BASO Gas Products LLC

Installation Instructions
Issue Date July 2, 2014

BG1600M Intermittent Pilot Ignition Control

Application

The BG1600M Intermittent Pilot Ignition Control is a safety control designed for indirect burner ignition and supervision, for use with all gases and applicable to gas-fired appliances.

The BG1600M is a microprocessor based ignition control. The microprocessor provides reliable software control of all timings and operates a diagnostic red Light-Emitting Diode (LED). It provides ignition sequence, flame monitoring, and safety shutoff for intermittent pilot boilers, furnaces and other heating appliances. For a complete listing of specifications, refer to the *Technical Specifications* section.

Installation

IMPORTANT: Only qualified personnel should install or service BASO Gas Products®. These instructions are a guide for such personnel. Carefully follow all instructions for the appliance.

IMPORTANT: Make all gas installations in accordance with applicable local, national, and regional regulations.

WARNING: Risk of Explosion or Fire.
Do not install the control in an area that is exposed to water (for example, dripping, spraying, rain). Do not use the control if it has been exposed to water. Exposure to water may cause malfunction and can lead to an explosion or fire and may result in severe personal injury or death.

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

Instructions for installing the pilot burner/igniter-sensor are typically provided by the appliance manufacturer. It is important to follow those instructions. If such information is not included, refer to the *Mounting* section.

Mounting

CAUTION: Risk of Electric Shock.
Disconnect power supply before making electrical connections to avoid electric shock.

WARNING: Risk of Explosion or Fire.
Shut off the gas supply at the main manual shutoff valve before installing or servicing the control. Failure to shut off the gas supply can result in the release of gas during installation or servicing, which can lead to an explosion or fire, and may result in severe personal injury or death.

IMPORTANT: Do not mount the control where it can be exposed to direct infrared radiation from the main burner or to temperatures in excess of the maximum product temperature rating.

Location Considerations

Choose a location that provides the shortest, direct cable route to the spark electrode, pilot burner/igniter-sensor assembly. Easy access to the terminals is desired for wiring and servicing. The control may be mounted in any position. Mount the control on a grounded metal surface with #6 sheet metal or machine screws through the mounting holes provided in the enclosure.

The pilot burner/igniter sensor must be securely mounted to the main burner to ensure that the pilot burner flame remains properly positioned with respect to the main burner flame. The pilot burner must be located such that the flame receives an ample supply of air, free from the products of combustion, the flame must not be exposed to draft conditions, the full force must not be exposed to draft conditions, the full force of main burner ignition, or falling scale, which could otherwise impede ignition of main burner flame.

Securely mount the pilot burner/igniter-sensor to the main burner with metal screws at a distance approximately 3/8 in. (9.52 mm) above and 1/4 in. (6.35 mm) away from the center of the nearest main burner port. Ensure that the main burner flames do not impinge on any part of the pilot burner.

The spark electrode, flame sensor, and BG1600M must share a common ground with the burner to operate correctly. Thermoplastic insulated wire with a minimum rate of 221˚F (105˚C) is recommended for the ground wire. Ensure that the flame sensor wire and the high voltage spark transformer wire are separated from one another by a minimum distance of 1/4 in. (6.35 mm) and are not wrapped around any pipe, other wiring, or accessory.

Note: A shorting plug that jumpers pins 2 and 3 of the damper connector is supplied with the control. The shorting plug must be used if a vent damper is not used. When a vent damper has been connected and power turned on, an internal fuse in the control will blow and the control will only operate with a vent damper connected. Now you cannot disconnect the vent damper plug and put back the shorting plug. The ignition control will not work.

Wiring

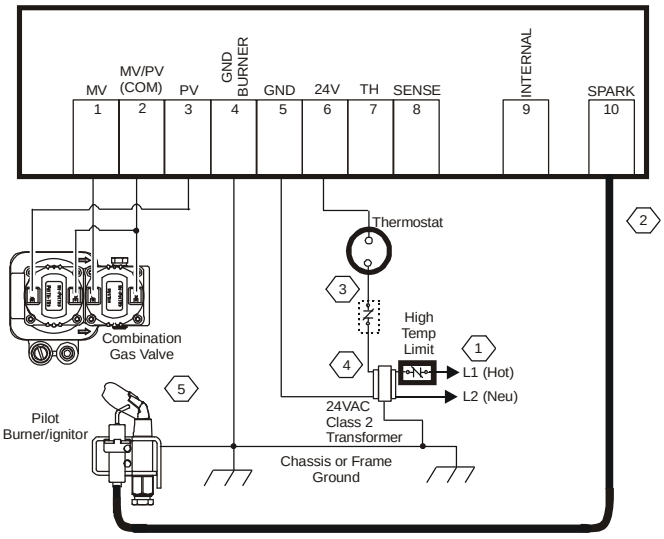
WARNING: Risk of Explosion or Fire.
Locate all safety, limit, and operating controls in series with the thermostat terminal (TH) on the ignition control. Improper installation may cause gas leaks, which can lead to an explosion or fire and may result in severe personal injury or death.

Refer to Figure 1 through Figure 6 for wiring diagrams. All wiring should be in accordance with the National Electrical Code (NEC) and all other local codes and regulations.

Check the voltage rating marked on the control and make sure it is suited to the application. Use a Class 2 transformer capable of providing 24 VAC under maximum load, including valves. A transformer having excessive primary impedance due to poor coupling affects the ignition potential.

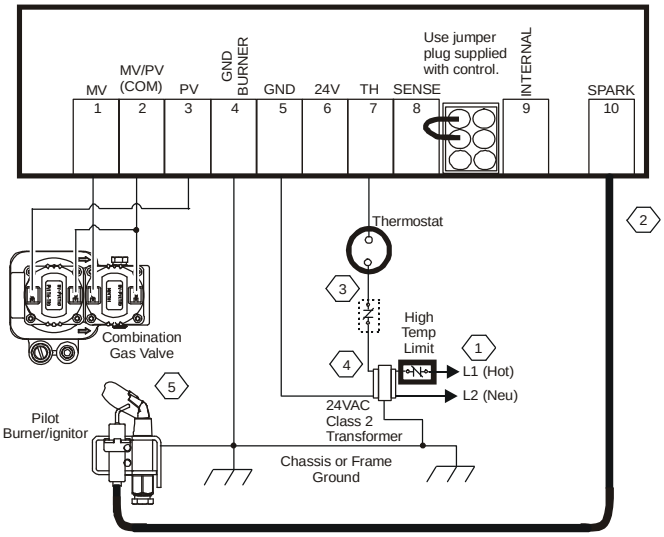
The high-voltage spark transformer cable is noise suppression (resistive) type rated for at least 15Kv and must not be in continuous contact with a metal surface. Use standoff insulators. Ensure that the flame sensor wire and high voltage spark transformer cable are separated from one another by a minimum of 1/4 in. (6.35 mm) and are not wrapped around any pipe, other wiring, or accessories.

WARNING: Risk of Electric Shock.
Before applying power to the control, connect the high voltage cable to the spark transformer terminal and spark electrode (pilot burner assembly). Verify the ground wire is attached to the pilot burner and the control ground terminal strip. Failure to follow this procedure can cause electric shock and may result in severe personal injury or death.



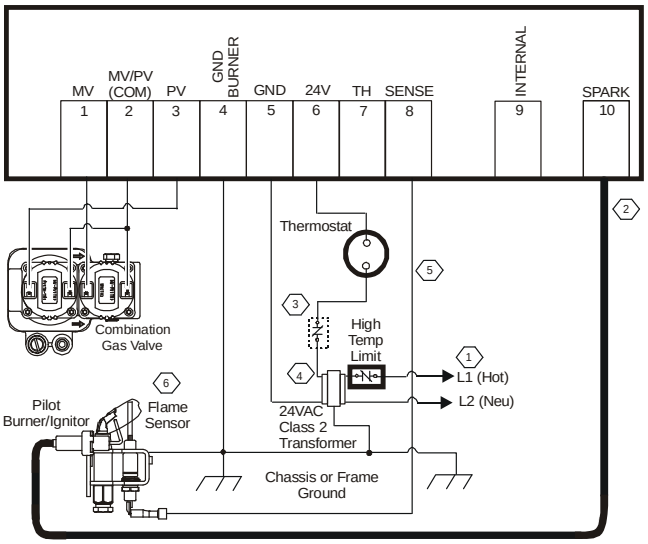
1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Sensor rod must be 3/8” (9.53 mm) to 1/2” (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 1: Wiring for 1 Rod Flame Sense without Vent Damper Jumper Plug



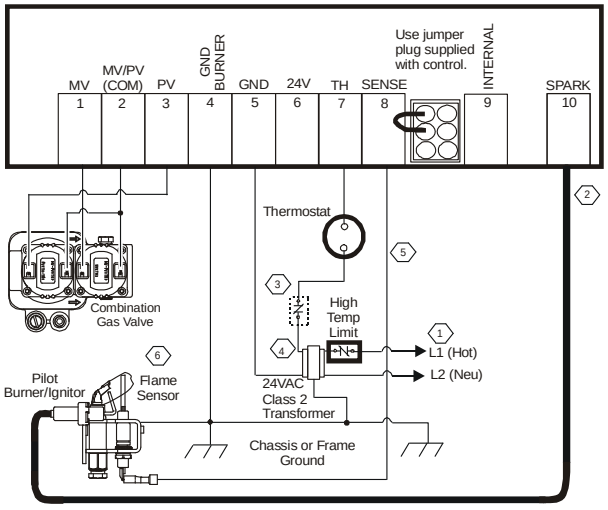
1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Sensor rod must be 3/8” (9.53 mm) to 1/2” (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 2: Wiring for 1 Rod Flame Sense with Vent Damper Jumper Plug



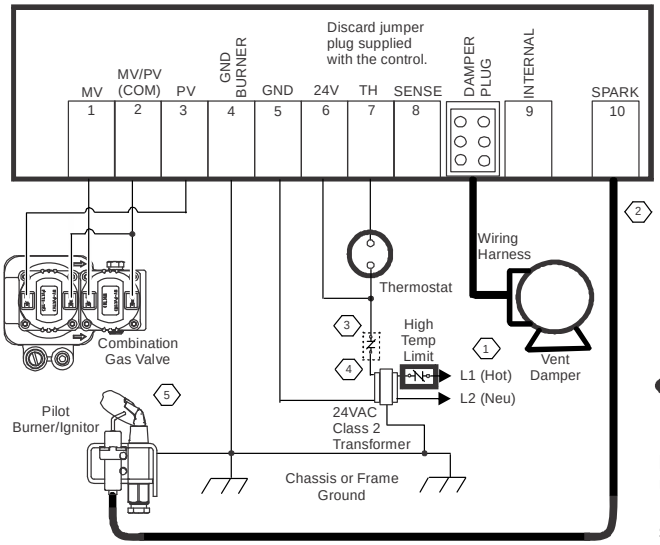
1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Maximum cable length 48 inches (1,220 mm).
6. Sensor rod must be 3/8” (9.53 mm) to 1/2” (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 3: Wiring for 2 Rod Flame Sense without Vent Damper Jumper Plug



1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Maximum cable length 48 inches (1,220 mm).
6. Sensor rod must be 3/8” (9.53 mm) to 1/2” (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

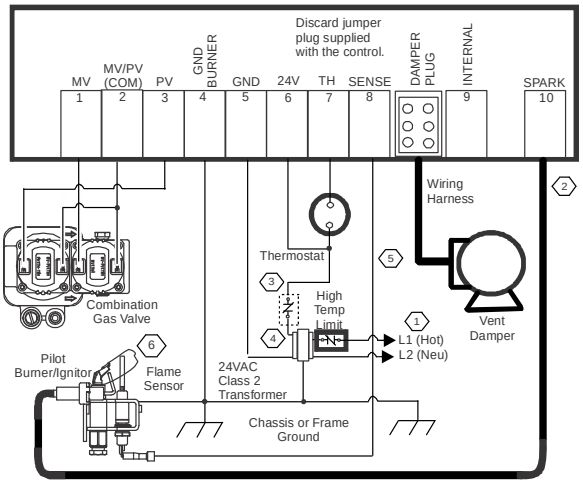
Figure 4: Wiring for 2 Rod Flame Sense with Vent Damper Jumper Plug



Note: If a vent damper is not used (see Figure 2), use the pin 2-3 jumper plug supplied with the control and omit 24V connection.

1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 5: Wiring for 1 Rod Flame Sense with Vent Damper



Note: If a vent damper is not used (see Figure 4), use pin 2-3 jumper plug supplied with the control and omit 24V connection.

1. Power Supply. Provides disconnect means and overload protection as required.
2. Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
3. Alternate location for limit controller.
4. Controls in 24V circuit must not be in ground leg to transformer.
5. Maximum cable length 48 inches (1,220 mm).
6. Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 6: Wiring for 2 Rod Flame Sense with Vent Damper

Setup and Adjustments

Checkout

WARNING: Risk of Explosion or Fire. Verify that there are no gas leaks by testing with appropriate equipment. Never use a match or lighter to test for the presence of gas. Failure to test properly can lead to an explosion or fire and may result in severe personal injury or death.

Make sure all components function properly by performing the following test.

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 the system is properly grounded, including ground connection to the pilot burner.
2. With the gas and thermostat off, turn on power to the appliance.
3. Turn the thermostat to a high setting and verify that the control goes through the operating sequence to a shutoff condition.

   Note: The burner does not light because the gas is off.
4. Turn off the thermostat.
5. Turn on the gas and purge gas lines of all air.
6. Check for gas leaks on all pipe joints upstream of the gas valve with a soap solution.
7. Turn the thermostat to the highest setting and verify successful ignition and a normal run condition for at least 5 minutes. If the appliance fails to run, see the *Troubleshooting* section.
8. Check for gas leaks on all pipe joints downstream of the gas valve with a soap solution.
9. Turn the thermostat down for at least 30 seconds and then back up again. Verify successful ignition at least five times.
10. Return the thermostat to a normal temperature setting before leaving the installation.

IMPORTANT: Only qualified personnel should install or service BASO Gas Products®. If any faults are detected, see Troubleshooting Table 2. If control module has been opened or any attempts to repair are done, the warranty is void.

Operation

Table 1: Red LED Indications, Normal Operation

Flash Code	Flash Code Indication
Steady On	Flame detected, main burner on
0.1 Second On 0.1 Second Off	Trial time spark on trying to light pilot burner
0.5 Second On 0.5 Second Off	Pre-Purge or Inter-Purge Time
1.0 Second On 4.0 Second Off	Retry or Recycle Time

Sequence of Operation

The heating cycle starts when a call for heat from the thermostat supplies 24VAC to the 24V/TH terminal. After a 1 second maximum diagnostic period, the control enters **pre-purge mode**, after pre-purge time, the spark starts and the pilot valve opens, starting with the trial for ignition period. If **no pre-purge**, trial for ignition mode begins immediately (see Table 1 for red LED normal operation).

During the trial for ignition period, the control sparks while rapidly flashing red LED. It then turns off the spark and red LED while checking pilot flame sense. This cycle will repeat until pilot flame is detected or trial time is over.

When pilot flame is detected, the spark stops, the main valve opens and the red LED stays on continuously. The control will remain in this state until the pilot flame is lost or the call for heat ends. **Model with no inter-purge**, if the pilot flame is lost, the main valve will close and a new trial for ignition will start. **Model with inter-purge**, if flame is lost within 5 seconds of an established flame, the main valve will close; the control initiates sparking, and begins a trial for ignition period immediately. If flame is lost after 5 seconds of an established flame, both main and pilot valves will close, and the control initiates the inter-purge time delay before beginning another trial for ignition period. **Model with no retry and one trial**, if pilot flame is not detected during the trial for ignition period, the pilot valve will close. Lockout will occur and a red LED will flash indicating an error (see Table 2 for proper diagnostics of the error). Remove power to end lockout. If the ignition period is “infinite”, then the pilot valve remains open for a continuous spark. Remove power to end spark. **Model with retry and three trials**, if flame is not sensed by the end of the trial for ignition time period, both main and pilot valves will close and the control module will initiate an inter-purge time delay, followed by another trial for ignition period (this occurs up to three trials). After the third trial, the control will initiate a 5 or 60 minute retry period. If flame is not sensed, the ignition sequence will repeat, until flame is sensed. If flame still is not sensed, remove power to reset the ignition.

Troubleshooting

If the system does not function properly, determine the cause using the procedures in this section.

Before proceeding with troubleshooting the system, check the following.

Preliminary Checks

- ❑ Are you using resistive wire between the module spark (10) and the pilot connection?
- ❑ Are all mechanical and electrical connections tight?
- ❑ Is the system wired and ground correctly?
- ❑ Is gas inlet pressure per manufacturer's specifications?
- ❑ Is the system powered?
- ❑ Is the thermostat calling for heat?

WARNING: Risk of Personal Injury.
Do not place face, hands, or other parts of the body in or near the burner area when the red LED is flashing (retry mode). When the red LED is flashing, the control may at any time (while in the retry mode) re-energize the burner control system and ignite the burner which may result in electric shock from contact with the electrode or severe burn injury from firing of the burner.

Red LED Error Indications

If the control module's internal diagnostics detect a fault it will go into lockout. Spark and both valves will be turned off. The red LED will flash an error code .25 seconds on and .25 seconds off for each count of the error code with 1 second off between codes. The control will remain in this condition until power is removed by turning off the call for heat. A flashing red LED error code indicates either a problem with wiring, or a component not working, or the control module is faulty. Try to cycle the control again. If the error repeats then see Table 2 for troubleshooting.

Table 2: Red LED Error Indications

Flash Code	Flash Code Description	Troubleshooting Guide
No LED“ ON”	No Power	1. Check Controller for a Molex connection; 1.1. Controller w/MOLEX connector and the Vent Damper jumper plug installed, check for 24 volts on terminal 7 (TH) and terminal 5 (GND). If using a Vent Damper, make sure it is connected and the damper is working, check for 24 volts on terminal 6 (24V) and terminal 7 (TH) to terminal 5 (GND). 1.2. Controller w/o MOLEX connector, check for 24 volts on terminal 6 (24V) and terminal 5 (GND). 2. Check for 24 volts on the secondary coil of the incoming transformer.
1	No flame in trial time	1. Check if the gas is turned “ON”. 2. Check Controller for a Molex connection; 2.1. Controller w/MOLEX connector and the Vent Damper jumper plug installed, check for 24 volts on terminal 7 (TH) and terminal 5 (GND). If using a Vent Damper, make sure it is connected and the damper is working, check for 24 volts on terminal 6 (24V) and terminal 7 (TH) to terminal 5 (GND). 2.2. Controller w/o MOLEX connector, check for 24 volts on terminal 6 (24V) and terminal 5 (GND). 3. If no spark, check spark wire and connection to terminal 10 (SPARK) and spark ground to terminal 4 (GND BURNER). 4. Check if PV is wired to terminal 3 (PV) and common is wired to terminal 2 (MV/PV COM). 5. Check for 24 volts at the PV coil.
2	Flame sense circuit error	1. Check Flame Sensor tip is in the flame. For proper sensing the rod tip must be 3/8” (10mm) to 1/2” (13 mm) in the flame. 2. Check Flame Sensor Circuits; 2.1 For 1 Rod Flame Sense circuit, check Spark/Flame Sensor is wired to terminal 10 (SPARK) and terminal 4 (GND BURNER). 2.2 For 2 Rod Flame Sense circuit, check Flame Sensor is wired to terminal 8 (SENSE) and terminal 4 (GND BURNER).
3	PV (Pilot Valve) circuit error	1. Check for 24 volts on terminal 3 (PV) and terminal 2 (MV/PV COM). 2. Check for 24 volts at the PV coil. 3. Check if PV is wired to terminal 3 (PV) and common is wired to terminal 2 (MV/PV COM). 4. Check gas valve connections, terminals and coil current.
4	MV (Main Valve) circuit error	1. Check for 24 volts on terminal 1 (MV) and terminal 2 (MV/PV COM). 2. Check for 24 volts at the MV coil. 3. Check MV is wired to terminal 1 (MV) and common is wired to terminal 2 (MV/PV COM). 4. Check gas valve connections, terminals and coil current.
5 to 9	Control error	1. Review all ground connections and terminals. Make sure you have good continuity on all of the ground wires (See Ground Continuity Check for details). 2. Check that the Spark Wire is not touching any other control wires and/or metal frame. The Spark Wire should be isolated 3/8” to 1/2” away from all other control wires and metal frame (chassis). 3. Check if using fiber core resistive wire for the Spark Wire. 4. Try restarting the power (Call to Heat) to the control module. 5. All ground connections should be cleaned and rust free.

NOTE: If Troubleshooting Guide has been used, and the Control Module is flashing an ERROR CODE, then the Control Module may be faulty. Replace the Control Module.

NOTE: Ground Continuity Check:
Perform a continuity check on each of the 3 ground wires which are needed and going to the Control Module. First, turn power off to the ignition module. With a Multi-Meter on ohm’s scale, place a meter’s test probe on any of the grounds at the Controls Module. With the other Meter’s test probe, place it at the following ground terminations of each wire:
1. Transformer Ground (COM) 2. Gas Valve (COM) 3. Burner Frame (COM)
Each wire measure should read less than 1 ohm of resistance. If any wire reads more than 1 ohm of resistance, this is a problem. Replace wire or connections until less than 1 ohm is read on the continuity check.

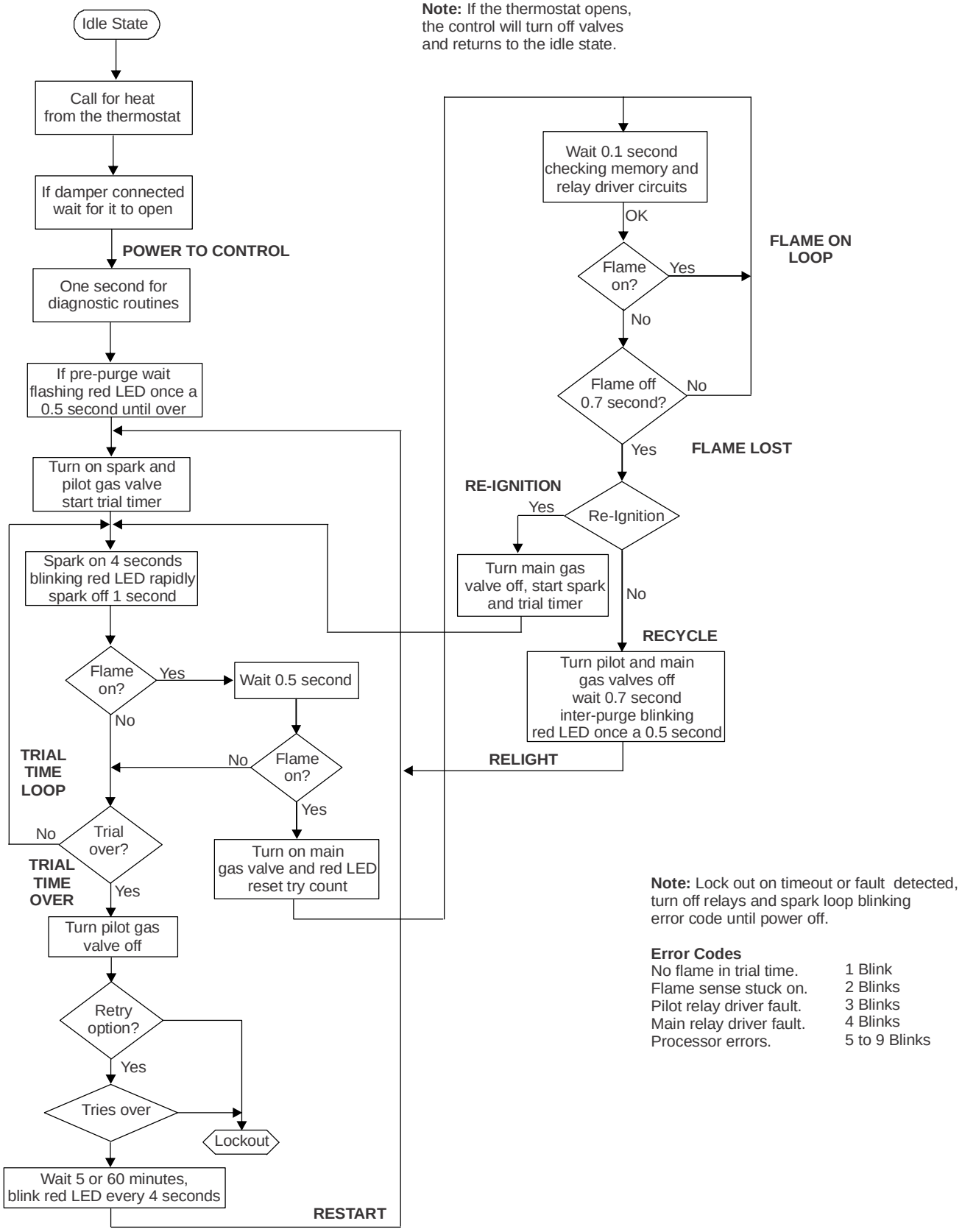


Figure 7: Sequence of Operation

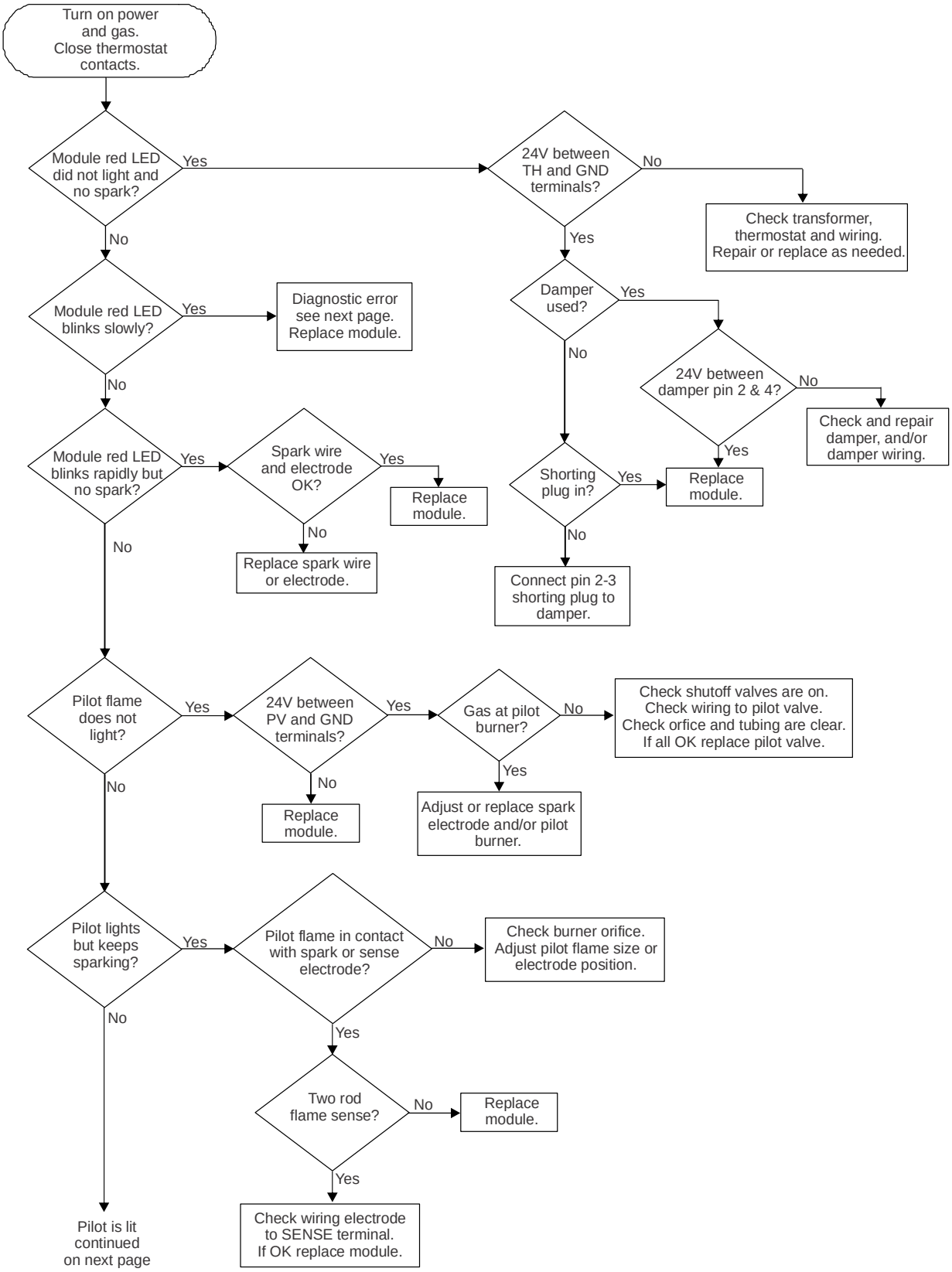


Figure 8: Troubleshooting Flow Chart (1 of 2)

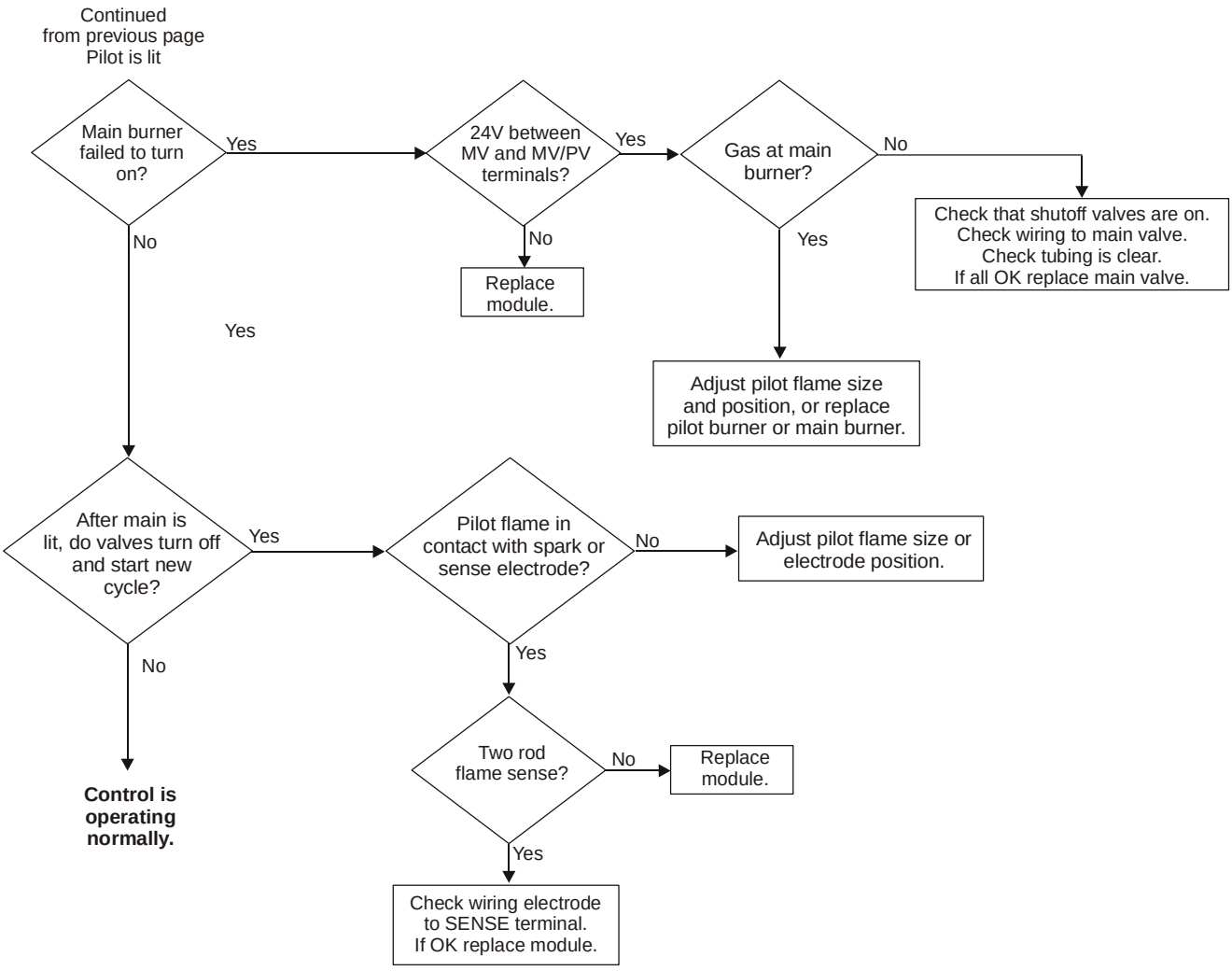


Figure 9: Troubleshooting Flow Chart (2 of 2)

Maintenance Requirements in Severe Environments

Regular preventive maintenance is important in any application, but especially so in commercial cooking, agricultural, and industrial applications because:

- In many such applications, particularly commercial cooking, the equipment operates 100,000 to 200,000 cycles per year. Such heavy cycling can wear out the gas control in one to two years. A normal forced air furnace, for which the controls were originally intended, typically operates less than 20,000 cycles per year.
- Exposure to water, dirt, chemicals, and heat can damage the ignition control module or the gas control and shut down the control system. A NEMA 4 enclosure can reduce exposure to environmental contaminants.

WARNING: Risk of Explosion or Fire. Do not attempt to take the ignition control module apart or to clean it. Improper reassembly and cleaning may cause unreliable operation, which can lead to an explosion or fire, and may result in severe injury, property damage or death.

Maintenance frequency must be determined individually for each application. Some considerations are:

- Cycling Frequency – Appliances that may cycle more than 20,000 times annually should be checked monthly.
- Intermittent Use – Appliances that are used seasonally should be checked before shutdown and again before the next use.
- Consequence of Unexpected Shutdown – Where the cost of an unexpected shutdown would be high, the system should be checked more often.
- Dust, Wet, or Corrosive Environment – Since these environments can cause the controls to deteriorate more rapidly, the system should be checked more often.

Repairs and Replacement

CAUTION: Risk of Electric Shock.
Disconnect power supply before making electrical connections to avoid electric shock.

WARNING: Risk of Explosion or Fire.
Shut off the gas supply at the main manual shutoff valve before installing or servicing the control. Failure to shut off the gas supply can result in the release of gas during installation or servicing, which can lead to an explosion or fire, and may result in severe injury or death.

WARNING: Risk of Explosion, Fire, or Electric Shock. Label all wires before they are disconnected when replacing or servicing the BG1600M. Wiring errors can cause improper or dangerous operation and may result in an explosion, fire, or electric shock leading to severe personal injury or death.

Field repairs must not be made to the BG1600M control. Any attempt to repair this assembly voids the manufacturer's warranty. For a replacement control, contact the original equipment manufacturer or the nearest BASO Gas Products distributor.

All other accessories, such as flame sensors, electrode assembles, pilot assemblies, and leads can be obtained through the original equipment manufacturer or a BASO Gas Products distributor.

Ignition Control Accessories

Table 3: Ignition Control Accessories

Part Number	Description
RAA1600A-601D	Rajah to 1/4” Spade Adapter (box of 50)
RAA1600A-601H	Rajah to 1/4” Spade Adapter (bag of 10)
WHA40A-600D	18” Resistive Wire Harness with (2) 1/4” Terminals (box of 25)
WHA40A-600H	18” Resistive Wire Harness with (2) 1/4” Terminals (bag of 1)
WHA40A-601D	18” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (box of 25)
WHA40A-601H	18” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (bag of 1)
WHA40A-602D	24” Resistive Wire Harness with (2) 1/4” Terminals (box of 25)
WHA40A-602H	24” Resistive Wire Harness with (2) 1/4” Terminals (bag of 1)
WHA40A-603D	24” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (box of 25)
WHA40A-603H	24” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (bag of 1)
WHA40A-604D	36” Resistive Wire Harness with (2) 1/4” Terminals (box of 25)
WHA40A-604H	36” Resistive Wire Harness with (2) 1/4” Terminals (bag of 1)
WHA40A-605D	36” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (box of 25)
WHA40A-605H	36” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (bag of 1)
WHA40A-606D	48” Resistive Wire Harness with (2) 1/4” Terminals (box of 25)
WHA40A-606H	48” Resistive Wire Harness with (2) 1/4” Terminals (bag of 1)
WHA40A-607D	48” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (box of 25)
WHA40A-607H	48” Resistive Wire Harness with (1) 1/4” Terminal and 1 Rajah Terminal (bag of 1)

Notes

Technical Specification

Product	BG1600M Intermittent Pilot Ignition Control
Ignition Type	Indirect
Ignition Source	High voltage spark, capacitive discharge
High Voltage Cable Maximum Length	48 in. (1,220 mm) (Resistive wire recommended, rated for at least 15kV.)
Flame Sense Cable Maximum Length	48 in. (1,220 mm)
Flame Detection Means	Flame Rectification
Flame Detection Type	Local or Remote
Minimum Flame Current	0.15 microamperes
Flame Failure Response Time	2 seconds maximum
Maximum Spark Gap	0.2 in. (5.1 mm)
Number of Trials Before 100% Shutoff	One or Three
Trial-for-Ignition Time	Infinite, 8, 15, 25, 50, 85, 90 or 120 seconds
Prepurge Time	0 (none), 4, 10, 15 or 30 seconds
Inter-Purge Time	0 (none), 5, 15 or 30 seconds
Retry (Recycle) Delay Period	0 minutes (none) 5 minutes 60 minutes
Power Requirements	Control: 24 VAC (+/- 20%), 50/60 Hz Operation Current: 0.2 A nominal + valves
Contact Rating	Main Valve: 2 A maximum Pilot Valve: 1 A maximum
Wiring Connections	1/4 in. (6.35 mm) male spade
Maximum Firing Rate	400,000 Btu/hr (117 kW)
Ambient Operating and Storage Temperature	-40 to 170°F (-40 to 77°C)
Humidity	95% RH noncondensing
Type of Gas	Natural, Liquefied Petroleum (LP), Manufactured, Mixed or LP Gas-Air Mixture
Packaging	Bulk pack supplied to original equipment manufacturer (25 per box) Individual pack (1 per box) Individual overpack (20 per box)
Pack Weight	Bulk pack 14 lb (6.36 kg) Individual pack 1 lb (.454 kg) Individual overpack 18 lb (8.17 kg)
Agency Listing	CSA Certificate Number 246569-2161442
Specifications Standards	ANSI Standard Z21.20 CAN/CSA-C22.2 No. 199

The performance specifications are nominal and conform to acceptable industry standards. All agency certification of BASO products is performed under dry and controlled indoor environmental conditions. Use of BASO products beyond these conditions is not recommended and may void the warranty. If the product is exposed to water (dripping, spraying, rain, etc.) or other harsh environments, it must be protected. The original equipment manufacturer or end user is responsible for the correct application of BASO products. For questionable applications, please consult BASO Gas Products LLC. BASO Gas Products LLC shall not be liable for damages or product malfunctions resulting from misapplication or misuse of its products.

1007 South 12th Street
PO Box 170
Watertown, WI 53094
1-877-227-6427

Published in U.S.A.
www.baso.com