Capable Controls inc.

INSTALLATION INSTRUCTIONS FOR SERIES 9
INTERMITTENT PILOT IGNITION CONTROL

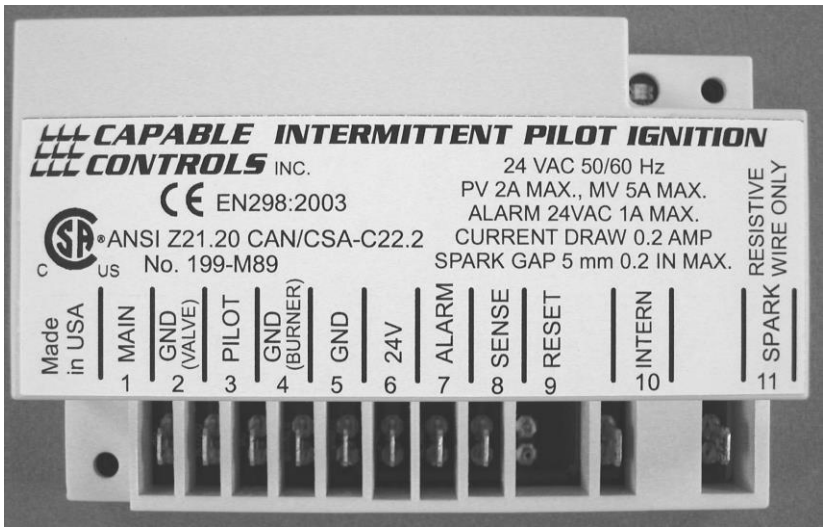

Figure 1 Series 9 Intermittent Pilot Ignition Control

Application

The Series 9 Intermittent Pilot Ignition Control is a microprocessor based ignition control. The microprocessor provides reliable software control of all timings and operates a diagnostic led. It is designed for indirect burner ignition and supervision and can be used with all gases. It provides ignition sequence, flame monitoring, and safety shutout for intermittent pilot boilers, furnaces and other heating appliances.

Specifications see part number matrix on page 2

Electrical ratings:	Voltage	24VAC (+/- 20%) 50/60 Hz
	Pilot valve	2A maximum
	Main valve	5A maximum
	Alarm output	1A maximum
	Operating current	0.2A
	Wiring connections	1/4” male spade

Environmental:	-40 to +80 degrees C (-40 to +176 F)
Waiting time;	0 to 99 (1 second minimum diagnostic)
Safety time:	4 to 125 seconds (see table)
Flame loss response:	spark restoration or recycling
Flame loss waiting time:	for recycle 1 to 99 seconds
Retries:	1 to 9 tries or continuous retry
Inter-Purge time:	1 to 99 seconds or 1 to 99 minutes
Flame failure response time:	1 second maximum
Minimum flame current required:	0.15 microamperes

Type of gas:	Natural, LP, or manufactured
Recommended Spark Gap:	5 mm, 0.2 inches maximum
Pilot burner rating:	1,500 Btu/hr. maximum
Main burner rating:	400,000 Btu/hr. maximum

WARNING: Be sure this control is suitable to replace existing control.

The control replaces many existing intermittent pilot ignition controls with flame rectification flame sense and spark ignition made by various manufacturers. When replacing an existing control be sure characteristics match.

Model Number Matrix Series 9 CE Ignition Controls

9	Always 9 for series 9 controls
A	Hardware Model see table 1
B	Special Options see Note 1 0 = None, 1 = Flame Stabilization 2 = Quick Start, 3 = Both
C	Number of Trials 0 = Continuous Retry No Lockout or select 1 to 9
D, E, F	Inter-Waiting Time Between Trials 001 to 900 sec in 1 sec steps 901 to 999 = 1 to 99 min in 1 min steps
G, H	Flame Loss Response See Note 2 If 00 Uses Spark Restoration If 01 to 99 uses Recycle 1 to 99 sec Flame Loss Waiting Time
J, K	Waiting Time Before Valve On 00 to 99 sec in 1 sec steps
L, M, N	Safety Time 000 = Infinite No Lockout 004 to 124 sec in 4 sec steps 005 to 125 sec in 5 sec steps and 006 seconds
O	Special Customer Options

Table 1 Hardware Models

0	Intermittent Pilot Int.Sense Volatile
1	Intermittent Pilot Ext.Sense Volatile
2	Intermittent Pilot Univ.Sense Volatile
8	Intermittent Pilot Int.Sense Non-Volatile
9	Intermittent Pilot Ext.Sense Non-Volatile
A	Intermittent Pilot Univ.Sense Non-Volatile

Hardware Flame Sense Options
Int. Internal through spark wire only
Ext. External with probe only
Univ. Universal Internal or External Jumper selected

Hardware Lockout options
Volatile turning off power resets lockout
Non-Volatile must operate external reset switch to reset lockout

Note 1 Special Options
Flame stabilization is only for controls with flame loss waiting time (G-H) 1 sec or more. If flame is lost within 5 sec use spark restoration. If flame lost after 5 sec use recycling. See note 2
Quick Start is only for controls with external sense only. Can turn on main valve in 1 sec instead of 4 or 5 sec.

Note 2 Flame Loss Response
With Spark Restoration main valve turns off pilot valve stays on and spark and new cycle start immediately.
With Recycing pilot and main valve turn off and new cycle starts after Flame Loss Waiting Time (G-H).

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WARNING Fire or explosion hazard. Follow these instructions carefully.

Control must only be installed by a qualified service technician.

Warning: This control is approved for use with only noise suppression (resistive) spark wires. If application has copper wire it must be replaced.

Control must be protected from water dripping or condensing on it. A wet control may malfunction causing hazardous conditions.

Appliance must be inspected for any hazardous conditions before starting up. Must be checked for proper wiring, gas leaks, water leaks, burners must be clean and vents clear.

Replacement instructions

Mounting the new control

Before replacing existing control turn off power to the appliance being serviced.

Mark wires to existing control. Disconnect wires and remove existing control.

The control is not position sensitive. It may be mounted horizontally or vertically with two #6 sheet metal or machine screws

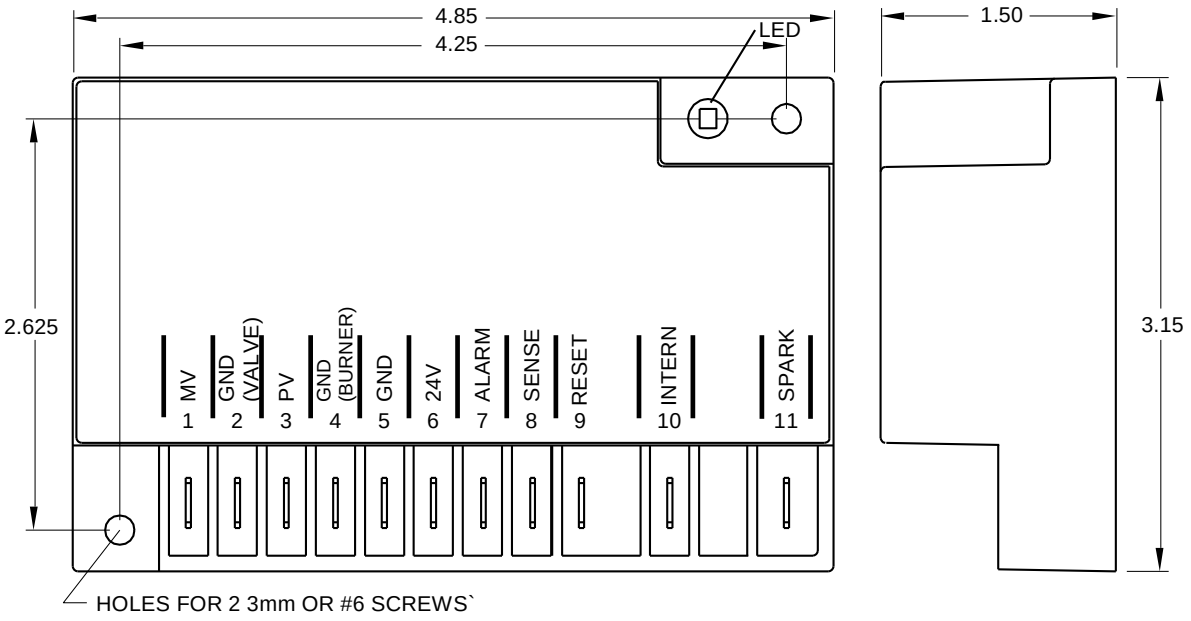

Figure 2 Mounting Dimensions

Wiring Control
Power must be provided from a properly sized 24 volt class 2 transformer. All wiring must be done in accordance with both local and national electrical code. All wiring and initial operation must be performed by a qualified service technician.

Controls with universal flame sense are supplied with a jumper wire between SENSE and INTERN terminals and is ready for internal (one rod) flame sense. With the jumper in, flame is sensed through the high voltage spark wire. For external (two rod) flame sense the jumper must be removed and discarded and the sense electrode wired to SENSE terminal.

Spark Cable
Cable must be noise suppression (resistive) type rated for at least 15kV and must not be in continuous contact with a metal surface. If separate flame sense probe is used, the sense wire must be separated from the high voltage wire by a minimum of 1/4".

Warning: This control is approved for use with only noise suppression (resistive) spark wires. If application has copper cable it must be replaced.

The schematics in Figures 3, 4, 5 and 6 show typical wiring hookups for the control.

Startup and Checkout

WARNING: The control module can not be serviced by user. If any faults are detected control module must be replaced.

1. Before starting the appliance perform a safety inspection of piping, burners and venting. Check for water leaks, etc. Check all wiring for proper connections. Be sure system is properly grounded including ground connection to pilot burner.

2. With gas shut off, turn on power to appliance with thermostat contacts closed. Verify led on module flashes rapidly and that there is a good spark at the pilot burner. If spark is not present see troubleshooting flow chart figure 8.

3. Turn off power to appliance and turn on gas shutoff valves. Check for gas leaks using a soap solution or gas detector.

4. Turn on power to appliance with thermostat contacts closed. Verify that spark lights pilot burner followed by main burner. If there are any problems shut down the appliance and refer to the troubleshooting flow charts figures 7 and 8.

5. Verify normal operation with both burners on for at least 5 minutes. Check for any gas leaks after the valves.

6. Cycle thermostat open/closed and verify proper ignition sequence at least 5 times.

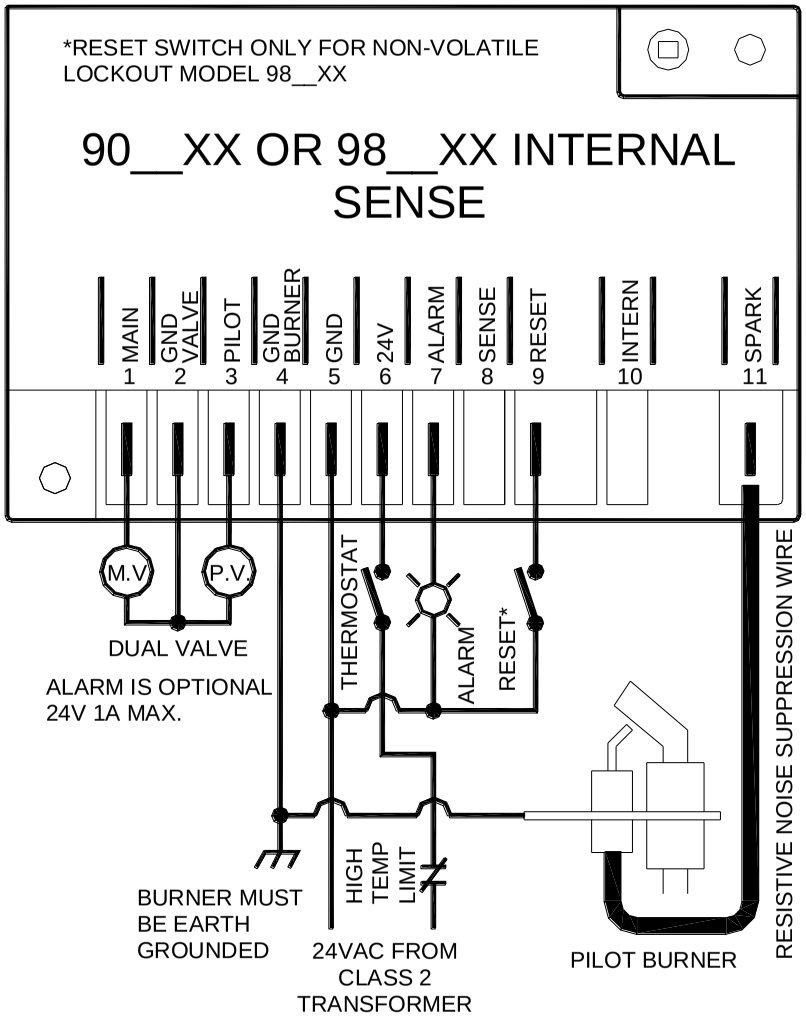

Figure 3 Wiring for Models 90_XX AND 98_XX Internal Flame Sense

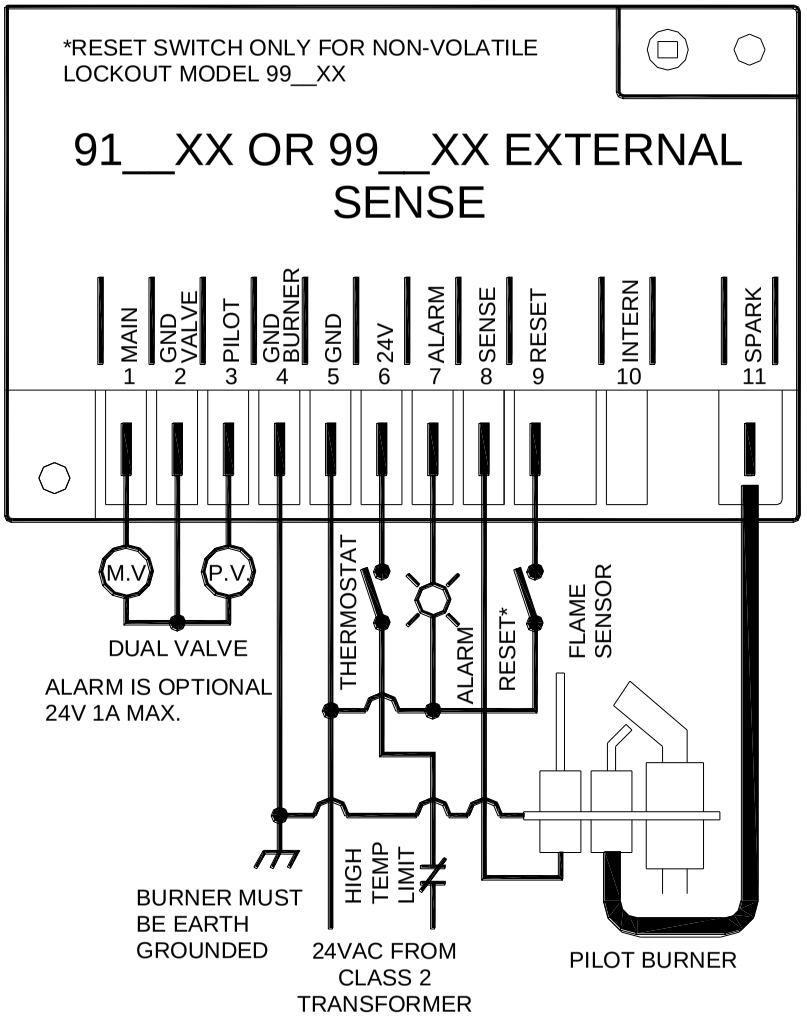

Figure 4 Wiring for Models 91_XX AND 99_XX External Flame Sense

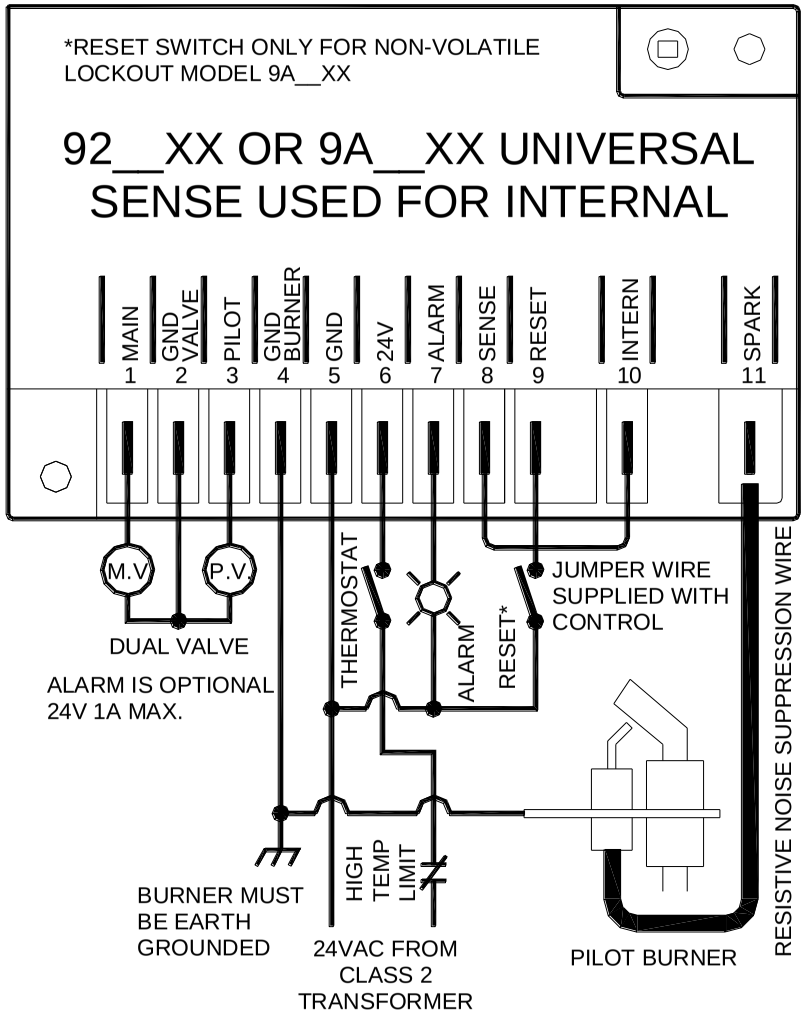

Figure 5 Wiring for Models 92_XX AND 9A_XX Univeral Flame Sense used for Internal Sense

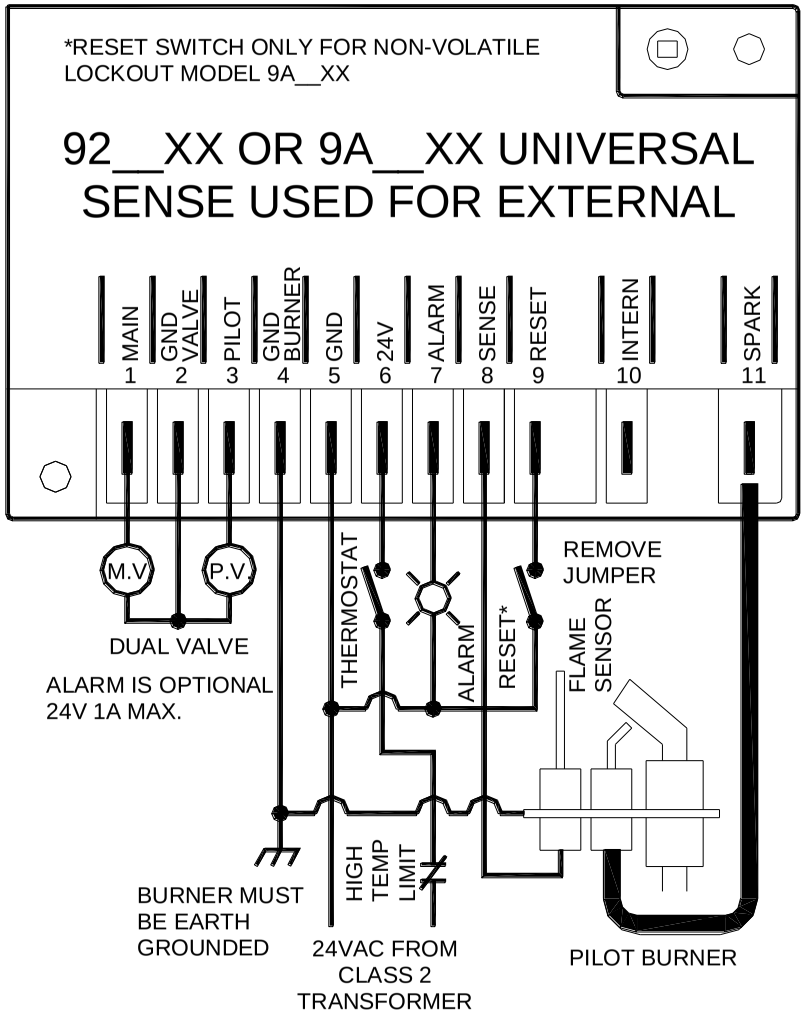

Figure 6 Wiring for Models 92_XX AND 9A_XX Universal Sense used for External Sense

Note: Letters and numbers in parenthesis refer to matrix on page 2.

Sequence of Operation Basic Control Software (B = 0)
Heating cycle starts when call for heat from thermostat supplies 24VAC to 24V terminal. Control will perform a 1 second maximum diagnostic. If waiting time is specified (J-K = 02 to 99) the control will wait for the specified time with led blinking orange once a second. Then the spark will start and pilot valve will turn on starting safety time.

On controls with internal sense it takes time for the flame sense to recover. Because of this the controls normally work in 4, 5 or 6 second cycles based on the safety time. The control rapidly flashes red led while generating sparks for 2.75, 3.75 or 4.75 seconds. Then turns off spark and led, Then waits 1.25 seconds before checking for flame. This cycle will repeat until pilot flame is detected or safety time is over.

If pilot flame is not detected during safety time limit, the pilot valve will be shut off. If 1 try is specified (C = 1) or number of tries has been completed control will go to lockout. If more than 1 try (C = 2 to 9) is specified The control will wait for inter-waiting time (D-E-F 1 to 99 sec or 1-99 min) while blinking the led orange at the end of each 5 seconds. When the inter-waiting time is over a new ignition sequence will start.

When pilot flame is detected, the spark will stop, main valve will turn on and led will stay on green continuously. The control will remain in this state until pilot flame is lost or thermostat opens.

If pilot flame is lost, and spark restoration is selected (G-H = 00), the main valve turns off and pilot valve stays on. Spark starts immediately and new safety time starts.

If pilot flame is lost, and recycle is selected (G-H = 01 to 99), the main and pilot valves turn off. Control waits flame loss waiting time (G-H) blinking orange led once a second. Then spark and pilot valve will turn on starting new safety time.

Flame Stabilization Option (B = 1 or 3)
Flame stabilization is only used on controls with flame loss waiting time (G-H 1 to 99). It is intended for applications with unstable pilot flame. If flame is lost after being on less than 5 seconds, the control uses spark restoration and turns off main valve and starts spark immediately. If flame is lost after 5 seconds, the control turns off pilot and main valves and waits flame loss waiting time (G-H) before starting new ignition cycle.

Quick Start Option (B = 2 or 3)
Quick start is only available for controls with external sense only hardware (A = 1 or 9). External sense controls do not have the flame sense while sparking problem. Quick start controls spark for 0.5 seconds. Turn off spark and check for flame immediately. Quick start controls can turn on main valve within 1 second.

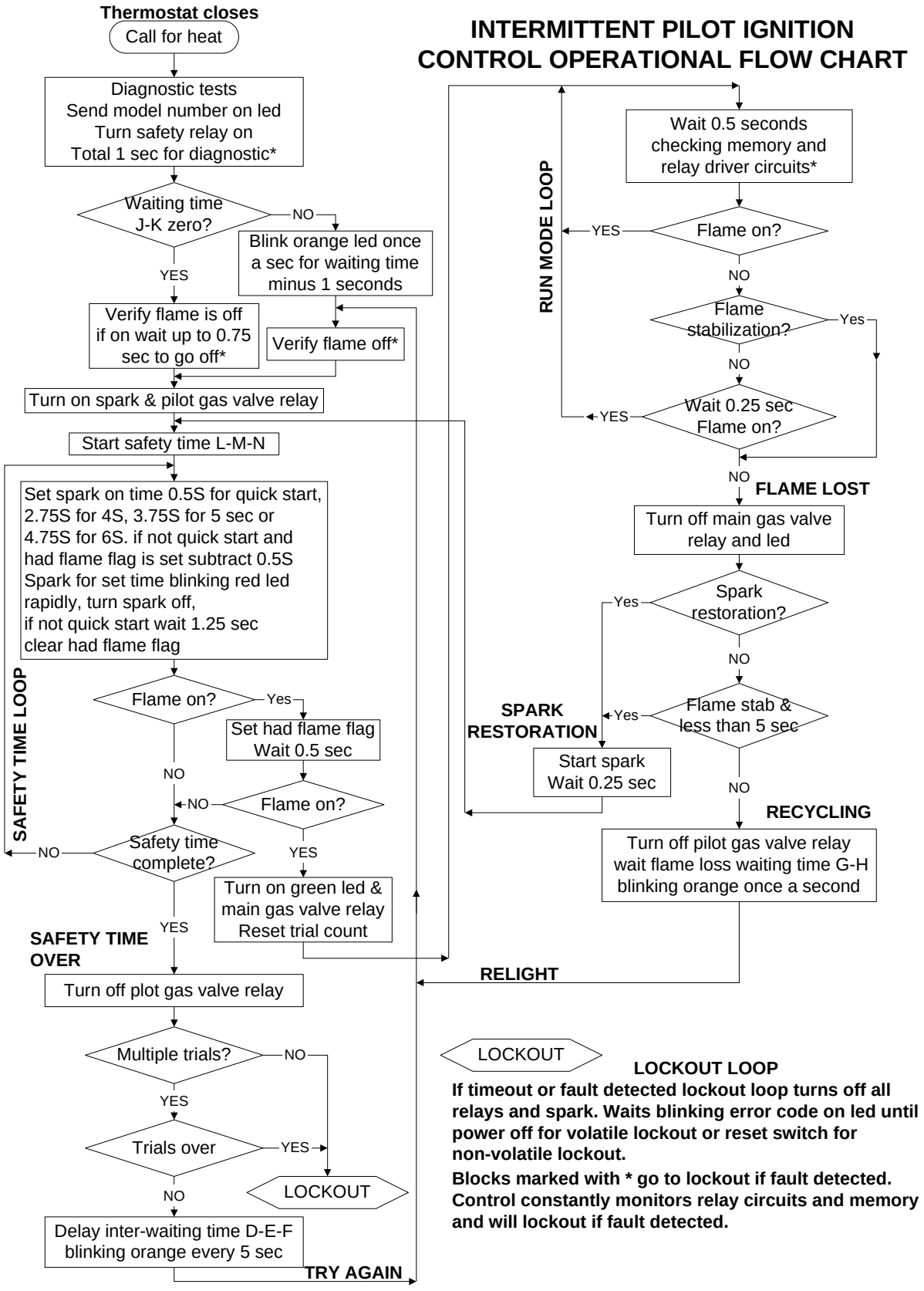

Figure 7 Operational Flow Chart

Alarm output
The alarm out put uses the normally closed contact on the safety relay. It will turn on if flame fails to light in the safety time or a fault is detected in the control. The output will also be on for a half second on power up until safety relay turns on.

Led Indications during normal operation

orange once a second	Waiting Time
rapid red flashing	Safety Time sparking
steady green	Running position flame on
orange once every 5 seconds	Inter-Waiting Time between trials
orange once a second	Flame Loss Waiting Time

Led error indications
If the control module internal diagnostics detect a fault it will go to lockout. Spark and both valves will be turned off. The led will flash the error code red .25 sec on and .25 sec off for the error code with then blink green per error code. Will turn off 1 second between codes. The control will remain in this condition until power is removed by turning off call for heat. Note the control contains 2 micros (microprocessors). The safety micro controls a safety relay that enables power to the valves. It monitors operation of master micro and will turn off safety relay if it detects a problem. The master micro controls the spark, flame sense and pilot and main valve relays.

Codes other than 1-0 for no flame within safety time may indicate a problem with the control. Recycle control and if error repeats control must be replaced.

Error codes are:

red	green	
1	0	Flame did not light in safety time
1	1	Flame sense circuit stuck on
1	2	Safety micro fault
1	3	Line frequency or micro clock error
2	1	Pilot valve relay transistor driver circuit fault
2	2	Pilot valve relay contact fault
2	3	Main valve relay transistor driver circuit fault
2	4	Main valve relay contact fault
The following are software faults unlikely to occur		
3	0	Main micro code memory error
3	1	Main micro timing parameter storage error
3	2	Main micro RAM (random access memory) error during operation
3	3	Main micro RAM (random access memory) error on power up
3	4	Main micro program flow error
4	0	Timing parameters in safety micro do not match master micro

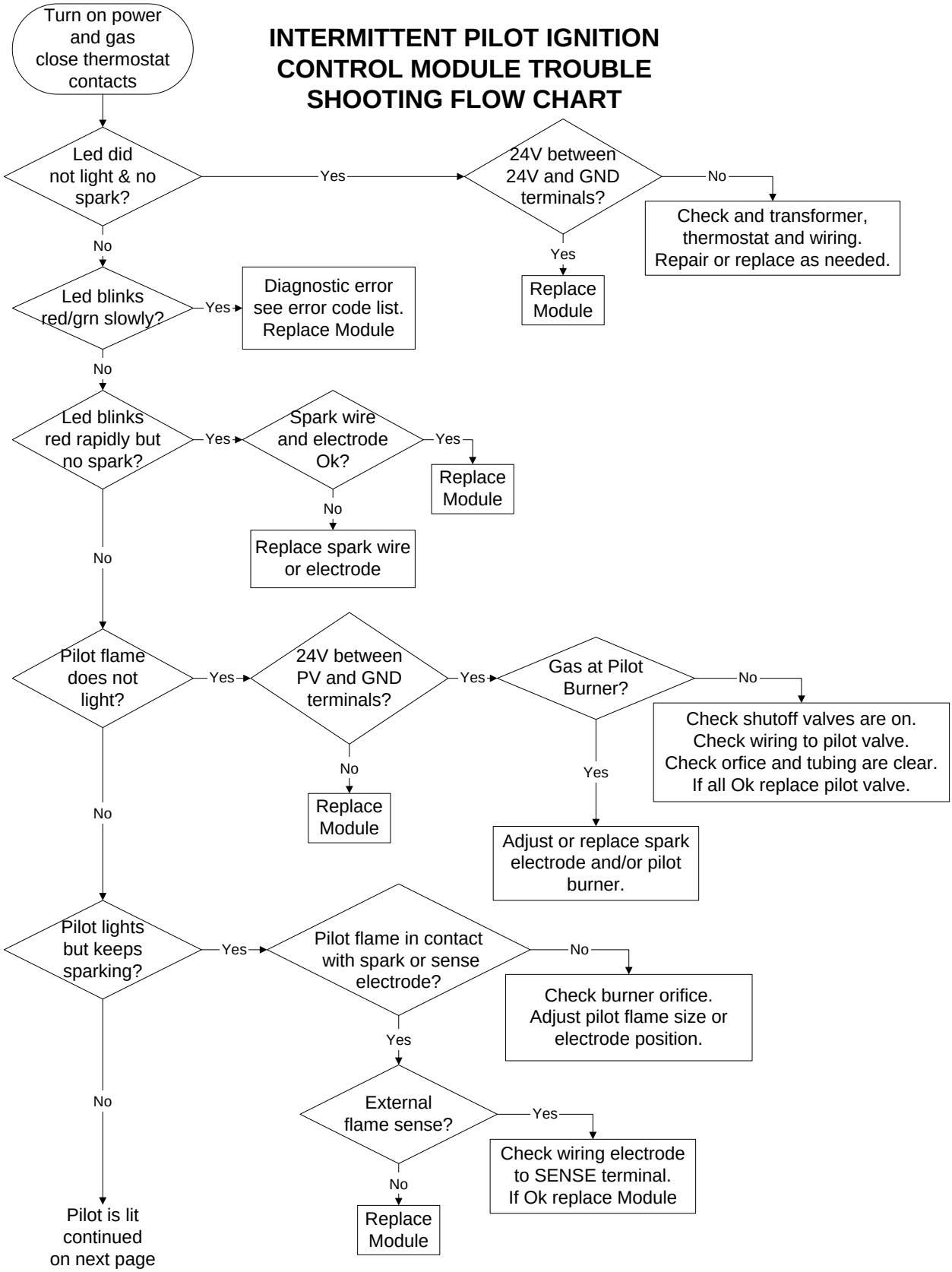

Figure 8 Troubleshooting Flow Chart Part 1

INTERMITTENT PILOT IGNITION CONTROL MODULE TROUBLE SHOOTING FLOW CHART

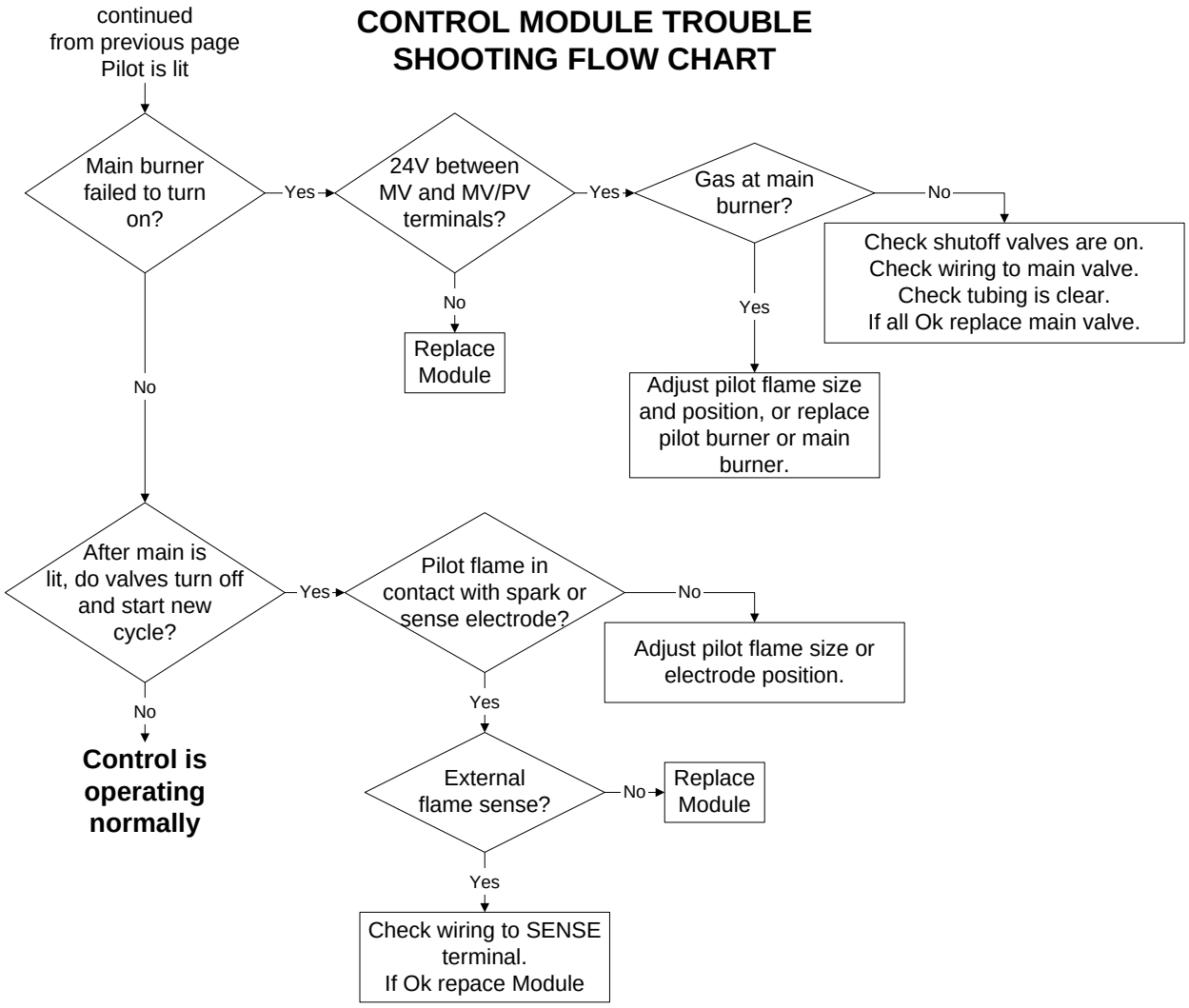

Figure 9 Troubleshooting Flow Chart Part 2

LED INDICATIONS

Led Indications During Normal Operation	
Orange once a second	Waiting Time
Red rapid flashing	Safety Time Spark On
Steady green	Running Position Flame On
Orange once every 5 seconds	Inter-Waiting Time Between Cycles
Orange once a second	Flame Loss Waiting Time

Led Error Indications		
Red	**Green**	**Error**
1	0	Flame did not light in safety time
1	1	Flame sense circuit stuck on
1	2	Safety micro fault
1	3	Line frequency or micro clock error
2	1	Pilot valve relay transistor driver fault
2	2	Pilot valve relay contact fault
2	3	Main valve relay transistor driver fault
2	4	Main valve relay contact fault
More than 2 red blinks indicate micro memory or software fault		