OpenAir™
Spring Return, 20 lb-in (2 Nm), Rotary
GQD Series, Electronic Damper Actuators

![UL Listed](image)

<table>
<thead>
<tr>
<th>Description</th>
<th>The OpenAir GQD Series direct-coupled spring return electronic actuator is designed for modulating, two-position, and floating control of building HVAC dampers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>• Bi-directional spring return (fail-safe)</td>
</tr>
<tr>
<td></td>
<td>• Pre-cabled</td>
</tr>
<tr>
<td></td>
<td>• Plenum-rated models available</td>
</tr>
<tr>
<td></td>
<td>• Fast run time</td>
</tr>
<tr>
<td></td>
<td>• Available in 20 lb-in (2 Nm) torque</td>
</tr>
<tr>
<td></td>
<td>• Signal inversion capability on modulating types (2 to 10 Vdc or 10 to 2 Vdc)</td>
</tr>
<tr>
<td></td>
<td>• UL and cUL listed, CE certified</td>
</tr>
<tr>
<td></td>
<td>• Compact footprint</td>
</tr>
<tr>
<td></td>
<td>• Low voltage models are 24 Vac/dc compatible</td>
</tr>
<tr>
<td></td>
<td>• 120 Vac model with 1/2&quot; NPT conduit connection</td>
</tr>
<tr>
<td>Application</td>
<td>Used in constant or variable air volume installations for the control of return air, mixed air, exhaust, and face and bypass, and residential zone dampers requiring up to 20 lb-in (2 Nm) torque.</td>
</tr>
<tr>
<td></td>
<td>Designed for applications that require the damper to return to a fail-safe position when there is a power failure.</td>
</tr>
</tbody>
</table>

Siemens Building Technologies, Inc.
Product Numbers

Table 1.

<table>
<thead>
<tr>
<th>Product Number*</th>
<th>Voltage 24 Vac/dc</th>
<th>Voltage 120 Vac</th>
<th>Control Signals 2-Position</th>
<th>Floating</th>
<th>Modulating 2 to 10 Vdc</th>
<th>10 to 2 Vdc</th>
<th>Plenum Cabling</th>
</tr>
</thead>
<tbody>
<tr>
<td>GQD121.1P</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>GQD131.1P</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>GQD151.1P</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>GQD221.1U</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

*Add /B to part numbers to order bulk pack of 10 each.

Warning/Caution Notations

<table>
<thead>
<tr>
<th>WARNING:</th>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal injury/loss of life may occur if you do not perform a procedure as specified.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION:</th>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment damage may occur if you do not perform a procedure as specified.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Actuator Components

Figure 1. Components of the GQD Spring Return Actuator.

Figure 2. GQD221.1U Only, Conduit Adapter.
### Specifications

| Power Supply | Operating voltage | 24 Vac ±20%; 24 Vdc ±15%  
120 Vac ± 15% |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>50/60 Hz</td>
<td></td>
</tr>
</tbody>
</table>
| Power consumption | running             | GQD121.1P 6.5 VA (4.5W)  
GQD131.1P 4 VA (2.5W)  
GQD151.1P 4.5 VA (3W) |
|             | holding           | GQD121.1P 4 VA (2.5W)    
GQD131.1P 3 VA (1.5W)  
GQD151.1P 3.5 VA (2W) |
| 120 Vac     | running           | GQD221.1U 10 VA          
holding 7 VA       |
| Equipment Rating | 24 Vac Class 2, in accordance with UL/CSA  
Class III per IEC 60536 |
|             | 120 Vac Double insulation |
| Control Signal | Input signal (wires 8–2) voltage input signal GQD151  
in resistance >100K ohms |
| Feedback Signal | Position output signal (wires 9–2) voltage output signal GQD151  
maximum output current +1 mA, -0.5 mA |
| Function     | Running/spring return torque 20 lb-in (2 Nm)  
Maximum torque 53 lb-in (6 Nm) |
|              | Runtime for 90° operating with motor 30 seconds  
closing (on power loss) with spring return 15 seconds typical |
| Mounting     | Nominal angle of rotation 90°  
Maximum angular rotation 95° |
|             | Shaft size 3/8 to 1/2-inch (8 to 13 mm) dia.  
1/4 to 7/16-inch (6 to 11 mm) square |
|             | Minimum shaft length 3/4-inch (20 mm) |
| Housing      | Enclosure NEMA 1  
IP40 |
|             | Material Plenum rated rugged plastic  
Gear lubrication Silicone-free |
| Ambient Conditions | Ambient temperature operation –25°F to 130°F (–32°C to 55°C)  
storage and transport –40°F to 158°F (–40°C to 70°C)  
Ambient humidity (non-condensing) 95% rh |
Agency Certification
UL listed per UL873
24 Vac cUL to CSA C22.2 No. 24-93
C-Tick conformity per AS/NZS3548
120 Vac EMC and Low Voltage Directives

Miscellaneous Pre-cabled connection 18 AWG (0.75 mm²)
Cable length 3 feet (0.9 m) length
Life cycle Designed for minimum of 60,000 full stroke cycles and a minimum of 1.5 million repositions at rated torque and temperature
Dimensions 4-23/32" H × 2-22/32" W × 2-15/32" D
(120 mm H × 69 mm W × 63 mm D)
GQD221.1U (only) 5 1/2" H × 2-22/32"W × 2-15/32" D
(138.5 mm H × 69 mm W × 63 mm D)

Weight 1.06 lbs (0.48 kg)

Service Parts

Figure 3. 985-055P24
Anti-rotation Bracket (mounting).

Figure 4. 985-124
499-ohm Resistor Assembly Kit for 4 to 20 mA Applications.
**Operation**

**GQD151**
Apply a continuous 2 to 10 Vdc control signal between wire 8 (Y) and wire 2 (G0) to operate the damper actuator. The angle of rotation is proportional to the control signal.

A 2 to 10 Vdc position feedback output signal is available between wire 9 (U) and wire 2 (G0) to monitor the position of the damper motor.

In the event of a power failure or when the operating voltage is shut off, the actuator returns to the "0" position.

**GQD121/GQD221.1U**
When power is applied, the actuator coupling moves toward the open position "90°". In the event of a power failure or when the operating voltage is shut off, the actuator returns to the "0" position.

**GQD131**
A floating control signal controls the damper actuator. The actuator's angle of rotation is proportional to the length of time the signal is applied. A 24 Vac/dc control signal to wire 6 (Y1) causes the actuator coupling to rotate clockwise. A 24 Vac/dc control signal to wire 7 (Y2) causes the actuator coupling to rotate counterclockwise.

With no control voltage, the damper actuator holds its position. In the event of a power failure, the actuator will return to the "0" position.

**Overload Protection**
In the event of a blockage in the damper, the actuator is overload protected over the full range to prevent damage to the actuator.

**Life Expectancy**
An improperly tuned loop will cause excessive repositioning that will shorten the life of the actuator.

**Sizing**
The type of actuator required depends on several factors:

1. Obtain damper torque ratings (lb-in/ft² or Nm/m²) from the damper manufacturer.
2. Determine the area of the damper.
3. Calculate the total torque required to move the damper:

   \[
   \text{Total Torque} = \frac{\text{Torque Rating} \times \text{Damper Area}}{\text{SF}^1}
   \]

4. Select a spring return actuator using Table 1.

   \(^1\) Safety Factor: When calculating the total torque required, a safety factor should be included for unaccountable variables such as slight misalignments, aging of the damper, etc. A suggested safety factor is 0.80.
Table 2. Sizing.

<table>
<thead>
<tr>
<th>Total Torque</th>
<th>Actuator</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \leq 20 \text{ lb-in (2Nm)} )</td>
<td>GQD</td>
</tr>
<tr>
<td>( &gt;20 \text{ lb-in} \leq 62 \text{ lb-in} ) ( (&gt;2\text{Nm} \leq 7 \text{ Nm}) )</td>
<td>GMA</td>
</tr>
<tr>
<td>( &gt;62 \text{ lb-in} \leq 142 \text{ lb-in} ) ( (7 \text{ Nm} \leq 16 \text{ Nm}) )</td>
<td>GCA</td>
</tr>
<tr>
<td>( &gt;142 \text{ lb-in} \leq 248 \text{ lb-in} ) ( (&gt;16 \text{ Nm} \leq 28 \text{ Nm}) )</td>
<td>Tandem GCA</td>
</tr>
<tr>
<td></td>
<td>\textbf{ASK73.2U*}: Tandem mounting bracket with any combination of GCA16x.</td>
</tr>
<tr>
<td></td>
<td>\textbf{ASK73.1U*}: Tandem mounting bracket for all other GCAx actuators.</td>
</tr>
</tbody>
</table>

*NOTE:* Mechanically coupled actuators must be of the exact same type. Use the correct mounting bracket.

Mounting and Installation

- The shaft adapter can be mounted on either side of the actuator. The actuator mounting orientation and shaft length determine how they will be mounted on the actuator.
- The minimum damper drive shaft length is 3/4-inch (20 mm).
- See Specifications for the minimum and maximum damper shaft dimensions.
- A mounting bracket is included with the actuator.
- See the detailed installation instructions included with each actuator.

DIP Switch Functionality

<table>
<thead>
<tr>
<th>Description</th>
<th>Label</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse Acting</td>
<td></td>
<td>Direct-Acting</td>
<td>Input Signal Inversion</td>
</tr>
</tbody>
</table>

Figure 5. DIP Switch.

Input Signal Inversion

Figure 6.
Wiring

All wiring must conform to NEC and local codes and regulations.

Use earth ground isolating step-down Class 2 transformers. Do not use autotransformers.

The maximum rating for a Class 2 step-down transformer is 100 VA. Determine the supply transformer rating by summing the VA ratings of all actuators and all other components used. It is recommended that one transformer power no more than 10 actuators (or 80% of its VA).

**WARNING:**

Installations requiring CE Conformance:

- All wiring for 24 Vac/dc actuators must only be safety extra-low voltage (SELV) or protective extra-low voltage (PELV) per HD384.
- Use safety transformers per EN61558 with double isolation, designed for 100% duty-cycle for supplying SELV or PELV circuits.
- Over-current protection for supply lines is maximum 10A.

Wire Designations

Each wire has the standard symbol printed on it. See Table 3.

**Table 3. Wire Designations.**

<table>
<thead>
<tr>
<th>Applicable Actuator</th>
<th>Standard Symbol</th>
<th>Function</th>
<th>Terminal Designations</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vac/dc</td>
<td>1</td>
<td>Supply (SP)</td>
<td>G</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Neutral (SN)</td>
<td>G0</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Control signal clockwise (CW)</td>
<td>Y1</td>
<td>Violet</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Control signal counterclockwise (CCW)</td>
<td>Y2</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Input signal: 2 to 10 Vdc or 10 to 2 Vdc</td>
<td>Y</td>
<td>Gray</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Position output: 2 to 10 Vdc</td>
<td>U</td>
<td>Pink</td>
</tr>
<tr>
<td>120 Vac</td>
<td>3</td>
<td>Supply</td>
<td>L</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Neutral</td>
<td>N</td>
<td>White</td>
</tr>
</tbody>
</table>
Wiring Diagrams

GQD121.1P
24 Vac/dc
2-Position Control

GQD131.1P
24 Vac/dc
Floating Control

GQD151.1P
24 Vac/dc
Modulating Control

GQD221.1U
120 Vac
2-Position Control

Figure 7.

Figure 8.

Figure 9.

Figure 10.
Wiring Diagrams, continued

Special Applications

GQD151

4 to 20 mA

Figure 11. GQD151 4 to 20 mA Applications.
Start-Up/Commissioning

GQD151
Spring Return
Modulating Control
24 Vac/dc

1. Check Operation:
   a. Connect wires 1 (red) and 2 (black) to the 24 Vac/dc power supply.
      NOTE: With no input signal present, the GQD151 actuator with input signal inversion switch set to Inverse Acting, will start driving towards 90°.
   b. Use a Digital Multimeter (DDM) and set the dial to Vdc for the actuator input signal.
   c. Connect wires 2 (black) and 8 (gray) to the DMM.
   d. Apply to input signal wire 8 (gray):
      \[ Y = 10 \text{ Vdc} \text{ (GQD151 with input signal inversion switch set to Direct Acting).} \]
      \[ Y = 2 \text{ Vdc} \text{ (GQD151 with input signal inversion switch set to Inverse Acting).} \]
      Allow the actuator shaft coupling to rotate from 0° to 90°.
   e. Apply to input signal wire 8 (gray):
      \[ Y = 2 \text{ Vdc} \text{ (GQD151 with input signal inversion switch set to Direct Acting).} \]
      \[ Y = 10 \text{ Vdc} \text{ (GQD151 with input signal inversion switch set to Inverse Acting).} \]
      The shaft coupling returns to the "0" position.

2. Check Spring Return:
   a. Set the DMM dial to Vdc.
   b. Connect wires 2 (black) and 8 (gray) to the DMM.
   c. Apply to input signal wire 8 (gray):
      \[ Y = 6 \text{ Vdc} \text{ (GQD151).} \]
      Allow the actuator shaft coupling to rotate halfway.
   d. Disconnect wire 1 (red).
      The spring returns the actuator shaft coupling to the fail-safe "0" position.
   e. Connect wire 1 (red) and the actuator moves.

3. Check Feedback:
   a. Set the DMM dial to Vdc.
   b. Attach wires 2 (black) and 9 (pink) to the DMM.
   c. Apply the input signal as in Step 1d, to wire 8 (gray).
      • The reading at the DMM should increase (decrease for GQD151 with output signal inversion switch set to Inverse Acting Feedback).
      • The reading at the DMM should decrease (increase for GQD 151 with output signal inversion switch set to Inverse Acting Feedback) and the actuator shaft coupling returns to the fail-safe "0" position.

GQD121.1P
Spring Return
2-Position
24 Vac/dc

1. Check Operation:
   a. Connect wires 1 (red) and 2 (black) to 24 Vac/dc power supply.
      Allow the actuator shaft coupling to rotate from 0° to 90°.
   b. Disconnect wire 1 (red) and the actuator shaft coupling returns to the "0" position.

2. Check Spring Return:
   a. Connect wire 1 (red).
      Allow the actuator shaft coupling to rotate halfway.
   b. Disconnect wire 1 (red).
      The spring returns the actuator shaft coupling to the fail-safe "0" position.
### Start-Up/Commissioning, Continued

**GQD131 Spring Return Floating 24 Vac/dc**

1. **Check Operation:**
   - a. Connect wires 1 (red) and 2 (black) to a 24 Vac/dc power supply.
   - b. Apply a control signal (24 Vac/dc) to wire 6 (violet).
   - c. Stop the control signal to wire 6 (violet).
   - d. Apply a control signal (24 Vac/dc) to wire 7 (orange).
   
   Allow the actuator shaft coupling to rotate from 0 to 90°.

2. **Check Spring Return:**
   - a. Apply a control signal (24 Vac/dc) to wire 6 (violet).
   - b. Disconnect wire 1 (red).
   - c. Connect wire 1 (red).

   Allow the actuator shaft coupling to rotate half way.

**GQD221.1U Two-Position 120 Vac**

1. **Check Operation:**
   - a. Switch on 120 Vac power.
   - b. Allow the actuator shaft coupling to rotate from 0 to 90°.

2. **Switch off power.**
   
   The actuator shaft coupling will return to the "0" position.

3. **Check Spring Return:**
   - a. Switch on 120 Vac power.
   - b. Allow the actuator shaft coupling to rotate halfway.
   - c. Switch off 120 Vac power.

   The spring returns the actuator shaft coupling to the fail "0" position.

### Service

**WARNING:**

Do not open the actuator.
If the actuator is inoperative, replace the unit.

### Troubleshooting

**WARNING:**

To avoid injury or loss of life, pay attention to any hazardous voltage (For example, 120 Vac) when performing checks.

- Check that the wires are connected correctly.
- Check that DIP switch is set correctly, if used.
- Use a Digital Multimeter (DMM) to verify that the operating voltage is within range.
- If the actuator is not working, check the damper for blockage.
- If blocked, remove the obstacle and cycle the actuator power off and on. The actuator should resume normal operating mode.
Dimensions

Figure 12. GQD Actuator and Mounting Bracket Dimensions in Inches (Millimeters).

Figure 13. GQD 221.1U Actuator Only, Dimensions in Inches (Millimeters).

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. OpenAir is a trademark of Siemens Building Technologies, Inc. Product or company names mentioned herein may be the trademarks of their respective owners. © 2008 Siemens Building Technologies, Inc.