G600 Series Replacement
Intermittent Pilot Ignition Controls

Installation

IMPORTANT: These instructions are intended as a guide for qualified personnel installing or servicing Johnson Controls products. Carefully follow all instructions in this document and all instructions on the appliance. Limit repairs, adjustments, and servicing to the operations listed in this document or on the appliance.

WARNING: Shock Hazard.
Avoid electrical shock and equipment damage. Disconnect electrical power and turn off the gas before wiring the control into the circuit.

WARNING: Equipment Damage Hazard.
Label all wires prior to disconnection when replacing the control. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

Perform the following procedure to remove the existing ignition control:

1. Shut off power to the appliance.
2. Turn off gas at the manual shutoff valve adjacent to the appliance. (If the manual shutoff valve services more than one appliance, be sure to light the other pilots before leaving the installation.)
3. Label each wire with the correct terminal designation prior to disconnection.
4. Disconnect the power supply (transformer) and the thermostat lead wire at the ignition control.
5. Disconnect the sensing probe lead wire from Terminal 4 on the ignition control.
6. Disconnect the high-voltage cable from the spark transformer on the ignition control.
7. Disconnect the Pilot Valve 1 and Main Valve 3 lead wires from the terminal board or 5-end plug-in Heyco® terminals on the ignition control.
8. Disconnect the Y79 lockout module lead wire (if a Y79 is used) from the ignition control.
   Note: The Y79 lockout module is no longer necessary as the replacement G600 ignition control (100% lockout models only) has a built-in lockout function.
9. Disconnect the vent damper plug/cable (if used) from the ignition control.
10. Remove the two screws holding the ignition control to the valve (if direct valve-mount model) or remove the screws holding the control to the appliance chassis (if foot-mount model).
11. Remove the old ignition control and discard.

Mounting

WARNING: Fire or Explosion Hazard.
If the control is installed in an area that is exposed to water (dripping, spraying, rain, etc.), it must be protected. If the control has been exposed to water in any way, do not use it.

CAUTION: Equipment Damage Hazard.
Do not mount the control where it will be exposed to direct infrared radiation from the main burner or to temperatures in excess of the maximum product temperature rating.
Perform the following procedure to mount the new G600:

1. Choose a location that provides the shortest, direct-cable route to the spark electrode/flame sensor assembly. Easy access to the terminals is desired for wiring and servicing. The G600 may be mounted in any position.

2. Mount the control on a grounded metal surface.

   Note: The G600 is packaged with a mounting plate and two hex head screws. Use the two screws to secure the new ignition control to the valve assembly or to the back mounting plate. Refer to Table 1 for mounting instructions.

Table 1: Mounting Instructions

<table>
<thead>
<tr>
<th>Original Ignition Control</th>
<th>Mounting Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>G60, G66, CSA</td>
<td>Use same holes as old ignition.</td>
</tr>
<tr>
<td>G65</td>
<td>Cannot mount G600 on valve. Mount on flat surface and wire to valve.</td>
</tr>
</tbody>
</table>

Wiring

**CAUTION: Equipment Damage Hazard.**
Connect the high voltage cable to the spark transformer terminal and spark electrode (pilot burner assembly) before applying power to the control. Be certain the ground wire is attached to the pilot burner and control ground terminal strip.

**CAUTION: Equipment Damage Hazard.**
Locate all limit and operating controls in series with the thermostat terminal (THS 2) on the ignition control.

Check the voltage rating marked on the control and make sure it is suited to the application. Use a National Electrical Code (NEC) Class 2 transformer to provide 24 VAC under maximum load, including valves. A transformer having excessive primary impedance due to poor coupling will affect the ignition potential.

Refer to Figures 1 through 3 for wiring diagrams. All wiring should be in accordance with the NEC and all other local codes and regulations. The high-voltage spark transformer cable must not be in continuous contact with a metal surface. Use standoff insulators. Ensure that the flame sensor wire and the high voltage spark transformer cable are separated from one another a minimum of 6.35 mm (1/4 in.) and are not wrapped around any pipe, other wiring, or accessories.

![Wiring Diagram](Figure 1: Wiring Diagram for Non-100% Lockout G600 with Terminal Board Connections)
Notes:
1. This un-switched 24 VAC line must be used as shown if a vent damper is to be installed in the system.

2. If the G600 is mounted directly to a valve having two leads numbered 1 and 3, it is internally grounded and does not require the ground connection shown.

3. Damper plug installation instructions:
   a. If the original control was not connected to an external control (e.g., M35) through the 6-pin receptacle, the damper plug must be inserted.
   b. If the original control was connected to an external control through the 6-pin receptacle, reconnect as found and discard the damper plug.

**Figure 2: Wiring Diagram for 100% Lockout G600 with Terminal Board Connections**

Notes:
1. This un-switched 24 VAC line must be used as shown if it is already available on the system. Otherwise, omit the 24 VAC line and connect Terminals 5 and 6 with the jumper provided.

2. If the G600 is mounted directly to a valve having two leads numbered 1 and 3, it is internally grounded and does not require the ground connections shown.

**Figure 3: Wiring Diagram for Non-100% Lockout G600 with 5-end Heyco Connections**

Note: Non-lockout and lockout models are provided in both terminal board and Heyco wiring connection styles. Refer to the wiring connection information supplied in the Technical Data section.
Setup and Adjustments

Commissioning

The anticipator setting is normally equal to the ignition system current draw, plus that of the pilot and main valve.

Due to variations in appliance wiring and valves, it is advisable to measure the actual current draw of the heating system at the thermostat location. Measuring this current can be accomplished by opening the thermostat contacts (lowering the setpoint) and installing an AC ammeter across the terminals, or by using a clamp-on ammeter with a ten turn multiplier attached to the terminals. See Figure 4.

**IMPORTANT:** Measuring the current with an ammeter energizes the system. Wait until the appliance is in the run condition before taking a current draw measurement.

![AC Ammeter Low Scale Setting](image1)

![Clamp-on Ammeter](image2)

**Figure 4: Measuring Thermostat Current Checkout**

Checkout

**WARNING: Fire or Explosion Hazard.**
Avoid personal injury or property damage by making sure the control functions properly and there are no gas leaks. Follow this checkout procedure before leaving the installation.

Make sure all components are functioning properly by performing the following shutoff test:

1. Turn on power to the appliance with the gas and the thermostat off.
2. Turn the thermostat to the highest setting and verify that the control goes through the operating sequence to a lockout condition. (Non-lockout models will not lockout, but spark indefinitely.)
   - **Note:** The burner will not light because the gas is off.
3. Turn off the thermostat.
4. Turn on the gas and purge gas lines of all air.
5. Test for leaks on all pipe joints and connections upstream of the gas valve with a soap solution.
6. Turn the thermostat to the highest setting and verify successful ignition and a normal run condition for at least 3 minutes. If the appliance fails to run, see the Troubleshooting section.
   - **Note:** The burner will not light because the gas is off.
7. Test for leaks on all pipe joints and connections downstream of the gas valve with a soap solution.
8. Turn the thermostat down for at least 30 seconds and then back up again. Verify successful ignition at least three times.
9. Return the thermostat to a normal temperature setting before leaving the installation.
Operation

Operating Mode Definitions
The following definitions describe the G600 operating conditions:

• Prepurge: Initial time delay between thermostat contact closure and trial for ignition.

• Trial-for-Ignition: Period during which the pilot valve and spark are activated, attempting to ignite gas at the pilot burner. The control attempts to prove flame at the pilot burner within the trial-for-ignition time. Once flame is proven, the main valve is energized.

• Run: Main gas valve and pilot valve remain energized and spark is turned off after successful ignition.

• Lockout: Pilot gas did not ignite within the trial-for-ignition time. Open the thermostat contacts for 30 seconds, then close to restart the sequence of operation.

• Flameout: Loss of proven flame.

Sequence of Operation
Figure 5 illustrates the sequence of operation of the G600 controls.

When the G600 is used to replace an original control, the system sequence of operation does not change. Following is the sequence of operation for all G600s:

1. Call for Heat: The thermostat contacts close, powering Terminal 2 on the G600.

2. Pilot Flame Checking: If the G600 detects the presence of pilot flame (from the flame sensor) when there should not be (i.e., before the call for heat), the G600 will not operate.

3. Vent Damper Actuation: On models electrically interlinked with a vent damper, the G600 powers the vent damper motor. Once the vent damper reaches its open position, the motor stops, and the G600 is allowed to begin the prepurge (purge models only) or trial for ignition.

4. Prepurge: The appliance prepurge fan or relay is energized through the thermostat contacts. The control delays for the 4-second prepurge before simultaneously opening the pilot valve and supplying a continual spark at the pilot burner (models with prepurge only).

5. Trial for Ignition: During the trial for ignition, the G600 energizes Terminal 1 and the spark transformer, which opens the pilot valve and activates the spark in an attempt to light the pilot burner. If the G600 detects the presence of the pilot flame within the trial-for-ignition time, it proceeds to the run state. If the G600 does not detect the presence of the pilot flame within the trial-for-ignition time, it de-energizes all outputs (locks out) and remains in this condition until the thermostat is recycled. The G600AX and G600AY have infinite trials for ignition and spark indefinitely.

6. Run: If pilot flame is detected within the trial for ignition, Terminal 3 is energized and the spark transformer is de-energized, which opens the main valve and shuts off the spark. The pilot valve and main valve are kept open throughout the run state. The control remains in the run condition until the call for heat ends or until a flameout occurs.

7. Flameout: If, during the run state, the control detects the loss of pilot flame, it de-energizes the main valve within 0.8 second (flame failure response time). The pilot valve is kept open, the spark is re-established, and another trial for ignition begins.
Start

Thermostat call for heat

Flame present for 30 seconds?

Yes → Lockout → End

No → Prepurge

Note: Models with prepure only.

Trial for ignition

Flame sensed?

Yes → Energize main valve. → Run

No → Flameout?

Yes → Lockout

No → thermostat calling for heat?

Yes → Fifth flameout?

Yes → De-energize control and valve.

No → No

Is control a G600AX or AY?

Yes → Is control a G600KX, LX, LY, MX, NX, or RX?

Yes → No

No → thermostat calling for heat?

Yes → De-energize control and valve.

No → No

Figure 5: G600 Sequence of Operation
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:

- Are all mechanical and electrical connections tight?
- Is the system wired correctly?
- Is gas inlet pressure per the manufacturer’s specifications?
- Is the system powered?
- Is the thermostat calling for heat?

There are three potential system failure conditions:

- No spark, and system does not work.
- Spark present, but pilot does not light.
- Pilot lights, but main burner does not come on.

Determine the failure condition, then use the respective flowchart on the following pages to troubleshoot the system. Perform the procedures in the Checkout section after any servicing.

Repairs and Replacement

⚠️ CAUTION: Equipment Damage Hazard.
Label all wires prior to disconnection when replacing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

The G600 controls are not field repairable. **Do not** attempt field repairs. Use only an exact or factory-recommended replacement control.

All other accessories, such as flame sensors, electrode assemblies, pilot assemblies, and leads can be obtained through the original equipment manufacturer or a Johnson Controls distributor.
Start

Is 24 VAC present between Terminal 2 and ground?

Yes

Open thermostat contacts for 30 seconds and then close.

No

Check for defective transformer, thermostat, or faulty wiring.

Is 24 VAC present between Terminal 2 and ground?

Yes

Open thermostat contacts for 30 seconds and then close.

No

Check for defective transformer, thermostat, or faulty wiring.

Is spark present now?

Yes

System was in lockout (if control is 100% lockout). Causes include flameout or an internal fault.

No

Did pilot remain lit from previous cycle?

Yes

Replace gas valve.

No

Turn off supply voltage.

Is spark cable securely connected to the ignition control?

Yes

Correct

No

Is spark cable brittle, burnt, or cracked?

Yes

Replace cable.

No

Is spark electrode ceramic cracked?

Yes

Replace pilot burner.

No

Is spark gap per manufacturer’s specifications and located in pilot gas stream?

Yes

Replace control.

No

Correct or replace pilot burner.

Figure 6: No Spark, and System Does Not Work
Start

Are pilot valve connections correct and secure?  
Yes

Is 24 VAC between Terminal 1 and ground?  
Yes

Is inlet gas pressure per manufacturer’s specifications?  
Yes

Is gas at pilot burner?  
Yes

Correct or replace pilot burner.

Is spark gap per manufacturer’s specifications and located in pilot stream?  
Yes

Shield from drafts.

If OK, replace pilot valve.

Correct gas pressure.

Replace control.

Connect pilot valve securely between Terminal 1 and ground.

No

Are pilot valve connections correct and secure?

Is 24 VAC between Terminal 1 and ground?

Is inlet gas pressure per manufacturer’s specifications?

Is gas at pilot burner?

Is spark gap per manufacturer’s specifications and located in pilot stream?

End

Figure 7: Spark Present, but Pilot Does Not Light
Start

Does spark stay on after pilot lights?

Yes

Make sure sensor cable and spark cable are separated and not wrapped around any pipes or accessories.

No

Is 24 VAC between Terminal 3 and ground?

Yes

Is gas inlet pressure per manufacturer’s specifications?

Yes

Correct

No

Replace control.

Is sensor cable securely connected to Terminal 4 and flame sensor?

Yes

Correct

Is sensor ceramic cracked?

Yes

Replace flame sensor.

No

Replace main valve.

Correct

Is sensor cable grounded out?

Yes

Does sensor cable lack continuity or good insulation?

Yes

Replace cable.

No

Figure 8: Pilot Lights, but Main Burner Does Not Come On
### Technical Data

<table>
<thead>
<tr>
<th>Product</th>
<th>G600 Series Replacement Intermittent Pilot Ignition Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition Type</td>
<td>Indirect</td>
</tr>
<tr>
<td>Ignition Source</td>
<td>High voltage spark, capacitive discharge</td>
</tr>
<tr>
<td>High Voltage Cable</td>
<td>Maximum Length: 1,220 mm (48 in.)</td>
</tr>
<tr>
<td>Flame Sense Cable</td>
<td>Maximum Length: 1,220 mm (48 in.)</td>
</tr>
<tr>
<td>Flame Detection Means</td>
<td>Flame rectification</td>
</tr>
<tr>
<td>Flame Detection Type</td>
<td>Remote</td>
</tr>
<tr>
<td>Minimum Flame Current</td>
<td>G600AX and AY: 0.2 microamperes DC</td>
</tr>
<tr>
<td></td>
<td>G600KK, LX, LY, MX, NX, and RX: 0.15 Microamperes DC</td>
</tr>
<tr>
<td>Flame Failure Response Time</td>
<td>0.8 second maximum</td>
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<tr>
<td>Spark Gap</td>
<td>2.5 mm (0.1 in.) nominal</td>
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<tr>
<td>Prepurge Time</td>
<td>G600AX and AY: None</td>
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<td></td>
<td>G600KK, LX, LY, MX, NX, and RX: 4 seconds*</td>
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<tr>
<td>Trial-for-Ignition Time Model</td>
<td>G600AX, AY: Infinite</td>
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<tr>
<td></td>
<td>G600KKX, LX, LY, MX, NX, and RX: 8 seconds</td>
</tr>
<tr>
<td></td>
<td>G600MX: 25 seconds</td>
</tr>
<tr>
<td></td>
<td>G600NX: 50 seconds</td>
</tr>
<tr>
<td></td>
<td>G600RX: 120 seconds</td>
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<tr>
<td></td>
<td>G600AX, AY: 24 VAC at 60 Hz</td>
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<tr>
<td></td>
<td>G600AX, AY: 0.15 A nominal +valves</td>
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<tr>
<td>Spark Transformer Connection</td>
<td>Rajah</td>
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<tr>
<td>Power Requirements</td>
<td>Main Valve: 2 A continuous, 5 A inrush</td>
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<tr>
<td></td>
<td>Pilot Valve: 2 A continuous, 5 A inrush</td>
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<tr>
<td>Maximum Firing Rate</td>
<td>117 kW (400,000 Btu/hr)</td>
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<tr>
<td>Ambient Storage Conditions</td>
<td>-40 to 66°C (~40 to 150°F)</td>
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<td>Humidity Rating</td>
<td>95% RH non-condensing</td>
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<td>Type of Gas</td>
<td>Natural, Liquefied Petroleum (LP), manufactured, mixed, or LP gas-air mixture</td>
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<td>Agency Listings</td>
<td>CSA (AGA/CGA) Certificate Number 164933-1064436</td>
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<tr>
<td>Specification Standards</td>
<td>ANSI Standard Z21.20</td>
</tr>
</tbody>
</table>

* Timings listed are for 60 Hz operations. Timings increase by 20% under 50 Hz operation.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.