

# ACL

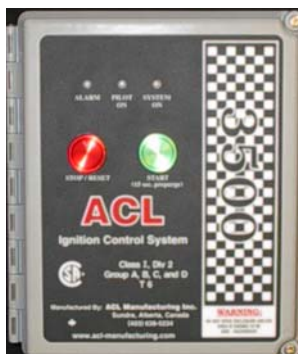
Manufacturing Inc.

## ACL 3500 Combustion Safety Control

The ACL 3500 provides low cost ignition, flame fail and shutdown capabilities for gas fired heaters.

### Features

- Simple to use, no programming necessary
- Built in logic allows for automatic ignition & re-light, shutdown interlocks, run status.
- Versatile power supply 9-30 VDC, 120 VAC 50/60 Hz. & Solar.
- Fastest flame out response time of 0.8 seconds.
- CSA approved for Class 1, Div 2 location.
- CSA approved C22.2 No 199-M89. Combustion safety controls and solid-state Igniters for Gas & Oil burning equipment.
- CSA B149.3 Compatible.
- Nema 4x enclosure, corrosion resistant and weatherproof.



### Simple Design

- No programming necessary
- Two button operation (Stop & Start)
- New innovative design allows ignition and flame fail with the use of one flame rod
- Control and ignition components are all housed in the Nema 4x enclosure control box
- Easily installed into any burner.

## ACL-3500 Combustion Safety Controller

### Features

- Provides safe ignition and flame monitoring for gas fired heaters.
- 12-24 VDC
- 120 VAC option available.
- CSA Class 1 Div 2
- CSA C22.2 No 199-M89
- Solid state ignition delivers 30 sparks per second.
- Flame rod technology utilized to sense flame, ignition resumes immediately upon loss of flame.

### Theory of Operation

The ACL-3500 utilizes a single ignitor/flame rod to provide both flame acknowledgement and ignition at the burner tip. When the ACL-3500 starts its ignition sequence, fuel gas travels to the burner tip where the ignitor/flame rod is located and sparking. Once the gas is lit, the flame becomes a current path for the ignitor/flame rod for flame acknowledgement and the unit stops sparking. If this flame is extinguished, the current path is broken and the ignitor/flame rod starts sparking within 1 second.

### Controller Mounting

The ACL-3500 can be mounted in a Class 1 Div 2 area, usually close to the burner. The maximum recommended length of ignition lead is 10' (supplied) and can be run free air. **Note:** Lead lengths in excess of 10' or use of metal or metallic sheathed conduit may result in a diminished ignitor rod voltage. A ground wire (also supplied) must be connected between the ground lug on the burner assembly and the bonding ground terminal on the main circuit board. If the controller must be mounted farther away from the burner assembly, the ignition module, which is mounted on the main circuit board, may be mounted in or near the burner housing using the optional, CSA approved, ACL5000R remote mount kit.

### Sequence of Operation

|  | System On Light | Pilot Light | Solenoid #1 | Solenoid #2 | Alarm Light                          | Ignition | Run Status Contacts |
|--|-----------------|-------------|-------------|-------------|--------------------------------------|----------|---------------------|
| Stop/reset pressed                       | OFF             | OFF         | OFF         | OFF         | OFF                                  | OFF      | OPEN                |
| Push start (5 second trial for ignition) | ON              | ON          | ON          | OFF         | OFF (Momentarily on for Diagnostics) | ON       | CLOSED              |
| Pilot flame lit                          | ON              | ON          | ON          | OFF         | OFF                                  | OFF      | CLOSED              |
| 20 seconds later (T1 adjustable)         | ON              | ON          | ON          | ON          | OFF                                  | OFF      | CLOSED              |
| Pilot flame extinguished                 | ON              | ON          | ON          | ON          | OFF                                  | ON       | CLOSED              |
| Fails to light after 5 seconds           | ON              | OFF         | OFF         | OFF         | ON                                   | OFF      | OPEN                |

### **Power Connections**

The ACL-3500 is available in 12-24 VDC or an optional 120 VAC. Voltage requirements must be specified when ordering. The supply voltage of each unit is clearly marked inside the door on the specification label and on the circuit board beside its respective terminal. **Incorrect polarity on 12-24 VDC units may result in damage to circuit board components.** The terminal marked ground is for power supply or system ground and the terminal marked bonding ground is strictly for the ground wire to the burner assembly. It is important that a ground wire (supplied) be connected between the bonding ground terminal and the burner assembly to provide an uninterrupted path for the flame acknowledgement current.

### **Solenoid Outputs**

There are two solenoid output terminals on the main circuit board marked solenoid #1 and solenoid #2. The output voltage at these terminals is always the same as the controller supply voltage. The combined power consumption of solenoids connected to a system should not exceed 12 watts for a 12 VDC unit, 24 watts for a 24 VDC unit and 30 watts for a 120 VAC unit. (ACL Manufacturing carries a line of Class I Div I extra low watt solenoid valves available in all three voltages.) Solenoid #1 output connects to the pilot or low fire solenoid and is energized when a start is initiated. Solenoid #2, (main burner) energizes only after the pilot or low fire flame has been proven. The time delay between proof of flame and energizing of output #2 is factory set at 20 seconds and is adjustable with T1.

### **S/D Interlock**

The shutdown interlock provides a means of connecting other shutdown devices such as low level or high temperature switches for additional protection. A jumper is installed at the factory and should only be removed to utilize this feature. Shutdown devices connected (in series) to the S/D interlock terminals must be dry contacts and be in a closed state during normal operating conditions. If any of the S/D switches go to a fault condition, their contacts will open, de-energizing the solenoid output and shutting down fuel to the burner. The controller will attempt one 5 second re-light but will be unsuccessful and go into alarm. Once the fault condition is corrected the system can be restarted by pressing the stop/reset and then the start buttons. **Note:** If a restart is attempted without clearing the fault condition the controller will again attempt a re-light, without energizing the solenoid output and will return to an alarm condition.

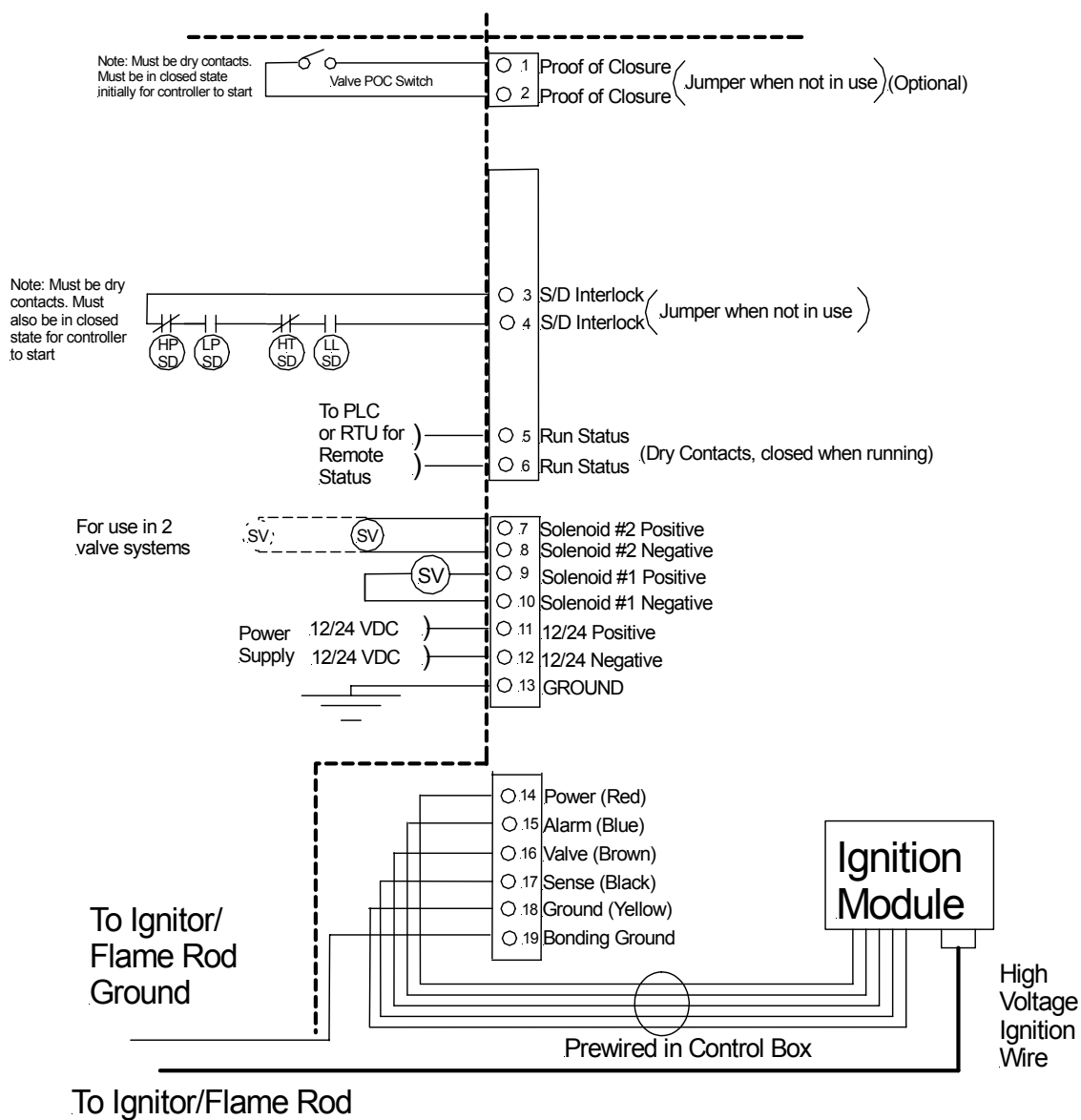
### **Proof of Closure (Optional)**

This feature allows controller to use valves with proof of closure switches for valve status. When valve switch contacts are in an open state confirming the valve may be open, the controller will not start. The contacts must be closed in order for controller to start. Once start is initiated, the contacts from proof of closure switch can then change state.

### **Run Status**

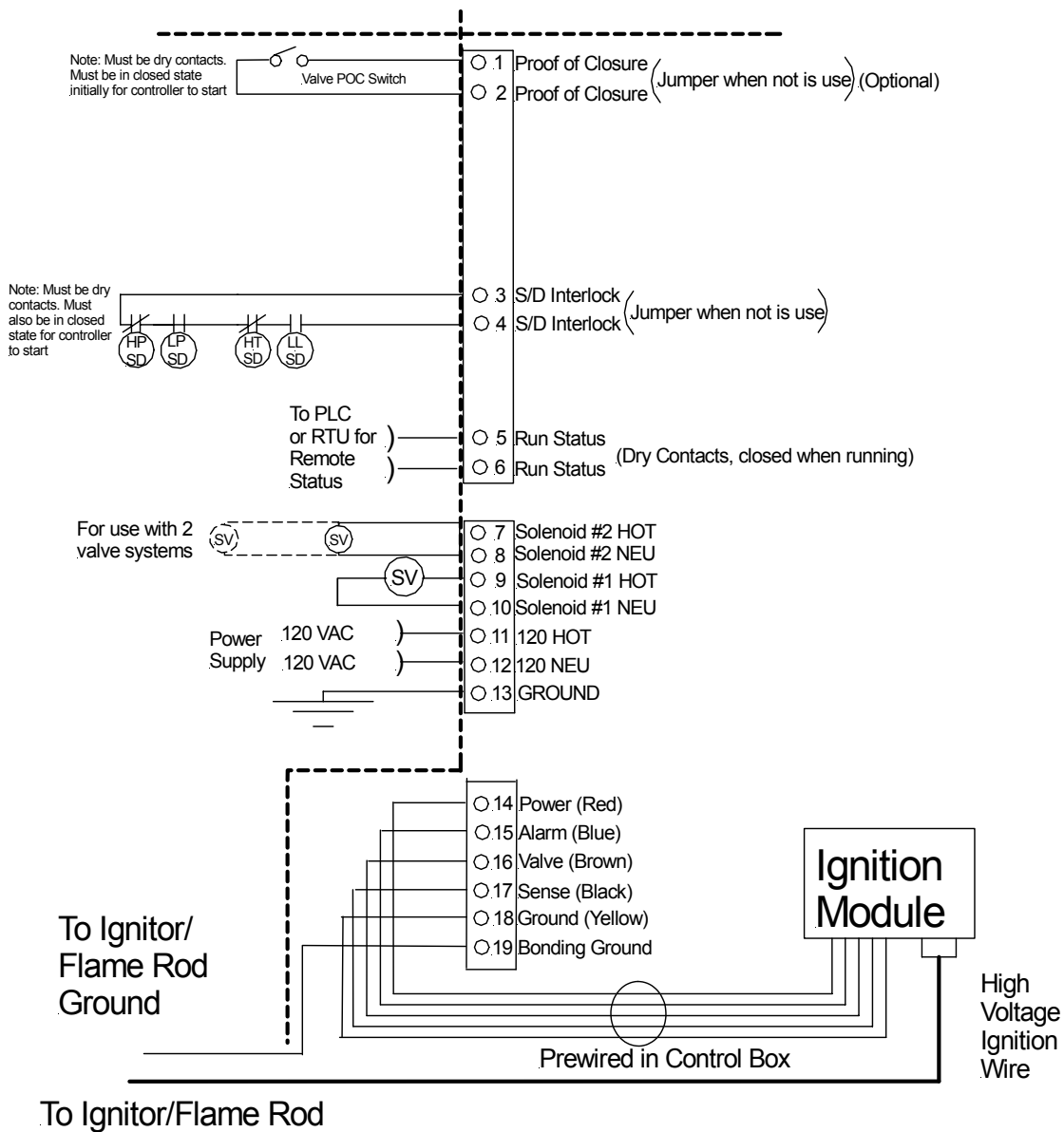
This output provides a run status of the controller. These contacts are a normally open set of dry contacts when the controller is off or in alarm state. When the controller is running normally, these contacts are closed.

# ACL 3500 12/24 VDC



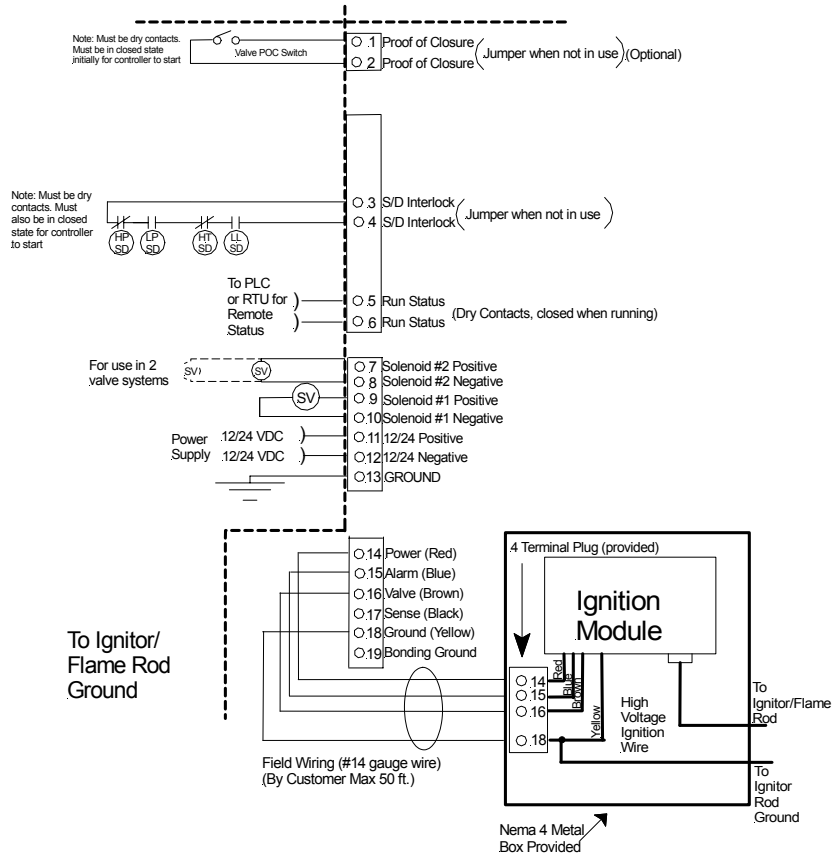
| Specifications              |                     |
|-----------------------------|---------------------|
| Voltage                     | 12-24 VDC           |
| Current                     | .204/.102 amps      |
| Power                       | 2.45 watts          |
| Operating temperature       | -40 C to 60 C       |
| Flame signal current        | 1 micro amp minimum |
| Flame failure response time | 0.8 seconds maximum |
| Spark rate                  | 30 sparks/second    |

# ACL 3500 120 VAC

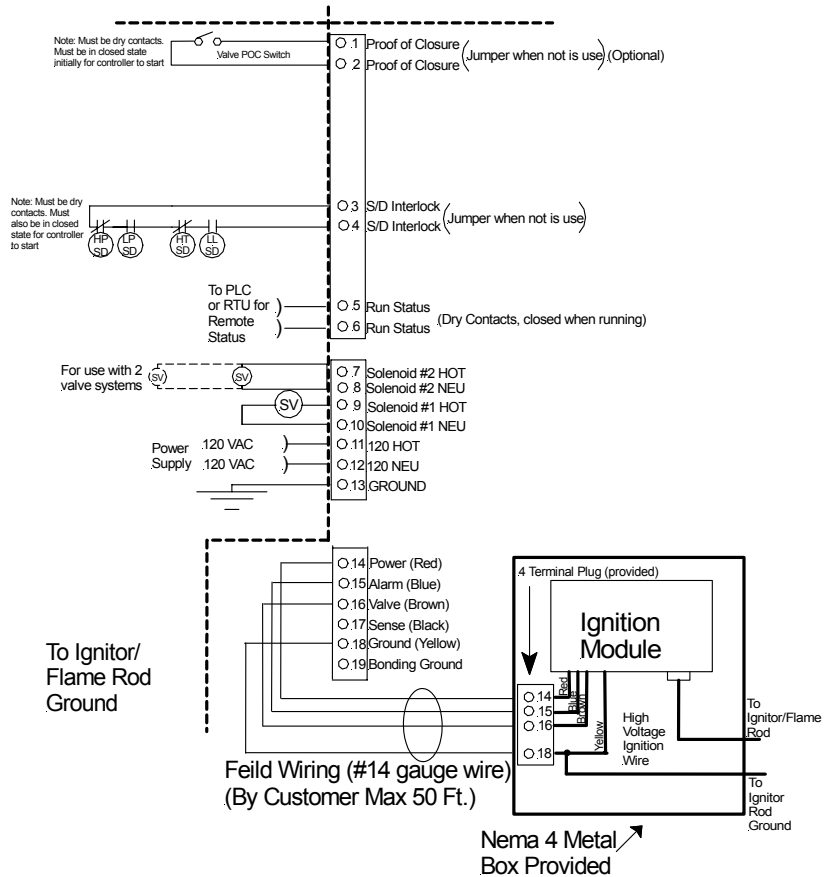


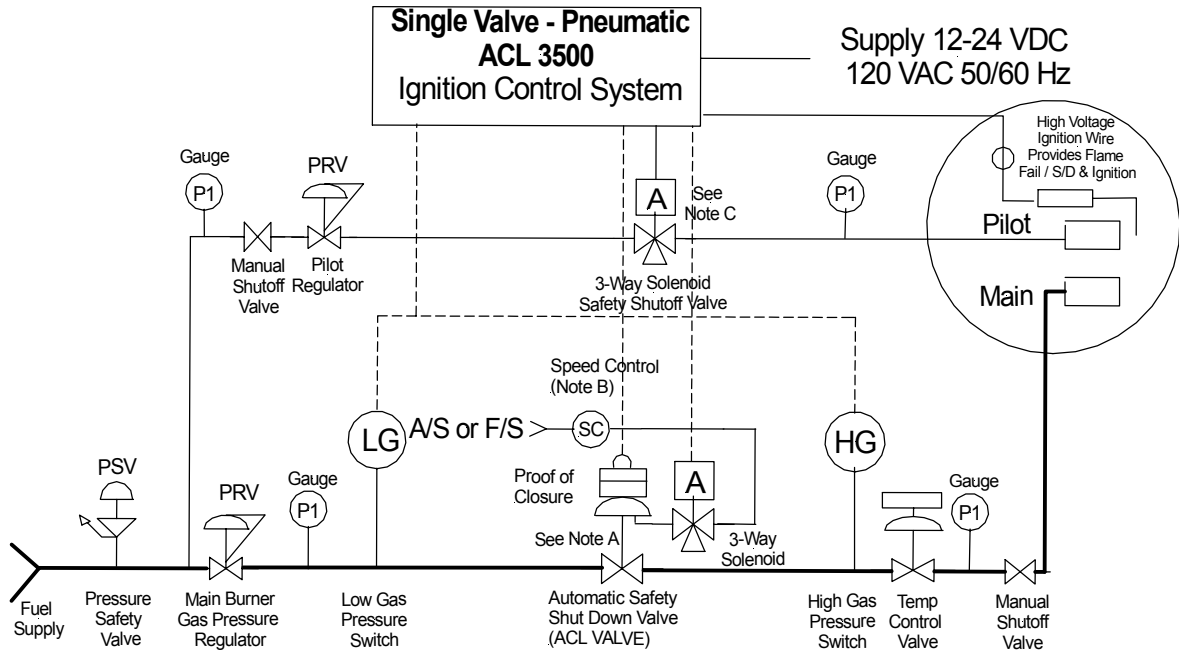
| Specifications              |                     |
|-----------------------------|---------------------|
| Voltage                     | 120/240 VAC         |
| Current                     | 1.05 amps           |
| Power                       | 12.75 watts         |
| Frequency                   | 50/60 Hertz         |
| Operating temperature       | -40 C to 60 C       |
| Flame signal current        | 1 micro amp minimum |
| Flame failure response time | 0.8 seconds maximum |
| Spark rate                  | 30 sparks/second    |

## Optional Remote Mount Ignition Module ACL 3500 12/24 VDC



## Optional Remote Mount Ignition Module ACL 3500 120 VAC



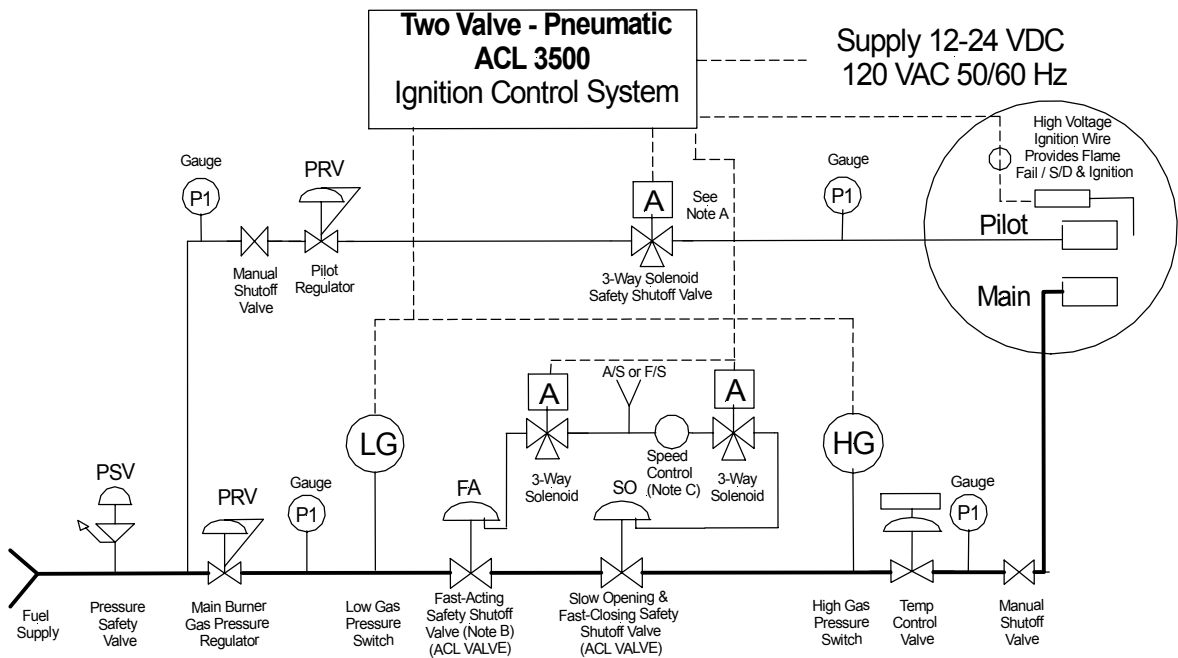


Note A: Auto safety shutdown valve with proof of closure switch  
Must be in accordance with CGA Standard 6.5/ANSI Z21.21  
and marked C/1 or in accordance with CGA Standard 3.9

Note B: 1/4" x 1/4" Speed Control Valve Supplied

Note C: CSA approved Class 1 Div 1 solenoid valve-ACL-SV-SSO 1/8" solenoid valve

NOTE: This drawing is recommended for use with gas appliances that must conform to CSA B149.3.  
Valve train diagram #3 Single Burner Application

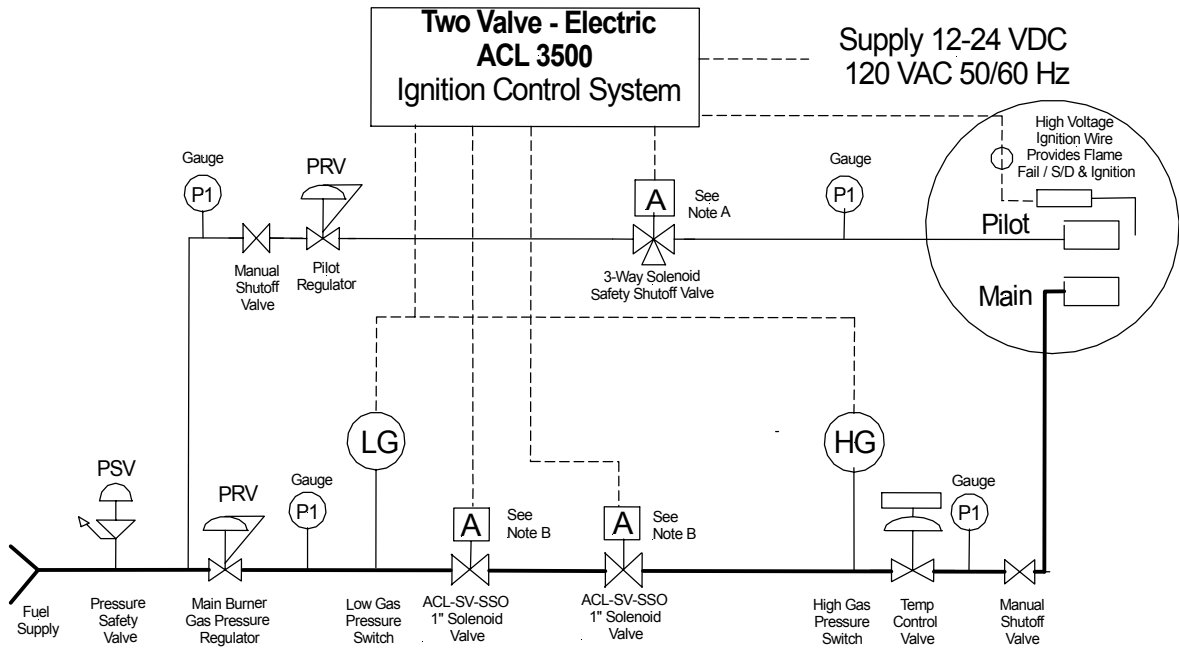


Note A: Solenoid CSA Certified Class I Div I

Note B: Must be in accordance with CGA Standard 6.5/ANSI Z21.21  
and marked C/1 or in accordance with CGA Standard 3.9

Note C: 1/4" x 1/4" Speed Control Valve Supplied

Note: This drawing is recommended for use with gas appliances that must conform to CSA B149.3 Valve Train diagram #3 Single Burner Application



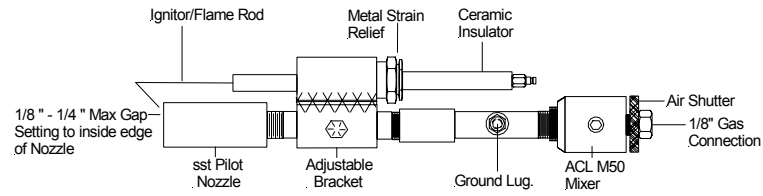
Note A: Solenoid CSA Certified 6.5-2000 C/I Class I Div I ACL-SV-SSO 1/8" solenoid valve

Note B: Solenoid CSA Certified 6.5-2000 C/I Class 1 Div 1 ACL-SV-SSO 1" solenoid valve

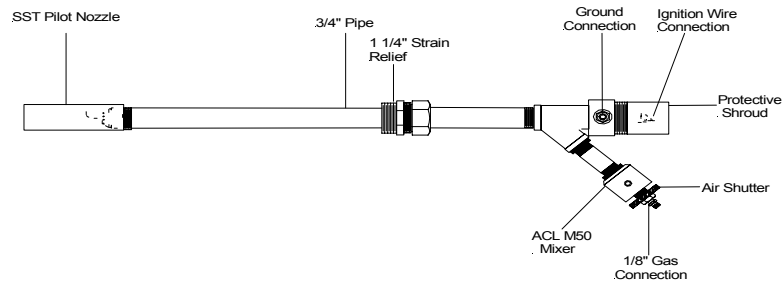
Note: This drawing is recommended for use with gas appliances that must conform to CSA B149.3 Valve Train diagram #3 Single Burner Application

## Optional Pilot Assemblies

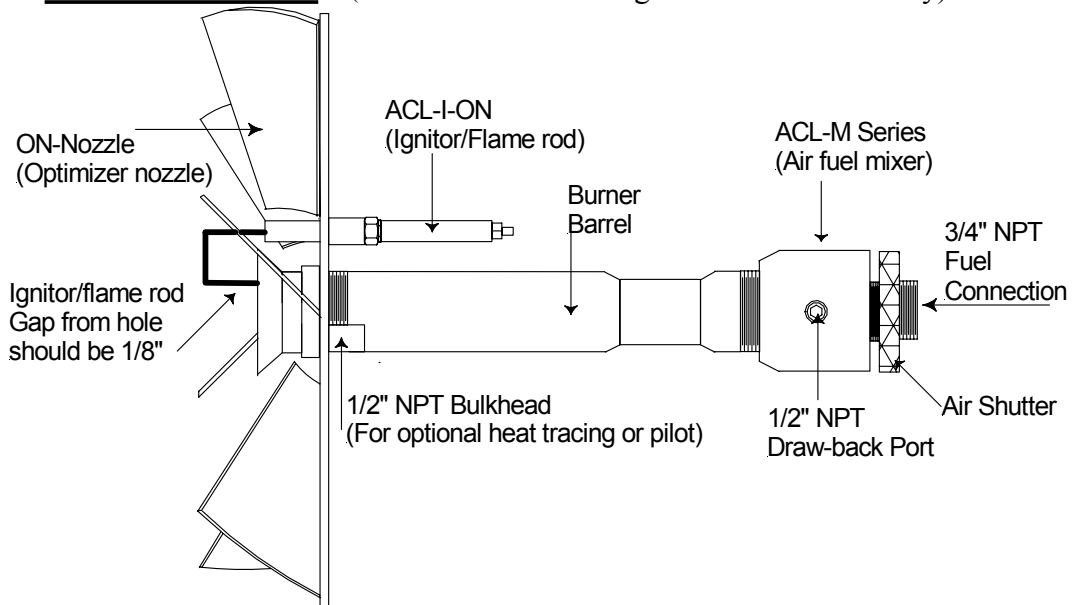
### Standard M50 pilot assembly



### ACL 1500 pilot assembly

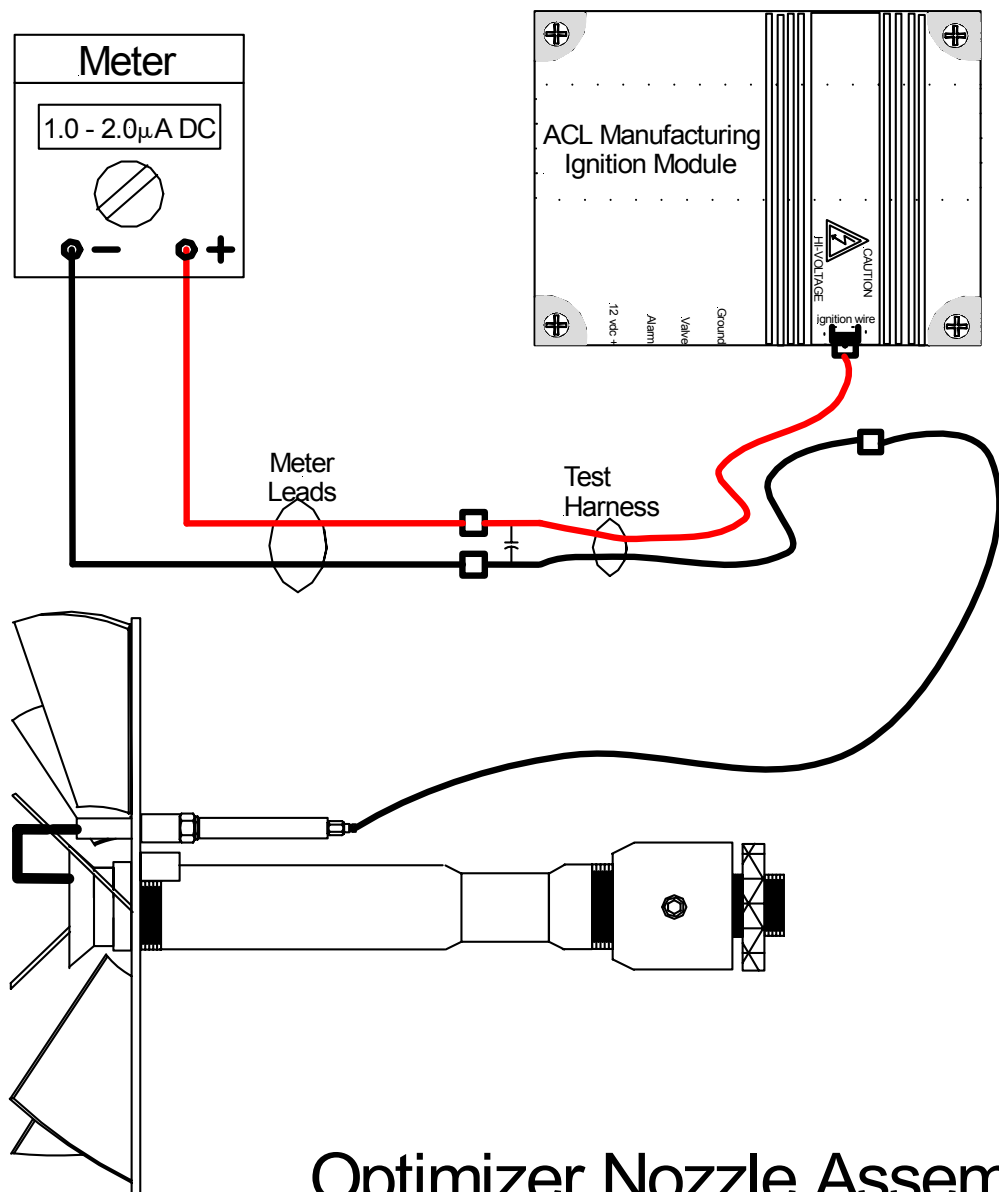


### ACL-HE-ON Burner (Combined low fire/high fire burner assembly)



# Flame Signal Test Procedure

1. Turn Power off to ACL Controller
2. Remove high-voltage ignition wire from ignition module and insert meter leads w/test harness as shown.
3. Turn on power and initiate start sequence.
4. Meter will give erratic readings during ignition period but should settle down between 1-2  $\mu\text{A}$  reading on meter.
5. Adjust air shutter on pilot mixer and adjust pressure on regulator to achieve a flame signal close to 2 $\mu\text{A}$  which is optimum.



Optimizer Nozzle Assembly  
with ignitor/flame rod

## Troubleshooting Guide

### Fails to attempt ignition

|  |  |
|--|--|
| Blown fuse                                       | Replace fuse 4 amp max-F1,F2 on circuit board  |
| Battery voltage low (solar pkg. only)            | Charge battery to minimum of 11.5 volts. Check solar panel connections.  |
| Poor power connections                           | Check connections on terminal strips   |
| Defective ignition module                        | Remove module and send for repair/replace  |
| Defective control board                          | Remove control board & send for repair   |
| Electrode shorted out                            | Ensure proper gap approx. 1/8" - 1/4" max  |
| Stop/Reset or Start button failed                | Disconnect button wiring from annunciator board terminals on the inside of controller door. With meter, check both buttons for normally open state. When the button is pushed, contacts should momentarily close.  |
| Proof of closure circuit open (where applicable) | If proof of closure feature is being utilized disconnect proof of closure field wiring on circuit board terminals. Place temporary jumper across terminals to verify operation. If proof of closure feature is not used, ensure a permanent jumper is installed. |

### Attempts ignition, but doesn't light ("pilot on" light is ON)

|   |   |
|---|---|
| Fuel gas supply to pilot may be too high or too low | Pilot fuel gas supply should be set at 5 psi, adjust air/fuel mix on pilot, and adjust regulator  |
| Gap setting on ignitor/flame rod not correct        | Gap should be approximately 1/8". On systems without a pilot, ensure that electrode tip is positioned near one of the small openings in the main burner nozzle. |
| Poor ground   | Ensure ground connections are good in control box and at pilot assembly in fire tube.   |
| Pilot solenoid failure (if applicable)              | Replace solenoid  |
| Plugged orifice on pilot (if used)                  | Clean out pilot orifice   |
| On systems without a pilot (low fire/high fire)     | Ensure that electrode tip is positioned near one of the small openings in the main burner nozzle when using the ACL HE-ON burner.                               |

### Attempts Ignition, but doesn't light ("pilot on" light is OFF)

|                                    |  |
|------------------------------------|--|
| Shutdown interlock circuit is open | Verify operation by removing shutdown interlock field wiring and install jumper in interlock terminals. If field circuit is determined to be open, correct fault (low level, high temp, etc.) or check for incorrect wiring. |
| Faulty ignition module             | Replace ignition module  |

### Weak or erratic spark

|  |   |
|--|---|
| Ignition cable may be too long, optimum length is 10 ft. or less | Shorten cable   |
| Ignition wire installed in metallic sheathed flex                | Install ignition wire in non-metallic sheathed flex or free air |
| Defective ignition module  | Replace ignition module   |
| Gap setting too wide   | Shorten gap setting to approx. 1/8"                             |
| Ignition cable defective or insulation worn                      | Replace cable   |
| Poor ground  | Check ground at both ends (control box & ignitor end)           |

### Pilot flame lit but doesn't acknowledge

|   |   |
|---|---|
| Ignitor/flame rod not positioned correctly        | Position flame rod tip to the side of one of the small holes in burner nozzle maintaining 1/8" spark gap.                                 |
| Pilot gas pressure incorrect                      | Pressure setting approx 5 psi   |
| Air shutter on mixer closed off                   | Open & adjust air shutter on mixer until good pilot established   |
| Ground not connected properly                     | Connect ground between mixer ground and bonding ground in controller  |
| Defective ignition cable or poor connection       | Make sure cable ends are connected well. A poor connection interrupts current path for acknowledgement but still allows a spark to occur. |
| Poor connection between ignition module and board | Check connections on wiring harness between ignition module and main board  |
| Defective ignition module                         | Replace   |