



BG1600M Intermittent Pilot Ignition Control with Rollout Switch

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 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 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.

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 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.

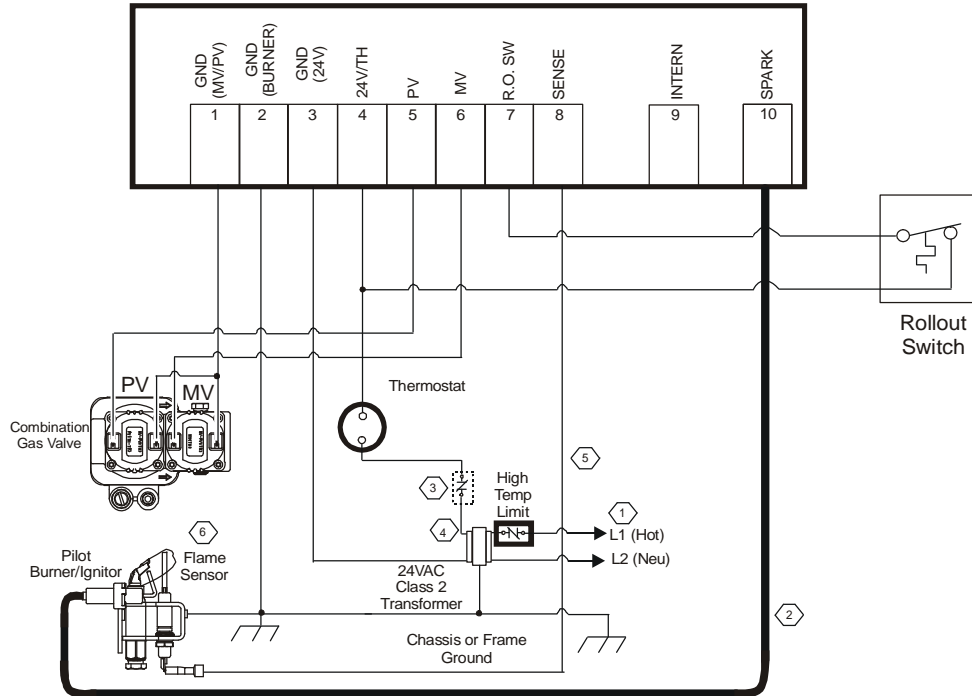


WARNING: Risk of Electric Shock.

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.

The BG1600M replaces existing intermittent pilot ignition controls with the following specifications:

- flame detection using flame rectification technology (ability of a flame to conduct and rectify current)
- 1 trial for ignition
- dual rod (remote sense) flame sensing
- 100% shutoff/lockout with none or 5 minutes continuous retry
- trial time for ignition is 85 seconds
- prepurge period of none or 15 seconds
- interpurge period of 15 seconds
- main burner 400,000 Btu/hr maximum
- pilot burners with flow rates of 1,500 Btu/hr or less
- must be used with redundant gas valves and not subjected to temperatures below -40°F (-40°C) or above 170°F (77°C)



- 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 1: Wiring for 2 Rod Flame Sense with Rollout Switch

Rollout Switch Function

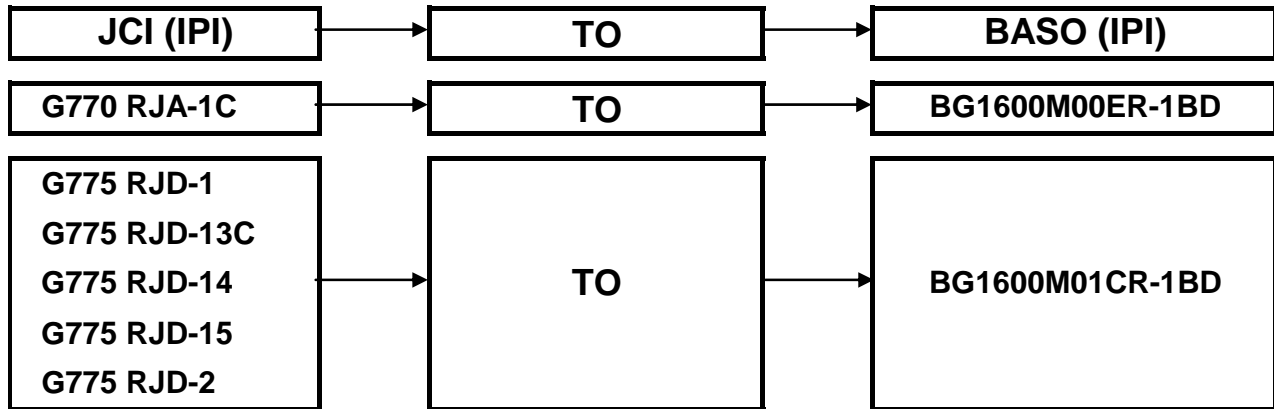
The rollout switch is wired to the BG1600M ignition control at Terminal 7 (R.O. SW) and Terminal 4 (24V/TH) (see Figure 1). The rollout switch (a normally closed set of contacts) is positioned to detect flames rolling out of the combustion chamber. If rollout occurs, the switch contacts open and the BG1600M immediately goes into a lockout condition, closing the main and pilot valves so that the system is not allowed to function.

The thermostat contacts must be opened for 30 seconds, then closed to escape the lockout condition. When the rollout switch contacts have returned to the closed position, the BG1600M will start its operating sequence when the thermostat contacts close.

Typical Wiring Chart

JCI (Johnson Controls) To BASO Intermittent Pilot Ignition (IPI) Control
with Rollout Switch

G77xRJx Series to BG1600M0 Series with Remote Sense
and R.O. Switch




Label (REF)	TB #	Connect To	TB SPADE	TB #	TB Label
GND (VALVE)	5/Chassis (frame)	Connect To	—	1	GND (MV/PV)
GND (BURNER)	5/Chassis (frame)	Connect To	—	2	GND (BURNER)
GND (24V)	5/Chassis (frame)	Connect To	—	3	GND (24V)
THS	2	Connect To	—	4	24V / TH
PV	1	Connect To	—	5	PV
MV	3	Connect To	—	6	MV
R.O. SWH	R1	Connect To	—	7	R.O. SW
SENSE	4	Connect To	—	8	SENSE
		NC	none		
		NC	none	9	INTERN
SPARK	Rajah	Connect To	—	10	SPARK

NOTE: NC means No Connection

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.



WARNING:
The control module can not be serviced by user. If any faults are detected, the control module must be replaced. If control module has been opened or any attempts to repair are done, the warranty is void.

Operation

Operating Mode Definitions

The following definitions describe the BG1600M operating conditions.

- **Prepurge:** Initial time delay between thermostat contact closure and activation of the spark circuit and pilot valve.
- **Trial for Ignition:** Total time the pilot valve is energized and spark/sense sequence is activated in an attempt to light the pilot. The control attempts to prove flame within the trial-for-ignition time.
- **100% Shutoff:** If the control does not prove the presence of pilot burner flame within the trial for ignition, the spark circuit and pilot valve are de-energized.
- **Recycle:** If 100% shutoff occurs, the control delays for a specific recycle delay period before beginning another trial for ignition (models with recycle only).
- **Run:** Main valve is energized and spark turns off after pilot flame is proven. The main valve remains energized until the thermostat is satisfied.
- **Flameout:** Loss of proven flame. Should a flameout occur, the main valve de-energizes and spark recurs within 2.0 seconds.
- **Lockout:** An internal or external fault has caused the control to de-energize the spark circuit and valve relays. The thermostat contacts must be opened for 30 seconds and then closed to begin another trial for ignition.
- **Inter-Purge:** Period between trials for ignition when both the gas valve and spark are de-activated to allow unburned gas to escape before the next trial.

Sequence of Operation

The heating cycle start when a call for heat from the thermostat supplies 24VAC to the TH terminal. The automatic vent damper (if used) is energized and when fully open, turns on the power to the ignition control. After a 1 second maximum diagnostic period, the spark will start and the pilot valve will turn on, starting with the trial for ignition period.

During the trial for ignition period, the control sparks for 4 seconds while rapidly flashing LED. It then turns off the spark and LED for 1 second 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 will stop, main valve will turn on and the LED will stay on continuously. The control will remain in this state until the pilot flame is lost or the call for heat ends. If pilot flame is lost, LED, main and pilot valves are turned off for 0.5 seconds and a new trial for ignition sequence will start.

If pilot flame is not detected during the trial for ignition period, the pilot valve will be shut off. Lockout will occur if your model has no retry. For models with retry, the control will wait for 5 minutes and then begin another trial-for-ignition sequence.

Table 1: LED Indications During Normal Operation

Flash Code	Flash Code Indication
Steady On	Flame detected, main burner on
.1 Second On .1 Second Off	Trial time spark on trying to light pilot burner
.25 Second On 1.0 Second Off	Trial time lockout

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 LED is flashing (recycle mode). When the LED is flashing, the control may at any time (while in the recycle 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.

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 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 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: LED Error Indications

Flash Code	Flash Code Description	Troubleshooting Guide
No LED "ON"	No Power	<ol style="list-style-type: none"> 1. Check for 24 volts on terminal 4 (24V/TH) and terminal 3 GND (24V). 2. Check for 24 volts on the secondary coil of the incoming transformer.
1	No flame in trial time	<ol style="list-style-type: none"> 1. Check that the gas is turned "ON". 2. If no spark, check spark wire and connection to terminal 10 (SPARK) and spark ground to terminal 2 GND (BURNER). 3. Check for 24 volts on terminal 5 PV and terminal 1 GND (MV/PV). 4. Check for 24 volts at the PV coil. 5. Check that the PV is wired to terminal 5 (PV) and common is wired to terminal 1 GND (MV/PV). 6. Check Flame Sensor tip is in the flame. For proper sensing the rod tip must be 3/8" (10 mm to 1/2" (13 mm) in the Flame. 7. Check Flame Sensor is wired to terminal 8 (SENSE) and terminal 2 GND (BURNER). 8. Check that the sense wire is not shorting to ground.
2	Flame sense circuit error	<ol style="list-style-type: none"> 1. Check if pilot flame is distinguished before the call-for-heat cycle is started.
3	PV (Pilot Valve) circuit error	<ol style="list-style-type: none"> 1. Check for 24 volts on terminal 5 PV and terminal 1 GND (MV/PV). 2. Check for 24 volts at the PV coil. 3. Check that the PV is wired to terminal 5 PV and common is wired to terminal 1 GND (MV/PV).
4	MV (Main Valve) circuit error	<ol style="list-style-type: none"> 1. Check for 24 volts on terminal 6 MV and terminal 1 GND (MV/PV). 2. Check for 24 volts at the MV coil. 3. Check that the MV is wired to terminal 6 (MV) and common is wired to terminal 1 GND (MV/PV).
5	Rollout errors	<ol style="list-style-type: none"> 1. Check for 24 volts on terminal 7 (R.O. SW) and terminal 3 GND (24V). 2. Check that the rollout switch is wired to terminal 7 (R.O. SW) and the 24V thermostat line. 3. Check that the rollout switch has continuity because an "open" rollout switch will cause an error.
7	Internal Control error	<ol style="list-style-type: none"> 1. Review all ground connections. 2. Check if using fiber core resistive wire for Spark Wire. 3. Software error – Restart control module.
Solid Red	Line Frequency/Voltage Error	<ol style="list-style-type: none"> 1. Check for 24 volts on the secondary coil of the incoming transformer (+10%/-15% rated voltage).

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.

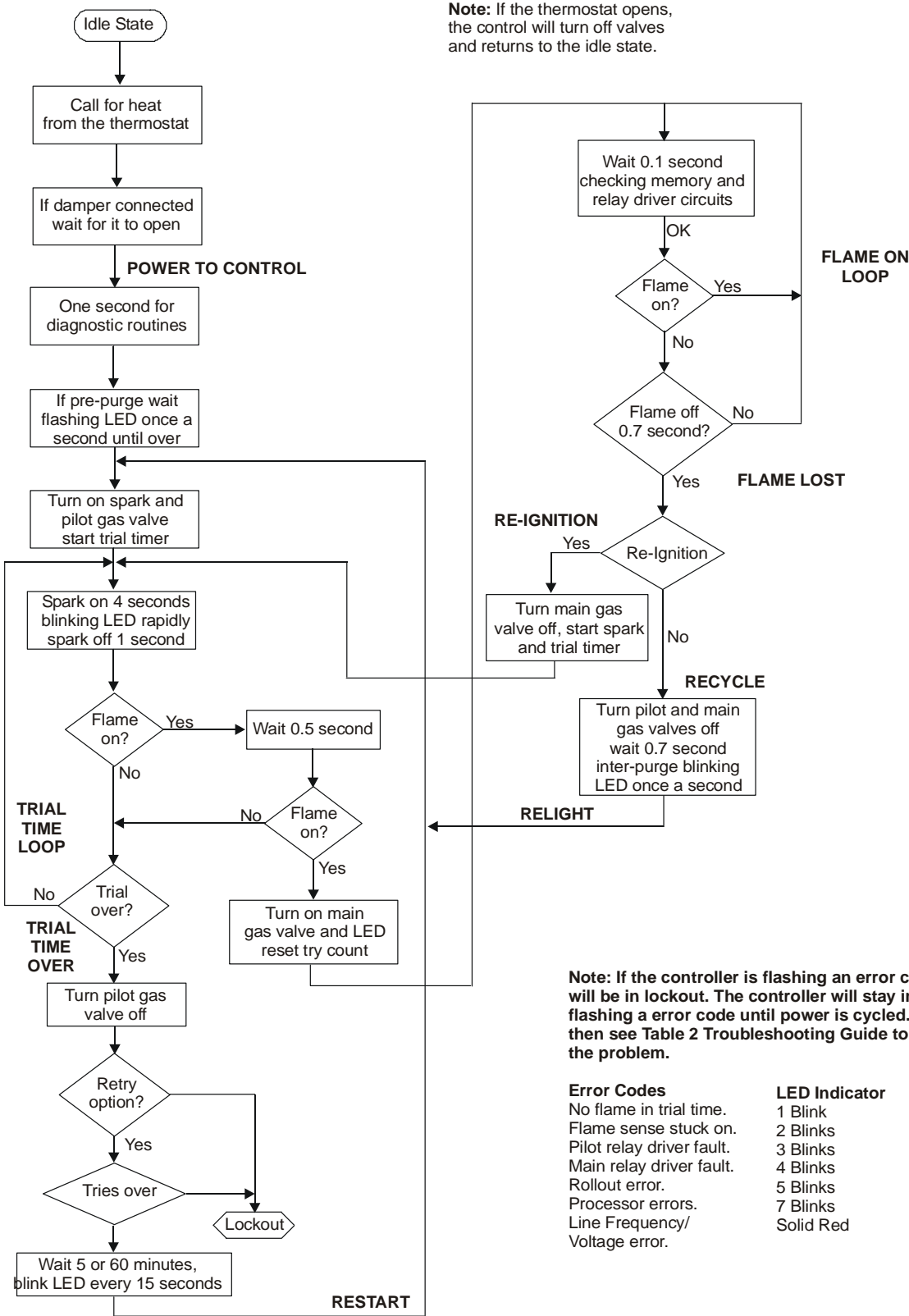


Figure 2: Sequence of Operation

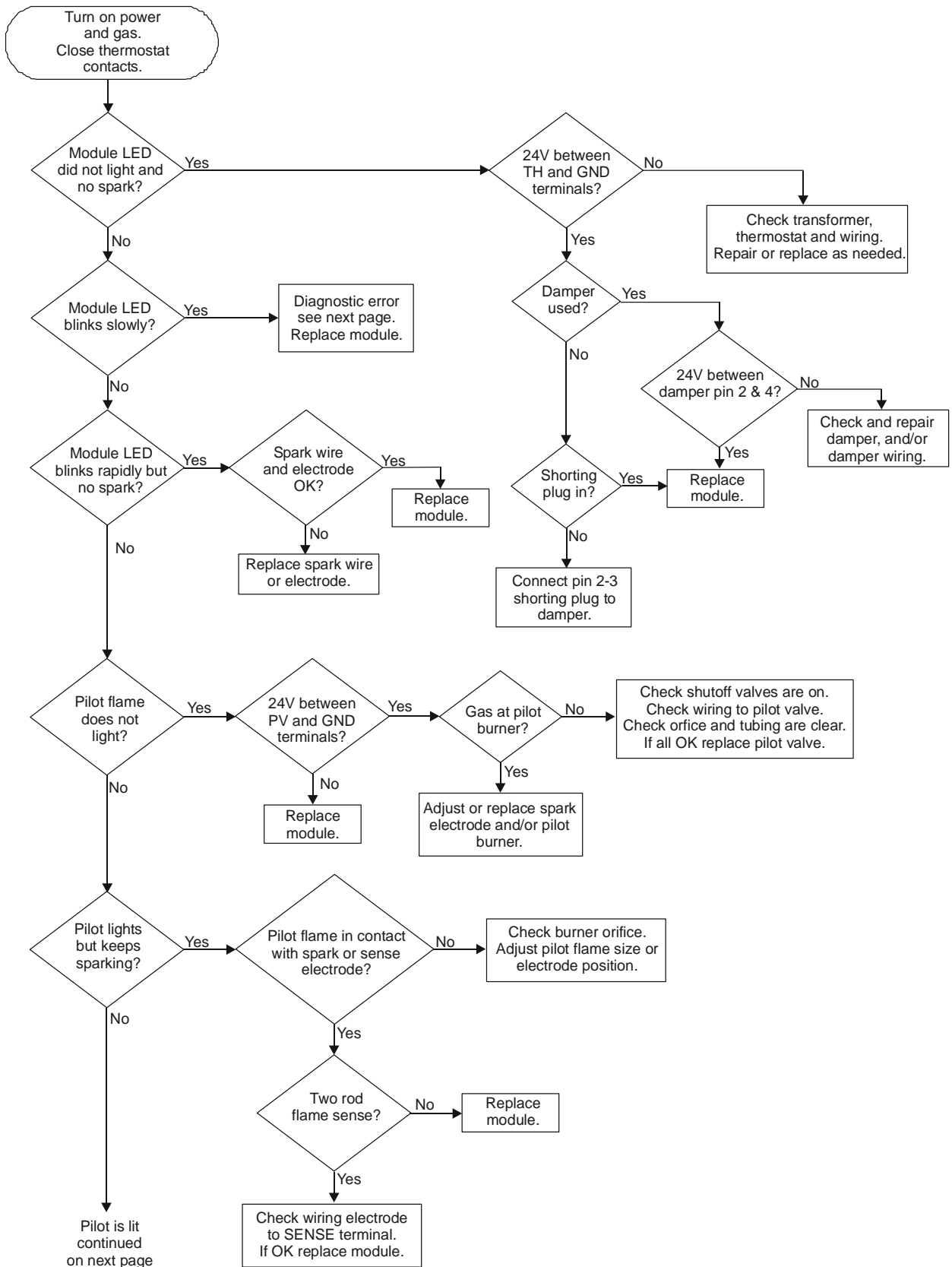


Figure 3: Troubleshooting Flow Chart (1 of 2)

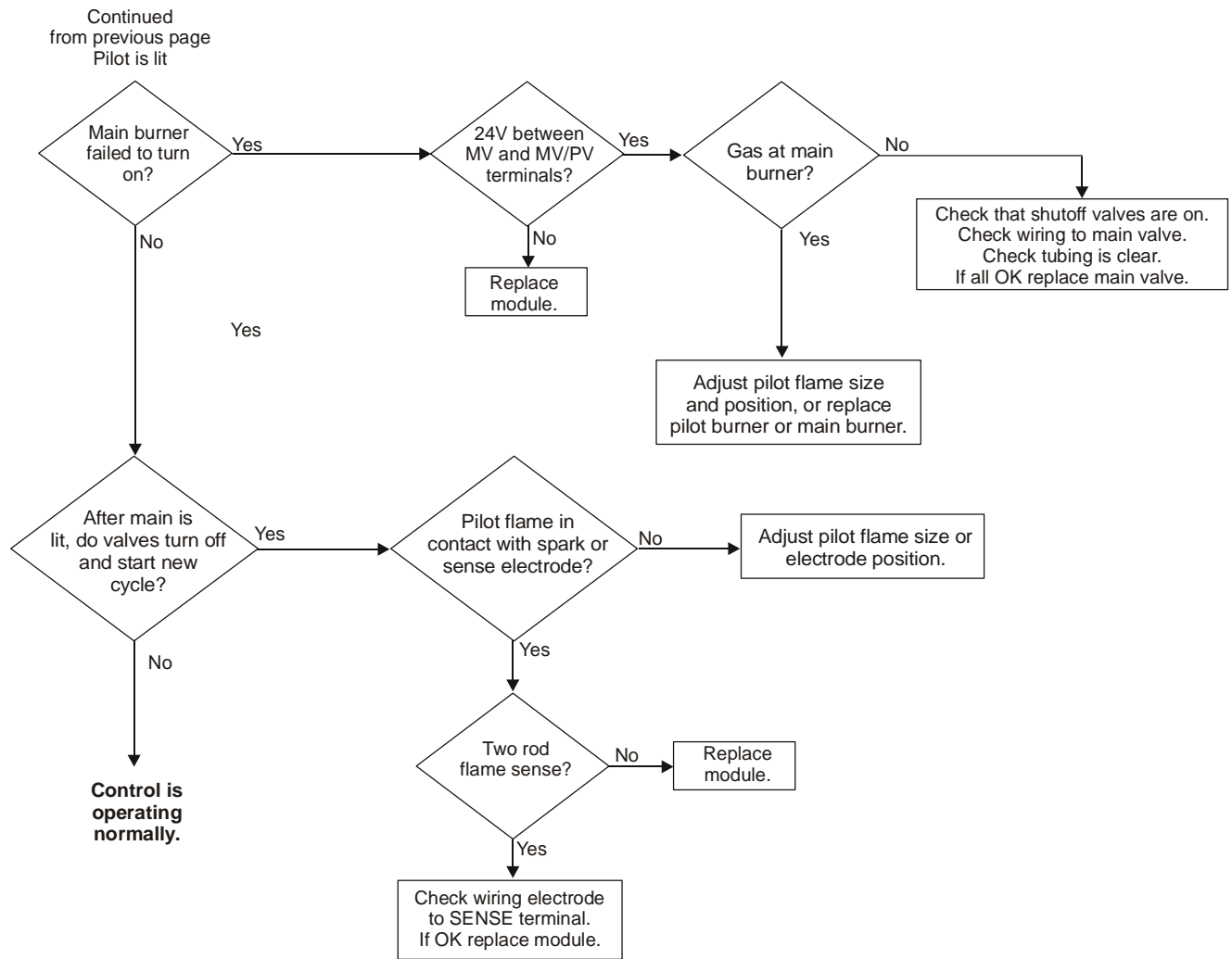


Figure 4: Troubleshooting Flow Chart (2 of 2)

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 assemblies, 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

Notes

Technical Specification

Product	BG1600M Intermittent Pilot Ignition Control with Rollout Switch	
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	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	
Trial-for-Ignition Time	85 seconds	
Prepurge Time	0 or 15 seconds	
Inter-Purge Time	15 seconds	
Automatic Recycle Delay Period	None or 5 minutes	
Power Requirements	Control:	24 VAC (+10%/-15%), 50/60 Hz
	Operation Current:	0.2 A nominal + valves
Contact Rating	Main Valve:	4 A maximum
	Pilot Valve:	2 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	Individual pack (1 per box) Individual overpack (20 per box)	
Pack Weight	Individual pack 1 lb (.454 kg) Individual overpack 18 lb (8.17 kg)	
Agency Listing	CSA Certificate Number Pending	
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

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