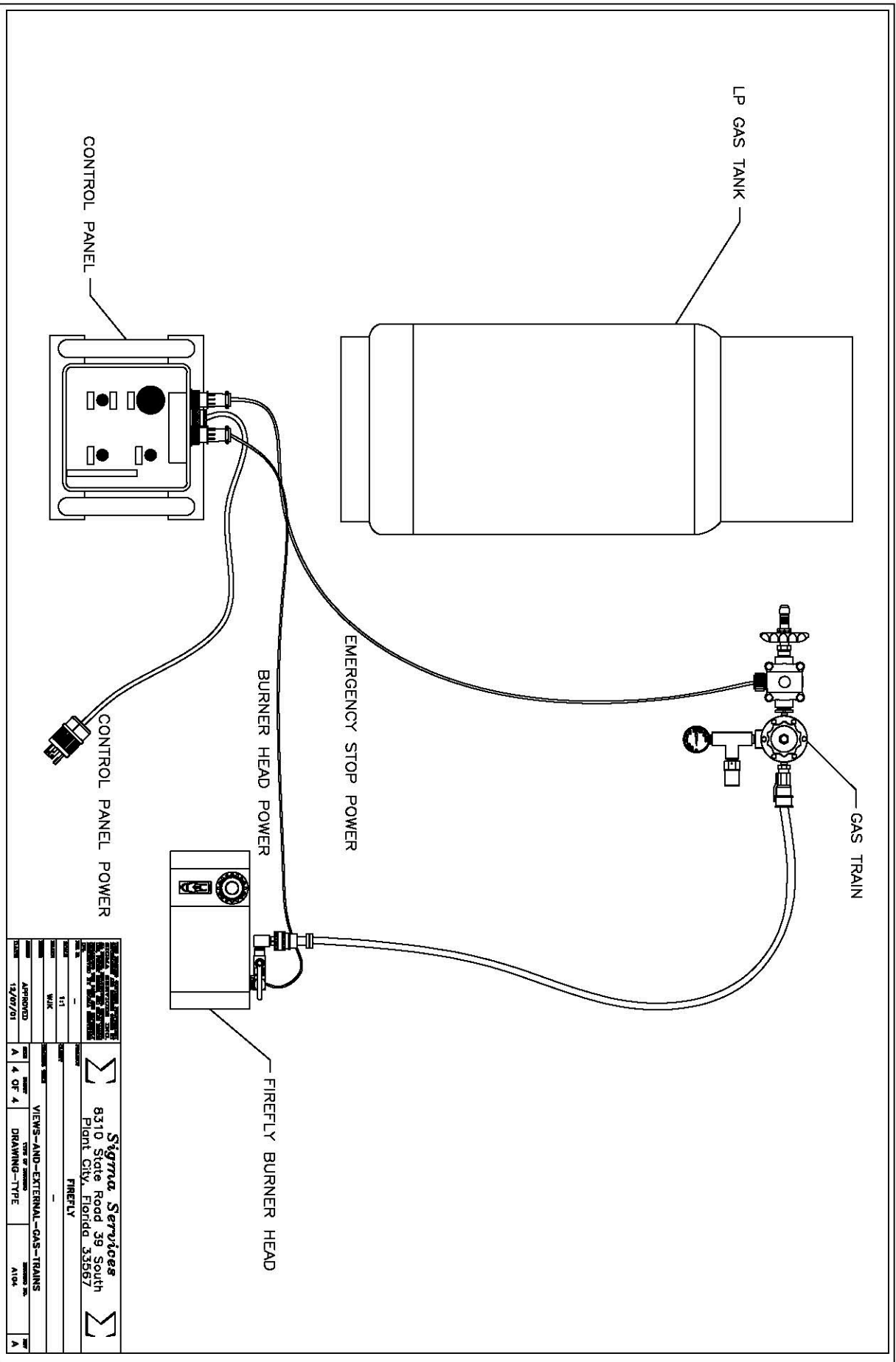


## **8 Related Documentation**

- **See Section #2 for details**







Sigma Services			
8310 State Road 39 South			
Plant City, Florida 33567			
FIREFLY			
-			
111			
W.K.			
APPROVED			
13/07/01			
A			
4 OF 4			
VIEWS-AND-EXTERNAL-GAS-TRAINS			
DRAWING-TYPE			
A104			
A			



## Q345A, Q348A, Q348B, Q362A, Q373A and Q381A Pilot Burner/Igniter-Sensors

### Application

These pilot burner/igniter-sensors provide pilot flame ignition and sensing in intermittent pilot systems. They consist of a target type pilot burner with a combination spark igniter and flame sensor mounted in place of the thermocouple.

### Installation

#### WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow instructions can damage product or cause a hazardous condition.
2. Check ratings given in instructions and on product to make sure product is suitable for your application.
3. Make sure installer is a trained, experienced service technician.
4. After completing installation, use these instructions to check out product operation.



### WARNING

**FIRE OR EXPLOSION HAZARD  
CAN CAUSE PROPERTY DAMAGE,  
SEVERE INJURY, OR DEATH.**  
Follow these warnings exactly:

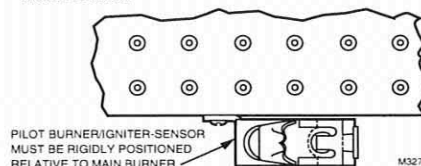
1. Disconnect power supply before wiring to prevent electrical shock or equipment damage.
2. To avoid dangerous accumulation of fuel gas, turn off gas supply at appliance service valve before starting installation and perform Gas Leak Test after completion of installation.
3. Do not bend pilot tubing at the control or pilot after compression nut has been tightened. Gas leakage at the connection may result.

Follow appliance manufacturer instructions if available; otherwise, use instructions provided below.

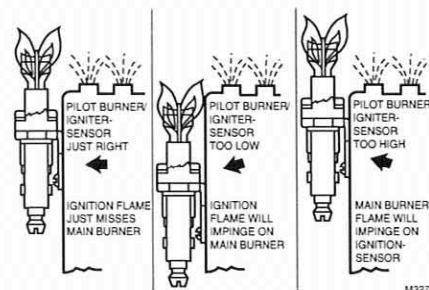
#### LOCATION

1. Position pilot burner/igniter-sensor for easy access and observation. In replacement applications, replace pilot burner/igniter-sensor with an identical unit and position new pilot burner/igniter-sensor in the same location and orientation as the original one.

**Fig. 1—Mount pilot burner/igniter-sensor on main burner.**



**Fig. 2—Location of pilot burner/igniter-sensor.**



2. Mount pilot burner/igniter-sensor on main burner. Mounting surfaces other than the main burner may shift, bend, or warp as furnace expands and contracts while operating. See Fig. 1.
3. Mount pilot burner/igniter-sensor so the pilot flame remains properly positioned with respect to the main burner flame. See Fig. 2.
4. Supply pilot flame with ample air free of combustion products.
5. Do not impinge pilot flame on adjacent parts. Do not impinge main burner flame on pilot burner/igniter-sensor.
6. Do not expose pilot flame to falling scale, which could impair main burner ignition.
7. Do not expose pilot burner/igniter-sensor to main burner rollout while igniting or extinguishing.
8. Do not expose pilot flame to drafts that push or pull pilot flame away from the igniter-sensor.

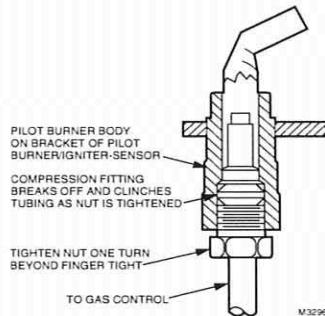
**NOTE:** The Q381A Pilot Burner/Igniter-Sensor is for horizontal mounting only. Mounting bracket must remain vertical.

#### CONNECT PILOT GAS TUBING

1. Cut tubing to desired length and bend as necessary for routing to pilot burner/igniter-sensor. Do not make sharp bends or deform tubing. Do not bend tubing at control after compression nut has been tightened because this can result in gas leakage at connection.
2. Square off and remove burrs from end of tubing.
3. Push tubing into compression nut clearance hole until tubing bottoms.

**NOTE:** When replacing a control, cut off old compression fitting and replace with new compression fitting provided with new pilot burner. Never use old compression fitting because it may not provide a gas-tight seal. See Fig. 3.

Fig. 3—Always use new compression fitting.



4. While holding tubing all the way in, engage threads and turn until finger tight.
5. Using a wrench, turn compression nut one turn beyond finger tight. *Do not overtighten.*
6. Connect other end of tubing to gas control according to gas control manufacturer instructions.

#### WIRE IGNITER-SENSOR

The igniter-sensor must be mounted on the burner. Connect the control module ground wire to one of the igniter-sensor mounting screws to complete the system grounding.

Connect ground wire as follows:

1. Use 221° F [105° C] minimum thermoplastic-insulated wire for the ground leadwire (asbestos insulation is not acceptable).
2. A male 1/4 in. [6 mm] quick-connect terminal is provided on Honeywell ignition modules. Fasten female quick-connect to wire end at ignition module.
3. Strip other end and fasten under igniter-sensor mounting screw.
4. If necessary, use shield to protect lead from radiant heat of burner.
5. The pilot burner serves as the grounding area for the flame signal. Run lead from pilot burner to the common ground selected.

Connect the ignition cable as follows:

1. The high tension ignition cable must conform to applicable local or national standards.

2. Connect one end of the ignition cable to stud terminal on igniter-sensor using 1/4 in. [6 mm] diameter snap-spring or cage-clips on cable ends.

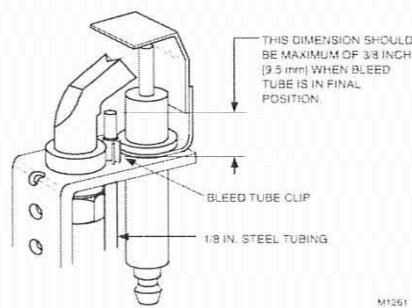
3. Connect the other end of the ignition cable to the igniter terminal on ignition module.

4. Use ceramic or plastic standoff insulators as necessary to prevent cable from contacting metal surfaces.

#### INSTALL BLEED GAS TUBE (optional)

1. Route bleed tube from bleed tap on gas control to the pilot burner/igniter-sensor.
2. Push clip into place. See Fig. 4.
3. Insert bleed gas tube until 3/8 in. [10 mm] to tubing is above pilot burner/igniter-sensor bracket. Tip of bleed gas tube must not extend into pilot flame.

Fig. 4—Install bleed gas tube.



## Startup and Checkout

#### PERFORM GAS LEAK TEST



### WARNING

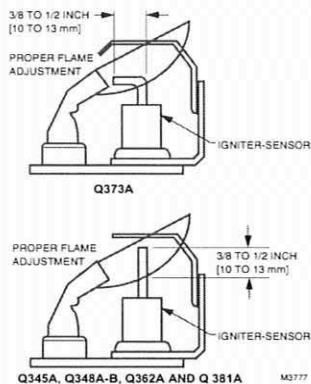
**FIRE OR EXPLOSION HAZARD  
CAN CAUSE PROPERTY DAMAGE,  
SEVERE INJURY, OR DEATH.**

Check for gas leaks with soap and water solution any time work is done on a gas system.

#### Gas Leak Test:

1. Ensure that gas supply is turned on at the appliance service valve.
2. Paint pipe connections upstream of pilot burner with rich soap and water solution. Bubbles indicate gas leak.
3. If leak is detected, tighten pipe connections.
4. Set thermostat to call for heat to light main burner.
5. With main burner in operation, paint pipe joints (including adapters) and gas control inlet and outlet with rich soap and water solution.
6. If another leak is detected, tighten adapter screws, joints, and pipe connections.
7. Replace part if leak cannot be stopped.

Fig. 5—Igniter-sensor tip must be in pilot flame.



#### ADJUST PILOT FLAME

The pilot flame should envelop 3/8 to 1/2 in. [10 to 13 mm] of the igniter-sensor tip. See Fig. 5. To adjust pilot flame:

1. Turn off system by setting thermostat below temperature to call for heat.
2. Disconnect lead to MV terminal on gas control.
3. Light pilot by setting thermostat to call for heat.
4. Remove pilot adjustment cover screw from gas control.
5. Turn inner pilot adjustment screw clockwise to decrease or counterclockwise to increase pilot flame.
6. Always replace pilot adjustment cover screw and tighten firmly after completing adjustment to assure proper operation.

## Service



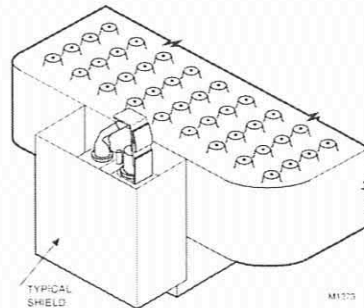
### WARNING

**FIRE OR EXPLOSION HAZARD  
CAN CAUSE PROPERTY DAMAGE,  
SEVERE INJURY, OR DEATH.**  
Perform Gas Leak Test anytime work is done to the system.

#### PILOT OUTAGE











1. If pilot flame goes out during ignition, but is properly adjusted, recheck mounting and location instructions in Location section.
2. Refer to ignition module instructions to check wiring between igniter-sensor and ignition module or between gas control and ignition module.
3. If all mounting and location instructions are followed but pilot continues to go out, construct shielding to protect pilot flame from main burner ignition and extinction and drafts. See Fig. 6.
4. Check pilot and main burner lightoff.

Fig. 6—Proper shielding of pilot flame.



- ☐ Set the thermostat to call for heat.
- ☐ Watch the pilot burner during the ignition sequence. See if:
  - Ignition spark continues after the pilot is lit.
  - The pilot lights and the spark stops, but main burner does not light.
  - S8600B.H; S86H only: The pilot lights, the spark stops and main burner lights, but the system locks out.
- ☐ If so, assure adequate flame current as follows:
  - Turn off furnace at circuit breaker or fuse box.
  - Clean the flame rod with emery cloth.
  - Make sure electrical connections are clean and tight. Replace damaged wire with moisture-resistant no. 18 wire rated for continuous duty up to 221° F [105° C].
  - Check for cracked ceramic insulator, which can cause short to ground, and replace pilot burner/igniter-sensor if necessary.
  - At the gas control, disconnect main valve wire from the TH or MV terminal.
  - Turn on power and set thermostat to call for heat. The pilot should light but the main burner will remain off because the main valve actuator is disconnected.
  - Check the pilot flame. Make sure it is blue, steady and envelops 3/8 to 1/2 in. [10 to 13 mm] of the flame rod. See Fig. 7 for possible flame problems and their causes.
  - If necessary, adjust pilot flame by turning the pilot adjustment screw on the gas control clockwise to decrease or counterclockwise to increase pilot flame. After adjustment, always replace pilot adjustment cover screw and tighten firmly to assure proper gas control operation.
  - Set thermostat below room temperature to end call for heat.
- ☐ Recheck ignition sequence as follows:
  - Reconnect main valve wire.
  - Set thermostat to call for heat.
  - Watch ignition sequence at burner.
  - If spark still does not stop after pilot lights, replace ignition module.
  - If main burner does not light or if main burner lights but system locks out, check module, ground wire, and gas control as described in control module instructions.

Fig. 7—Example of unsatisfactory pilot flames.

APPEARANCE	APPEARANCE	CAUSE
SMALL BLUE FLAME 	SMALL BLUE FLAME 	CHECK FOR LACK OF GAS FROM: • CLOGGED ORIFICE FILTER • CLOGGED PILOT FILTER • LOW GAS SUPPLY PRESSURE • PILOT ADJUSTMENT AT MINIMUM
LAZY YELLOW FLAME 	LAZY YELLOW FLAME 	CHECK FOR LACK OF AIR FROM: • DIRTY ORIFICE • DIRTY LINT SCREEN, IF USED • DIRTY PRIMARY AIR OPENING, IF THERE IS ONE • PILOT ADJUSTMENT AT MINIMUM
WAVING BLUE FLAME 	WAVING BLUE FLAME 	CHECK FOR: • EXCESSIVE DRAFT AT PILOT LOCATION • RECIRCULATING PRODUCTS OF COMBUSTION
NOISY LIFTING BLOWING FLAME 	NOISY LIFTING BLOWING FLAME 	CHECK FOR: • HIGH GAS PRESSURE
HARD SHARP FLAME 	HARD SHARP FLAME 	THIS FLAME IS CHARACTERISTIC OF MANUFACTURED GAS CHECK FOR: • HIGH GAS PRESSURE • ORIFICE TOO SMALL

M3778

#### CHECK IGNITION CABLE

1. Assure that ignition cable is not in contact with metal surfaces.
2. Assure that ignition cable is not more than 3 feet [1 m] long.
3. Assure connections to the ignition module stud terminal and the igniter-sensor are clean and tight.
4. Check electrical continuity of ignition cable.

#### CHECK GROUNDING

1. If ground is poor or erratic, safety shutdown will occur. Therefore, if nuisance shutdowns are reported, check the ground precautions in Wire Igniter-Sensor section.

2. If leadwire is damaged or deteriorated, use no. 14 to 18 gauge, moisture-resistant, thermoplastic, insulated wire with 221° F [105° C] minimum rating as replacement.

3. Excessive temperature at the ceramic flame rod insulator will permit electrical leakage to ground.

- a. If bracket is bent, bend it back to correct position.
- b. If insulator is cracked, replace pilot burner/igniter-sensor.

#### TEST SAFETY LOCKOUT

Refer to appliance manufacturer instructions to test for proper safety lockout times.

Home and Building Control  
Honeywell Inc.  
1985 Douglas Drive North  
Golden Valley, Minnesota 55422

Home and Building Control  
Honeywell Limited—Honeywell Limitée  
740 Ellesmere Road  
Scarborough, Ontario  
M1P 2V9

**Honeywell**  
*Helping You Control Your World*



Printed in U.S.A.

**Design:**  
2-way solenoid valve, direct acting, normally closed (Circuit function A).

**Seal Materials and Fluids handled:**  
See Table 1.

**Fluid and Ambient Temperature:**  
**For Hazardous Locations Div. 1 (T4 rated)**  
Max. Ambient Temperature 104 F (40 C)  
Max. Fluid Temperature 194 F (90 C)  
The UL-listed valve for Hazardous Locations is suitable for the fluids air, inert gas, water and gasoline.

**For Hazardous Locations Div. 1 (T6 rated)**  
Max. Ambient Temperature 104 F (40 C)  
Max. Fluid Temperature 140 F (60 C)

**For Intrinsically Safe Apparatus for use in Class I, II and III, Division 1 Hazardous Locations (T6 rated)**  
Max. Ambient Temperature 140 F (60 C)  
Max. Fluid Temperature 140 F (60 C)

**For Hazardous Locations Div. 2 and Ordinary Locations:**  
See Table 1.

**Pressure Range:**  
Maximum inlet pressure see label on valve.

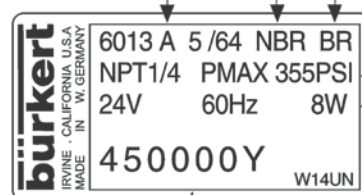
**Installation:**  
Before installing valve ensure that piping etc. is free of foreign matter (metal shavings, pipe sealing materials, welding scale etc.). Installation as required but preferable with coil uppermost. Installation in this position tends to prevent foreign matter remaining in core tube (increased life). Do not put any loads on coil unit.

PTFE tape is recommended for sealing ports. Mounting is accomplished by means of four M4 x 8 mm tapped holes located on the valve underside. Letters on valve body indicate pressure port, exhaust and outlet of the valve.

**Marking (example):**

**Body Material**  
BR = Brass  
SS = Stainless Steel  
**Seal Material**  
EPDM = EPDM  
NBR = NBR  
FKM = FKM

**Circuit function**  
A = Normally closed



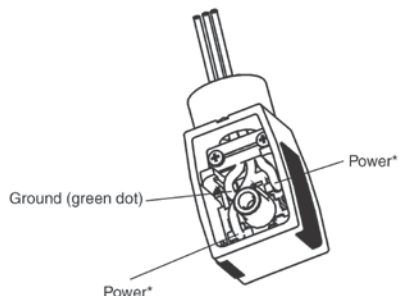
**Item No.**  
**Voltage / Frequency / Power Consumption**  
**Maximum Pressure**

**Approvals**

The valve is either approved as  
General Purpose valve for Hazardous Locations  
Class I, Division 1, Group A, B, C, D  
Class II, Division 1, Group E, F, G  
Class III, Division 1 and 2  
Operating Temperature T 4  
or  
General Purpose valve for Hazardous Locations  
Class I, Division 1, Group A, B, C, D  
Class II, Division 1, Group E, F, G  
Class III, Division 1 and 2  
Operating Temperature T 6  
or  
Intrinsically Safe Apparatus for Hazardous Locations  
Class I, Division 1, Group A, B, C, D  
Class II, Division 1, Group E, F, G  
Class III, Division 1  
Operating Temperature T 6  
or  
FM approved as  
Nonincendive for Hazardous Locations  
Class I, Division 2, Group A, B, C, D  
Class II, Division 2, Group F, G  
Class III, Division 1 and 2  
Operating Temperature T 4  
UL listed for General Purpose  
CSA approved for General Purpose  
See label on the valve.

Operating Instructions 0512/07\_EN-EN\_00893618

Table 1		Seal Materials		Seat / O-ring
Fluid	Temperatures [°F]	Buna "N" NBR	Ethylene Propylene (EPDM)	FKM
Air	Fluid Temp.	+ 14 to + 194	- 40 to + 266	+ 14 to + 266
	Ambient	+ 14 to + 130	+ 14 to + 130	+ 14 to + 130
Water	Fluid Temp.	+ 32 to + 194	+ 32 to + 212	+ 32 to + 212
	Ambient	+ 32 to + 130	+ 32 to + 130	+ 32 to + 130
Neutral gas	Fluid Temp.	+ 14 to + 194	- 40 to + 266	+ 14 to + 266
	Ambient	+ 14 to + 130	+ 14 to + 130	+ 14 to + 130
Light oil	Fluid Temp.	+ 14 to + 194		+ 14 to + 266
	Ambient	+ 14 to + 130		+ 14 to + 130

**Wiring Diagram****Electrical Connection Type 2509**

\* Orientation is not important

**Electrical Connection:**

Ensure supply voltage/frequency corresponds with that on label.

Voltage tolerance is  $\pm 10\%$ .

Available Electrical Connections see "Marking".

Wiring diagram see above.

For this product to be considered UL-listed and CSA approved for General Purpose and FM approved for Hazardous Locations Division 2, it must be in conjunction with either the type 2509 or the type H cable plug connector (Electrically Operated Valves Parts, YSY12). The connector and gasket must be assembled to the valve with the screw provided after the connection of the wire leads. This valve and connector assembly is delivered together and is to be used as one unit.

For valves to be used in Intrinsically Safe Applications the positive pole is identified by a "+" on the pin or wire No. 1 has to be connected to the "+".

See Control Drawing for the Rules of Interconnection.

**Warning:**

All valves to be used in Intrinsically Safe Applications must be clearly marked as Intrinsically Safe Apparatus.

**Trouble-Shooting:**

Check port connections, minimum operating pressure differential if required and supply voltage. Ensure pilot hole in piston is clear and pilot bore in the valve outlet is not obstructed. If core does not pull in, check for short circuit, coil burn-out or foreign matter impeding core movement. A jammed or missing core causes the coil to overheat in the case of AC supply.

**Warning:**

These products are designed to operate in a wide variety of applications, it is the user's responsibility to select a model that is appropriate for the application. This product is designed to be installed only by suitably qualified and trained personnel. Specifications should not be exceeded under any circumstances.

The maximum torque for the terminal screw on type 2509 is 0,5 Nm (4,4 lbf-in.).

Changes made to this product will render any applicable warranty null and void.

Specifications subject to change without notice.

Any questions? Please call Bürkert Contrumatic Technical Service at (949) 223 31 00.

**bürkert**

Steuer- und Regeltechnik  
Christian-Bürkert-Str. 13-17  
74653 Ingelfingen  
Telefon (0 79 40) 10-111  
Telefax (0 79 40) 10-448  
www.buerkert.com  
info@de.buerkert.com

Australia: Seven Hills NSW 2147, Ph. (02) 1300 888 868  
Austria: 1150 Wien, Ph. (01) 894 13 33  
Belgium: B-2110 Wijnegem, Ph. (03) 325 89 00  
Brazil: 04715-005 São Paulo - SP, Ph. (011) 51 82 00 11  
Canada: Oakville, Ontario L6L 6M5, Ph. (905) 847 55 66  
China: Shanghai, Ph. (8621) 58 68 21 19  
Czech Republic: 60200 Brno, Ph. (543) 25 25 05  
Denmark: 2730 Herlev, Ph. (44) 50 75 00  
Estonia: EE-12915 Tallin, Ph. (372)644 06 98  
Finland: FI-00370 Helsinki, Ph. (09) 54 97 06 00  
France: 67220 Triembach au Val, Ph. (0388) 58 91 11  
Hong Kong: Kwai Chung NT, Ph. 24 80 12 02  
India: Chennai 600 028, Ph. (044)52 30 34 56  
Italy: 20060 Cassina De' Pecchi (Mi), Ph. (02) 95 90 71  
Japan: Tokyo 166-0004, Ph.(03) 53 05 36 10  
Korea: Seoul 153-811, Ph. (02) 34 62 55 92  
Malaysia: 11960 Penang, Ph. (04) 64 350 08

Berlin, Ph. (0 30) 67 97 17-0  
Frankfurt, Ph. (0 61 03) 9 41 40  
Hannover, Ph. (05 11) 902 76-0  
Dresden, Ph. (03 59 52) 36-300  
Dortmund, Ph. (0 23 73) 96 81-0  
München, Ph. (0 89) 8 29 22 80  
Stuttgart, Ph. (07 11) 451 10-0

Netherlands: NL-3542 DP Utrecht, Ph. (0346) 58 10 10  
New Zealand: Penrose, Auckland, Ph. (09) 622 28 40  
Norway: 2013 Skjetten, Ph. (63) 84 44 10  
Philippines: Paranaque City, Ph. (02) 776 43 84  
Poland: PL-02-904 Warszawa, Ph. (022) 840 60 10  
Portugal: Sales office in Spain, Ph. (21) 21 28 490  
Singapore: Singapore 408933, Ph. 68 44 22 33  
South Africa: Millenium Business Park, Ph. (011) 574 60 00  
Spain: 08970 Sant Joan Despi, Barcelona, Ph. (93) 477 79 80  
Sweden: 21120 Malmö, Ph. (040) 664 51 00  
Switzerland: 6331 Hünenberg ZG, Ph. (041) 785 66 66  
Taiwan: Taiwan 115, Ph. (02) 26 53 78 68  
Turkey: TR-Yenisehir-Izmir, Ph. (0232) 459 53 95  
United Kingdom: Stroud, Glos, GL5 2QF, Ph. (01453) 731353  
USA: Irvine, CA 92614, Ph. (949) 223 31 00



**Design:**

2-way solenoid valve, direct acting, normally closed (Circuit function A).

**Seal Materials and Fluids handled:**

See Table 1.

**Fluid and Ambient Temperature:****For Hazardous Locations Div. 1 (T4 rated)**

Max. Ambient Temperature 104 °F (40 °C)

Max. Fluid Temperature 194 °F (90 °C)

The UL-listed valve for Hazardous Locations is suitable for the fluids air, inert gas, water and gasoline.

**For Hazardous Locations Div. 1 (T6 rated)**

Max. Ambient Temperature 104 °F (40 °C)

Max. Fluid Temperature 140 °F (60 °C)

**For Intrinsically Safe Apparatus for use in Class I, II and III,****Division 1 Hazardous Locations (T6 rated)**

Max. Ambient Temperature 140 °F (60 °C)

Max. Fluid Temperature 140 °F (60 °C)

**For Hazardous Locations Div. 2 and Ordinary Locations:**

See Table 1.

**Pressure Range:**

Maximum inlet pressure see label on valve.

**Installation:**

Before installing valve ensure that piping etc. is free of foreign matter (metal shavings, pipe sealing materials, welding scale etc.). Installation as required but preferable with coil uppermost. Installation in this position tends to prevent foreign matter remaining in core tube (increased life). Do not put any loads on coil unit.

PTFE tape is recommended for sealing ports. Mounting is accomplished by means of four M4 x 8 mm tapped holes located on the valve underside. Letters on valve body indicate pressure port, exhaust and outlet of the valve.

**Marking (example):****Body Material**

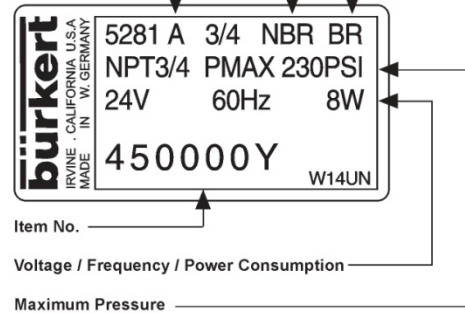
BR = Brass  
SS = Stainless Steel

**Seal Material**

EPDM  
NBR  
FKM

**Circuit function**

A = Normally Closed  
B = Normally Open

**Approvals**

The valve is either approved as

General Purpose valve for Hazardous Locations

Class I, Division 1, Group A, B, C, D

Class II, Division 1, Group E, F, G

Class III, Division 1 and 2

Operating Temperature T 4

or

General Purpose valve for Hazardous Locations

Class I, Division 1, Group A, B, C, D

Class II, Division 1, Group E, F, G

Class III, Division 1 and 2

Operating Temperature T 6

or

Intrinsically Safe Apparatus for Hazardous Locations

Class I, Division 1, Group A, B, C, D

Class II, Division 1, Group E, F, G

Class III, Division 1

Operating Temperature T 6

or

FM approved as

Nonincendive for Hazardous Locations

Class I, Division 2, Group A, B, C, D

Class II, Division 2, Group F, G

Class III, Division 1 and 2

Operating Temperature T 4

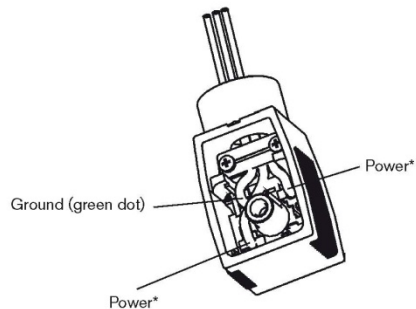
UL listed for General Purpose

CSA approved for General Purpose

See label on the valve.

Operating Instructions 0605/09\_EN-EN\_00800027

Table 1		Seal Materials			Seat / O-ring	
Fluid	Temperatures [°F]	Buna "N" NBR	Ethylene Propylene (EPDM)	FKM		
Air	Fluid	+ 14 to + 194	- 40 to + 194	+ 14 to + 194		
	Ambient	+ 14 to + 130	+ 14 to + 130	+ 14 to + 130		
Water	Fluid	+ 32 to + 194	+ 32 to + 194	+ 32 to + 194		
	Ambient	+ 32 to + 130	+ 32 to + 130	+ 32 to + 130		
Neutral gas	Fluid	+ 14 to + 194	- 40 to + 194	+ 14 to + 194		
	Ambient	+ 14 to + 130	+ 14 to + 130	+ 14 to + 130		
Light oil	Fluid	+ 14 to + 194		+ 14 to + 194		
	Ambient	+ 14 to + 130		+ 14 to + 130		

**Wiring Diagram****Electrical Connection Type 2509**

\* Orientation is not important

**Electrical Connection:**

Ensure supply voltage/frequency corresponds with that on label.  
Voltage tolerance is  $\pm 10\%$ .  
Available Electrical Connections see "Marking".  
Wiring diagram see above.

For this product to be considered UL-listed and CSA approved for General Purpose and FM approved for Hazardous Locations Division 2, it must be in conjunction with the type 2509 cable plug connector (Electrically Operated Valves Parts, YSY12).

The connector and gasket must be assembled to the valve with the screw provided after the connection of the wire leads. This valve and connector assembly is delivered together and is to be used as one unit.

For valves to be used in Intrinsically Safe Applications the positive pole is identified by a "+" on the pin or wire No. 1 has to be connected to the "+".

See Control Drawing for the Rules of Interconnection.

**Warning:**

All valves to be used in Intrinsically Safe Applications must be clearly marked as Intrinsically Safe Apparatus.

**Trouble-Shooting:**

Check port connections, minimum operating pressure differential if required and supply voltage. Ensure pilot hole in piston is clear and pilot bore in the valve outlet is not obstructed. If core does not pull in, check for short circuit, coil burn-out or foreign matter impeding core movement. A jammed or missing core causes the coil to overheat in the case of AC supply.

**Warning:**

These products are designed to operate in a wide variety of applications, it is the user's responsibility to select a model that is appropriate for the application. This product is designed to be installed only by suitably qualified and trained personnel. Specifications should not be exceeded under any circumstances.

The torque for the terminal screw on type 2509 is 0,5 Nm (4,4 lbf-in.).

Changes made to this product will render any applicable warranty null and void.

Specifications subject to change without notice.

Any questions? Please call Bürkert Contromatic Technical Service at (949) 223 31 00.

MAN 1000010153 EN Version: | printed: 05.07.2010 Status: RL (released | freigegeben)

**Germany**

Contact address:

Bürkert Fluid Control Systems  
Sales Center  
Chr.-Bürkert-Str. 13-17  
D-74653 Ingelfingen  
Tel. + 49 (0) 7940 - 10 91 111  
Fax + 49 (0) 7940 - 10 91 448  
E-mail: info@de.buerkert.com

**International**

Contact addresses can be found on the Internet at:

[www.burkert.com](http://www.burkert.com) → Bürkert → Company → Locations