The GS Series single-block multi-function gas control valves provide for protection and control of atmospheric and forced draft gas burners in industrial and commercial heating installations. Optional sizing of body flanges offers greater application flexibility. Valves are approved to European and North American standards.

Typical applications include commercial and industrial boilers, commercial and industrial burners and ovens, rooftop units, make up air heaters, hot water heaters, kilns, and paint booths.

These single-block multi-function gas control valves offer single unit control, replacing multiple components in a gas-train assembly, such as on-off gas valves, gas pressure regulators, and modulating gas valves. Options include adjustable start gas and slow open function, spring and servo regulators, and gas/air ratio control.
### Table 1: Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Types of Gas</strong></td>
<td>Natural and Liquid Petroleum (LP) Gas</td>
</tr>
<tr>
<td><strong>Maximum Operating Pressure</strong></td>
<td>5 psi (350 mbar)</td>
</tr>
<tr>
<td><strong>Maximum Inlet Pressure</strong></td>
<td>5 psi (350 mbar) on shutoff valves</td>
</tr>
<tr>
<td></td>
<td>3 psi (200 mbar) with pressure regulator</td>
</tr>
<tr>
<td><strong>Maximum Differential Pressure</strong></td>
<td>8 inches W.C. (20 mbar) (GS-03)</td>
</tr>
<tr>
<td></td>
<td>20 inches W.C. (50 mbar) (GS-405 and GS-406)</td>
</tr>
<tr>
<td><strong>Permissible Ambient Temperature</strong></td>
<td>5 to 140°F (-15 to 60°C)</td>
</tr>
<tr>
<td><strong>Body Connections</strong></td>
<td>Detachable flanges with pipe thread 3/8 inches to 1-1/2 inches NPT</td>
</tr>
<tr>
<td><strong>Pressure Taps</strong></td>
<td>Flanges: 1/8 inch threads with plastic tube fitting</td>
</tr>
<tr>
<td></td>
<td>Body: Standard is 1/8 inch (multi-position) Special is 1/4 inch (multi-position) on GS-4 only</td>
</tr>
<tr>
<td><strong>Filter Segment</strong></td>
<td>Dirt Strainer: 0.02 inch (0.5 mm) mesh</td>
</tr>
<tr>
<td></td>
<td>Filter: 0.002 inch (0.05 mm) gauze</td>
</tr>
<tr>
<td><strong>Valve Timings</strong></td>
<td>Closing Time: ≤ 1 second</td>
</tr>
<tr>
<td></td>
<td>Opening Time: &lt; 1 to 15 seconds</td>
</tr>
<tr>
<td></td>
<td>Dead Time: &lt; 1 second</td>
</tr>
<tr>
<td><strong>Operating Time Rating</strong></td>
<td>100% Continuous</td>
</tr>
<tr>
<td><strong>Coil Insulation Class</strong></td>
<td>Class F</td>
</tr>
<tr>
<td><strong>Electrical Connections</strong></td>
<td>Standard Plug DIN 43 650, screw terminals inside DIN plug (Set Number GO-9101-0000, see separate accessories.)</td>
</tr>
</tbody>
</table>

### Table 2: Electrical Ratings

<table>
<thead>
<tr>
<th>Valve Model</th>
<th>Operating Voltages</th>
<th>Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS-20_ _</td>
<td>230 VAC +10/-15%, 50/60 Hz</td>
<td>18 VA</td>
</tr>
<tr>
<td></td>
<td>120 VAC +10/-15%, 50/60 Hz</td>
<td>25 VA</td>
</tr>
<tr>
<td></td>
<td>24 VAC +10/-15%, 50/60 Hz</td>
<td>21 VA</td>
</tr>
<tr>
<td>GS-40_ _</td>
<td>230 VAC +10/-15%, 50/60 Hz</td>
<td>25 VA</td>
</tr>
<tr>
<td></td>
<td>120 VAC +10/-15%, 50/60 Hz</td>
<td>27 VA</td>
</tr>
<tr>
<td></td>
<td>24 VAC +10/-15%, 50/60 Hz</td>
<td>26 VA</td>
</tr>
</tbody>
</table>
CAUTION: This instruction sheet is intended as a guide for qualified service personnel installing or servicing Johnson Controls products.

WARNING: The system must meet all applicable codes. Improper installation may cause explosions, property damage, and injuries.

Carefully follow all instructions in this sheet and all instructions on the appliance. Limit repairs, adjustments, and servicing to the operations listed in this sheet or on the appliance.

CAUTION: Isolate the gas supply at the main manual shutoff valve before installing the GS Series valve.

The GS Series valve may be mounted on a horizontal manifold with the magnetic operator pointed up (vertical) or in any position not exceeding 90° from the vertical. The valve may also be mounted on a vertical manifold in any position around its axis (see Figure 2). Do not install the solenoid actuator upside down. Install vertically wherever possible.

![Figure 2: GS Series Valve Mounting Position](image)

The ambient temperature maximum must not exceed the specified limits (see Table 1).

Check the power supply voltage for compatibility with the required valve voltage. For valves with 24 volt coils, use only NEC Class 2 transformers, such as the Johnson Controls Y65 transformer.

Note: The Y65 transformer must be mounted to a grounded metal enclosure.

When installing the valve on the manifold, ensure the gas flows through the valve body in the direction indicated by the arrow on the body. If the valve is installed with the gas flow opposite the arrow, leakage can occur. When installing the valve, mount the flanges to the pipe separately, then mount the valve between the two flanges.
An optional thread lubricant may have been factory applied to the first two or three threads of the inlet and outlet to avoid galling. Use an approved pipe joint sealing compound on male threads before assembly.

Take care to see that excess compound is removed after mounting the flanges to the pipe work. Threads of pipe and nipples must be smooth and free of tears and burrs. Steam clean all piping to remove foreign substances such as cutting oil or thread chips.

**WARNING:** Shock Hazard. Avoid electrical shock and equipment damage by disconnecting electrical power to the valve before proceeding.

**CAUTION:** Equipment damage hazard. For 24V applications, the ground wire must not be connected to prevent possible grounding of the 24V transformer secondary.

Observe that the operating voltage is identical to the information on the product identification label.

Route the electrical connection for the valve solenoid actuators from the burner sequence control to the standard plug (DIN 43 650) and make the wiring connections in accordance with Figure 3.

![Electrical Connection Diagram]

**Figure 3: Electrical Connection Diagram**
The internal diameter of the impulse tubes for the combustion air ($P_a$) and the combustion chamber pressure, ($P_f$) should be $5/32$ inch (4.0 mm) (see Figure 4). Make the connections as short as possible and route to prevent the entry of condensate into the controller. The installation of a condensation trap in the connection line from the combustion chamber is highly recommended. Do not close the connection for $P_f$ if not used.

**Figure 4: Impulse Line Connections**

Close the upstream shutoff cock. Connect the test pressure of a maximum of 1 psi (70 mbar) to inlet pressure connection. Paint the pipe connection to the valve with a rich soap and water solution. Open the upstream shutoff cock and if bubbles occur this is an indication of a gas leak. To stop a leak, tighten joints and pipe connections. Replace the part if the leak cannot be stopped.
Adjustments

Pressure regulator adjustment must be made in conjunction with the gas appliance. See each version for specific adjustments.

Version GS-_01_

This valve provides manual flow adjustment throughout the full range from zero to maximum flow.

Flow adjustment is accessible below the metal plate on top of the valve cover. To adjust this device, loosen the screw nearest to the +/- scale and swing out the metal plate. Flow adjustment can now be accomplished by selective positioning of the adjustment screw.

Several hand turns of the setting screw, without undue force, will cover flow adjustment from almost zero to 100% of the maximum flow for most specific applications.

Version GS-_02_

The slow opening device is factory adjusted to maximum start gas position. The valve is factory adjusted to maximum flow.

The adjustment ring is provided with an unsealed locking screw. Loosen this screw and turn the entire damper assembly. Flow can now be adjusted from maximum flow down to the desired rate.

⚠️ CAUTION: The minimum flow rate of the valve must not be adjusted beyond the minimum safety working rate of the appliance.

For fast open/step adjustment, remove the cap then turn the adjustment screw counterclockwise until the required step level has been attained.

Version GS-_03_

Loosen the screws of the metal plate on top of the cover to access pressure adjustment screw, using a screwdriver to adjust to the required value.

To ensure proper control function, the pressure regulator must operate within its control range. With a selected pressure drop, the flow must remain within the given limits.

Version GS-405_

With valve in the open position, the plug screw (see Figure 5) below the gas outlet can be removed to check the start gas pressure. The scale \( P_{st} \) will show the setting (see Figure 6). As these are approximations, a subsequent fine adjustment may be necessary.
The start gas pressure ($P_{ST}$) remains at the set level until the plug screw is replaced and tightened. The pressure then rises to the setpoint ($P_{G}$).

Requirement: $P_{G} > P_{ST}$

Now $P_{G}$ can be adjusted.

The repeated switching of cycles will permit the observation of the pressure regulator timing and control performance (see Figure 7). The $P_{G}$ setting can also be revised.
Start repetitions require an interim pause of approximately 20 seconds for the evacuation of the pressure chamber.

With test pressure for external leakage applied, adjust pointer on scale \( P_g \) to white dot within curved ramp (see Figure 6).

For a typical installation, see Figure 8.

![Figure 8: Typical Application Installation](image)

P\(_g\) = Internal Gas Pressure Feedback Line  
P\(_A\) = Air Pressure Feedback Line  
P\(_F\) = Combustion Chamber Pressure Feedback Line

The ratio (R) of gas outlet pressure (P\(_g\)) to combustion air pressure (P\(_A\)) is adjustable within a range of 0.6:1 to 6:1 (see Figures 9 and 10).

Zero set (Z) can be accomplished by parallel shift of the characteristic curve from -0.8 to +0.8 inches W.C. (-2 to +2 mbar) (see Figure 9).

When operating the burner in low fire position, the gas/air ratio is adjusted on scale (Z).
With burner in maximum load position, the gas/air ratio must be adjusted on the scale (R) to meet the desired flue gas analysis readings. Then check the flue gas analyses on low and high settings without manipulating the adjustments, and thereafter, revise the settings if necessary.

Adjustment of the zero set (Z) and the gas/air ratio (R) can be made against the marked scales on both sides of the controller module. Scale divisions are approximate.

The factory settings are:

- zero set: \( (Z) = 0 \)
- gas/air ratio: \( (R) = 1:2 \)

Make adjustments in accordance with burner manufacturers’ instructions and check the outlet pressure at the pressure tap.

Otherwise set the burner to the low fire position, perform a flue gas analysis, and vary outlet pressure with adjustment on the scale (Z) until the desired flue gas analysis readings are obtained.
Set the burner to the maximum load and make flue gas analysis. Then adjust the outlet pressure against the scale (R) until the desired flue gas analysis readings are obtained.

Check the flue gas analysis readings on the low and high settings without manipulating adjustments. Thereafter revise settings if necessary.

The outlet pressure $P_G$:

- without combustion chamber pressure $P_F$: $P_G = R \cdot P_A + Z$
- with combustion chamber pressure $P_F$: $P_G - P_F = R \cdot (P_A - P_F) + Z$
Repairs and Replacement

Field repairs must not be made, except to replace the filter or strainer. For a replacement filter, strainer, replacement valves, or other accessories, contact the nearest Johnson Controls wholesaler or the original equipment manufacturer.

⚠️ CAUTION: Label all wires prior to disconnection when servicing valves. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

To Replace the Filter or Strainer

Perform the following steps to replace the filter or strainer:

1. Clean or replace the filter or strainer with each recommended inspection or at a minimum each annual functional inspection.
2. Close the upstream shutoff cock. Remove the screws on the flanges and remove the valve.
3. Clean or replace the filter or strainer. Reinstall.
4. Refasten the flange screws. Open the upstream shutoff cock. Check both flanges for leakage.