SIEMENS

Technical Instructions

Document Number 155-175P25
EA GCA-3
September 15, 2003

OpenAir™

GCA Series Spring Return Rotary 24 Vac/dc 3-position Control Electric Damper Actuators

c UL US LISTED

Description

The OpenAir direct-coupled, 24 Vac/dc spring return, electric actuator is designed for three-position control of building HVAC dampers.

Features

- Brushless DC motor technology with stall protection
- Bi-directional, fail-safe spring return
- Unique, self-centering shaft coupling
- 142 lb-in (16 Nm) torque
- Manual override
- 5° preload as shipped from factory
- Models with independently adjustable auxiliary switches or feedback are available
- UL- and cUL listed

Application

Used in constant or variable air volume installations to control return air, mixed air, exhaust, and face and bypass dampers requiring up to 142 lb-in (16 Nm) torque. Designed for applications that require the damper to return to a fail-safe position when power fails.

Product Numbers

Table 1. Product Numbers 24 Vac/dc Operating Voltage.

Cabling	Standard	With Feedback Potentiometer	With Dual Auxiliary Switches
Standard	GCA131.1U	GCA132.1U	GCA136.1U
Plenum	GCA131.1P	GCA132.1P	GCA136.1P

Warning/Caution Notations

WARNING	⚠	Personal injury/loss of life may occur if a procedure is not performed as specified.
CAUTION	⚠	Equipment damage or loss of data may occur if the user does not follow a procedure as specified.

Specifications

Power supply	Operating voltage	24 Vac ± 20% / 24 Vdc ± 10%
	Frequency	50/60 Hz
	Power consumption	
	running	8 VA/6W
	holding	5 VA/4W
Equipment rating		Class 2, in accordance with UL/CSA
Auxiliary features	**Feedback potentiometer** (GCA132)	
	Sliding contact (P2)	0 to 1000 ohm, <10mA
	Load	<1W
	Voltage	<24 Vac/dc
	Dual auxiliary switches (GCA136)	
	AC rating (standard cable)	24 to 250 Vac AC 6A resistive AC 2A general purpose
	AC rating (Plenum cable)	24 Vac AC 4A resistive AC 2A general purpose
	DC rating (Standard/Plenum cable)	12 to 30 Vdc DC 2A
	Switch Range	
	Switch A	0 to 90° with 5° intervals
	Recommended range usage	0 to 45°
	Factory setting	5°
	Switch B	0 to 90° with 5° intervals
	Recommended range usage	45 to 90°
	Factory setting	85°
	Switching hysteresis	2°

⚠ **WARNING:**

Apply only AC line voltage from the same phase, or only Class 2 voltage to the switching outputs of both auxiliary switches A and B. Mixed operation is not permissible. See *Wiring* for details.

Specifications, continued	Running/spring return torque	
Function	24 Vac	142 lb-in (16 Nm)
	24 Vdc	106 lb-in (12 Nm)
	Maximum torque	<360 lb-in (40 Nm)
	Runtime for 90°	
	operating with motor	90 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-inch (8 to 25.6 mm) diameter
		1/4 to 3/4-inch (6 to 18 mm) square
	Minimum shaft length	3/4-inches (20 mm)
Housing	Enclosure	NEMA 2 in vertical to horizontal 90° See Figure 12.
		NEMA 3R rated when installed with ASK75.1U Weather Shield in the vertical position. See *Accessories*.
	Material	Die cast aluminum alloy
	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 to UL60730 (to replace UL873)
		cUL-certified to Canadian Standard C22.2 No. 24-93
Miscellaneous	Pre-cabled connection	18 AWG
	Cable length	3 feet (0.9 m) length
	Life cycle	Designed for over 60,000 full strokes and a minimum of 1.5 million repositions at rated torque and temperature
	Noise level	<45 dBA (running)
	Dimensions	See Figure 16.
	Weight	4.85 lb (2.2 kg)

Accessories

NOTE: Neither the auxiliary switches nor potentiometer can be added in the field. Order the product number that includes the desired options. To use the correct kit, select from one of the product numbers shown in Figures 1 through 8.

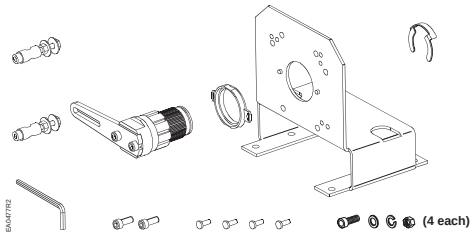


Figure 1. Floor Mount Kit.

ASK71.1U: Kit allows foot mounting of the OpenAir actuators. Kit to be used for in-the-airstream applications, and generally anywhere a foot-mounted actuator can be mounted. Kit contains:

- Crank arm to change the angular rotation into a linear stroke.
- Support bearing ring to minimize side loading on the actuator's output bearing.
- Mounting bracket.
- Required mounting fasteners.

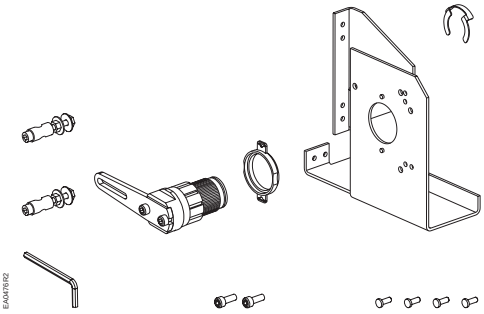


Figure 2. Frame Mount Kit.

ASK71.2U: Kit allows mounting of OpenAir actuators directly to a damper frame. Kit to be used with louvers and vents and in applications where uses of floor mount kit is not possible. Kit contains:

- Crank arm to change the angular rotation to linear stroke.
- Support bearing ring to minimize side loading on actuator's output bearing.
- Mounting bracket.
- Required mounting fasteners.

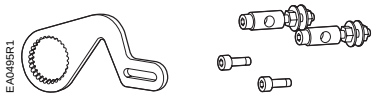


Figure 3. Crank Arm Kit.

ASK71.3: Kit allows direct-coupled actuator to provide auxiliary, linear drive. Crank arm kit can be used to simultaneously drive a set of opposing or adjacent dampers with a single actuator. Kit includes:

- Crank arm that attaches to splined hub of the shaft adapter.
- Other required mounting fasteners.

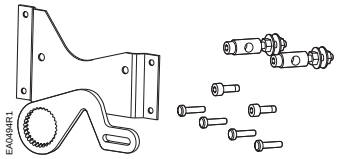


Figure 4. Crank Arm Kit with Mounting Bracket.

ASK71.4: Kit allows economical mounting of OpenAir actuator to a variety of surfaces. Kit should be used in applications where the actuator can be rigid-surface-mounted and linear stroke output is required. Kit includes:

- Crank arm to attach to splined hub of shaft adapter.
- Mounting bracket.
- Other required mounting fasteners

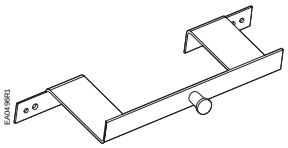


Figure 5. Tandem Mounting Bracket.

ASK73.1: Bracket provides extended anti-rotation pin allowing two OpenAir actuators to directly drive a single damper shaft.

For use with 2- and 3-position actuators.

Accessories, continued

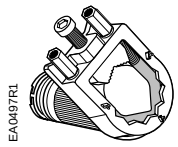


Figure 6. Special Shaft Adapter.

ASK74.1U: Attaches to 1.05-inch (26.6 mm) diameter shaft (standard self-centering adapter accepts up to a one-inch (25.4 mm) diameter shaft).

Can be used for coupling to one-inch jackshafts that are slightly oversized.

Adapter is 13/16-inch (20 mm) shorter than height of the self-centering shaft adapter.

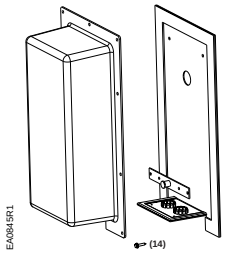


Figure 7. Weather Shield.

ASK75.1U: GCA actuators are UL-listed to meet NEMA 3R requirements (degree of protection against rain, sleet, and damage from external ice formation) when installed with ASK75.1U

Weather Shield and outdoor-rated conduit fittings must be mounted in the vertical position. For dimensions, see Figure 15.

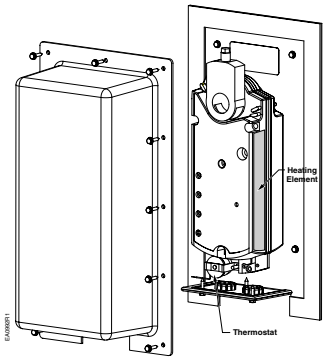
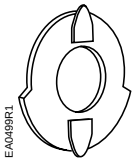


Figure 8. Heater/Weather Shield Assembly.

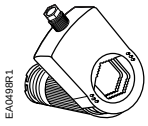
985-106: Provides protection for GCA, GIB, and GBB OpenAir down to temperatures of -58°F (-50°C). Assembly includes:

- Weather Shield
- Heater Kit

Service Parts

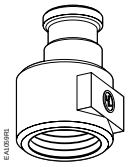


985-003
Position Indicators (10/pkg)



985-004
Standard Shaft Adapter

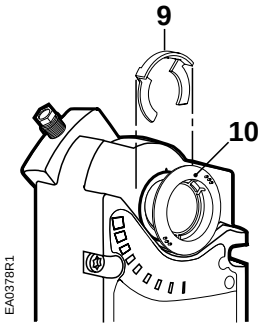
985-006
Anti-rotation (mounting) Bracket

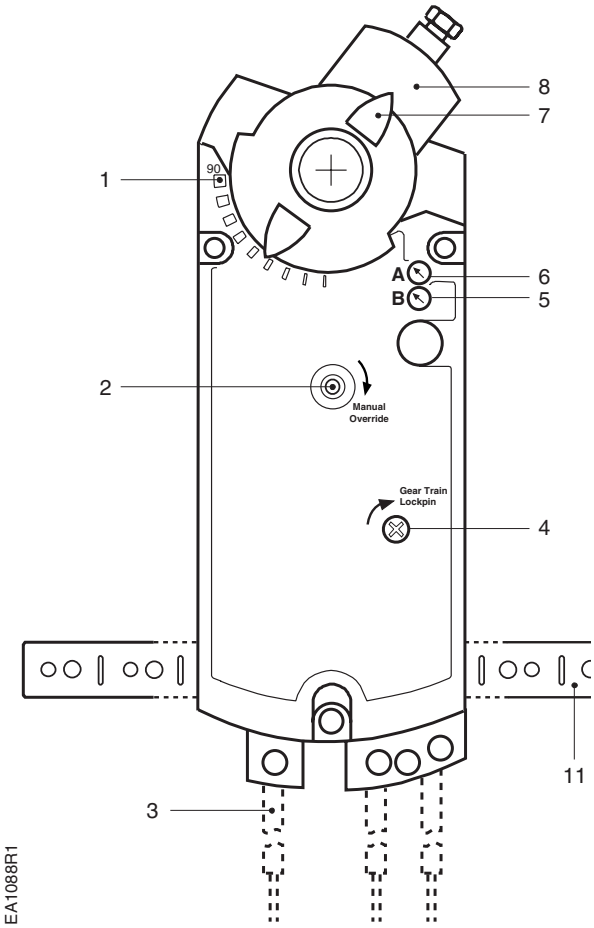


985-008
Conduit adapter, 1/2-inch (12 mm) for NPT connector.

Figure 9. Orderable Parts.

Actuator Components





Legend

1. Positioning scale for angle of rotation
2. Manual override wrench opening and direction of rotation arrow
3. Connection cables
4. Gear train lock pin
5. Auxiliary switch B
6. Auxiliary switch A
7. Position indicator
8. Self -centering shaft adapter
9. Shaft adapter locking clip
10. Position indicator adapter
11. Mounting bracket

Figure 10. Components of the 3-position Actuator.

Operation

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 Y1 causes the actuator coupling to rotate clockwise. A 24 Vac/dc control signal to 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 spring returns to the "0" position.

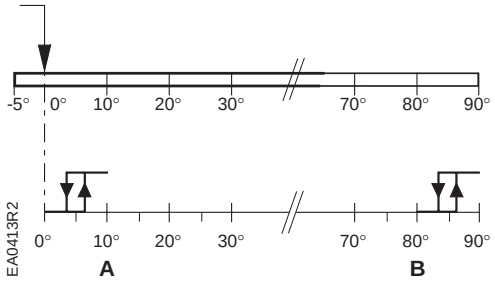
In the event of a blockage in the damper, the actuator is overload-protected over the full range to prevent damage to the actuator.

Life Expectancy

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

Auxiliary Switch

GCA136



Actuator rotary range with the shaft adapter mounted at position "0".

Setting range for switches A and B
Setting interval: 5°
Switching hysteresis: 2°

To change the settings of A and B:

- Make sure the actuator is in the "0" position. The scale is valid only in the "0" position.
- Use a flat-blade screwdriver to turn the switch-adjustment dials to the desired setting at which a signal is to be given.

Factory setting

Switch A	5°
Switch B	85°

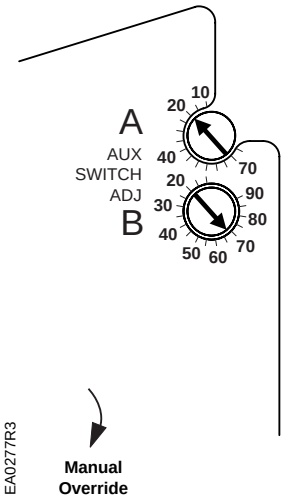


Figure 11. Dual-Auxiliary Switch Dials.

Sizing

To determine the type of actuator you need:

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

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

4. Select the actuator type using Table 2.

[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.

NOTE: Mechanically coupled actuators must all be of the exact same type except for the dual auxiliary switches and feedback potentiometer options. Make sure to use the correct tandem-mounting bracket, See Table 2.

Table 2.

DC Power (24 Vdc)		AC Power (24 Vac, 120 Vac)	
Total Torque	**Actuator**	**Total Torque**	**Actuator**
<62 lb-in (7 Nm)	GMA1xx	<62 lb-in (7 Nm)	GMA
>62 lb-in <106 lb-in (>7 Nm <12 Nm)	GCA12x, GCA13x GCA15x	>62 lb-in <142 lb-in (>7 Nm <16 Nm)	GCA
>106 lb-in <212 lb-in (>12 Nm <24 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: • GCA12x actuators • GCA13x actuators Use tandem mounting bracket ASK73.2U with any combination of GCA151 and GCA156 actuators. *	>142 lb-in <284 lb-in (>16 Nm <32 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: • GCA12x actuators • GCA22x actuators • GCA13x actuators • Master/Slave actuators, See *Technical Instructions (*155-543P25*)* Use tandem mounting bracket ASK73.2U with any combination of: • GCA151 and GCA156 actuators • GCA161 and GCA166 actuators*

*Use only with revision 2 of GCA15x (2 to 10 Vdc)

Mounting and Installation

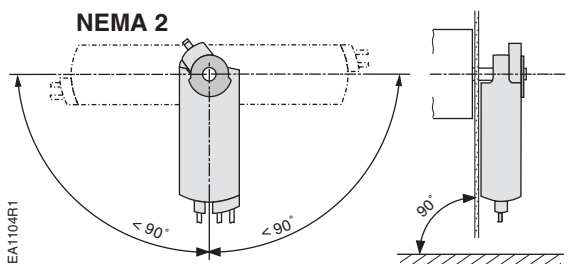
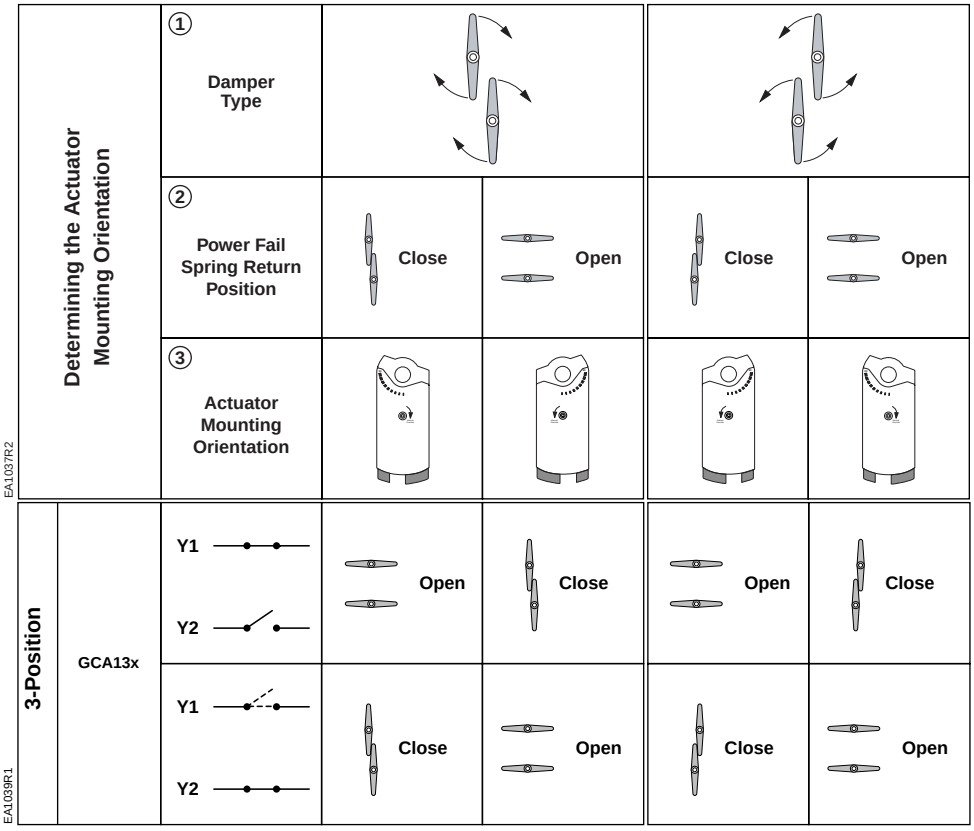


Figure 12. Acceptable NEMA 2 positions.

Mounting and Installation, continued

Flip the actuator to select either clockwise or counterclockwise fail-safe rotation of the damper shaft. Follow steps 1, 2, and 3 of Table 3 to determine the correct actuator mounting orientation.

Table 3. Actuator Mounting Orientation and Damper Control.



The shaft adapter and the position indicator 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-inches (20 mm).

See *Specifications* for the minimum and maximum damper shaft dimensions.

The actuator is shipped from the factory with a 5° preload enabling tight close-off of the damper in power-fail-close applications.

A mounting bracket is included with the actuator. The shaft adapter and mounting parts are shipped in a separate container with the actuator.

See the detailed mounting instructions included with each actuator.

Manual override

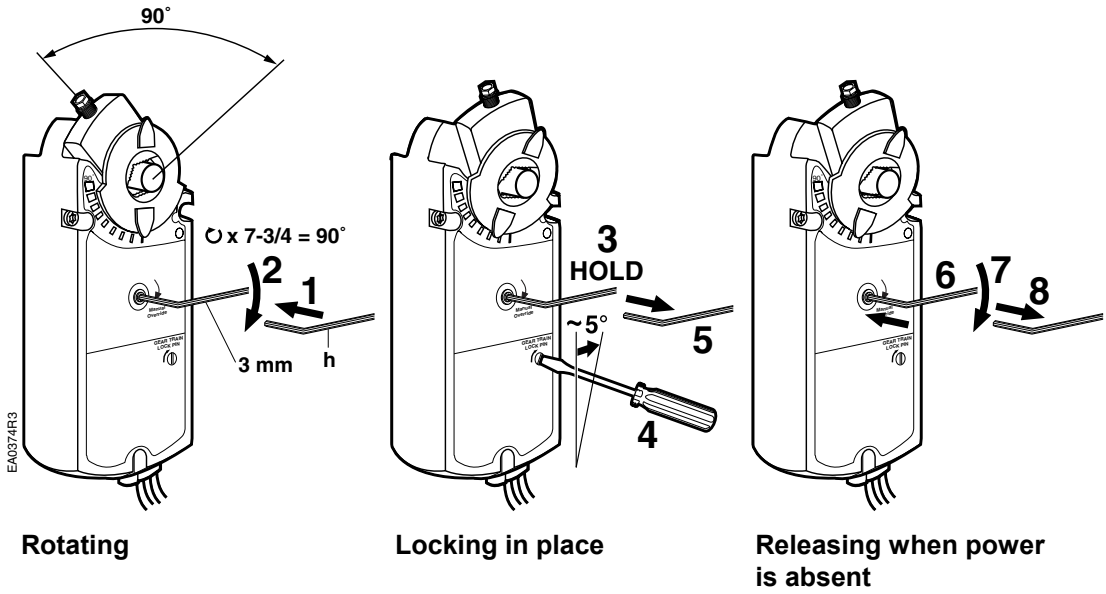


Figure 13. Manual Override.

NOTE: Always turn the key in the direction of the arrow.

CAUTION:

When you engage the gear train lock pin, be careful to turn only about 5 degrees until you hear a click or meet slight resistance. Turning too far will strip the lock pin.

- To release manual override, either restore power and send a control signal, or when power is absent, insert the 3-mm hex key in the override opening, turn the key in the direction of the arrow and remove the key.

Mechanical range adjustment

The angular rotation is adjustable between 0 and 90° at 5-degree intervals. To limit the range of shaft movement, remove the locking clip and self-adjusting shaft adapter. Rotate the damper blade shaft to its failed position. Rotate the shaft coupling to the desired position. Insert the shaft adapter into the actuator and fasten it with the locking clip. See Figure 14.

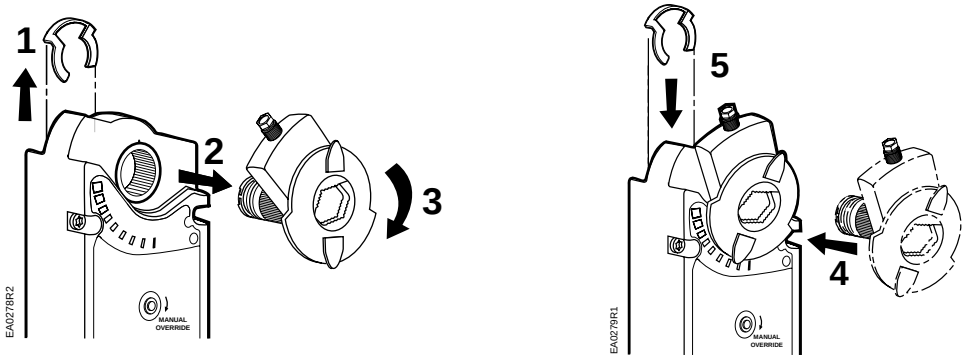


Figure 14. Mechanical Range Adjustment.

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:

Mixed switch operation is not permitted to the switching outputs of both auxiliary switches (A and B).

Either AC line voltage from the same phase must be applied to all six outputs of the dual auxiliary switches, or UL-Class 2 voltage must be applied to all six outputs.

NOTE: With plenum cables, only UL-Class 2 voltage is permitted.

Wire Designations

Each wire has the standard symbol printed on it. See Table 4.

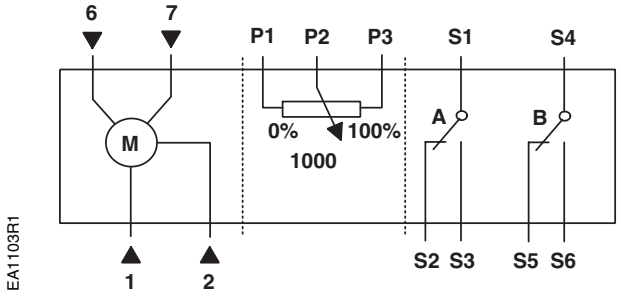


Table 4. Wire Designations.

Standard Symbol	Function	Terminal Designations	Color	
			Standard	Plenum
1	Supply (SP)	G	Red	Red
2	Neutral (SN)	G0	Black	Black
6	Control signal clockwise	Y1	Violet	Violet
7	Control signal counterclockwise	Y2	Orange	Orange
S1	Switch A Common	Q11	Gray/red	Gray/red
S2	Switch A N.C.	Q12	Gray/blue	Gray/blue
S3	Switch A N.O.	Q14	Gray/pink	Gray/pink
S4	Switch B Common	Q21	Black/red	Black/red
S5	Switch B N.C.	Q22	Black/blue	Black/blue
S6	Switch B N.O.	Q24	Black/pink	Black/pink
P1	Feedback Potentiometer 0 to 100% P1 - P2	a	White/red	Black
P2	Feedback Potentiometer Common	b	White/blue	Black
P3	Feedback Potentiometer 100 to 0% P3 - P2	c	White/pink	Black

* With dual auxiliary switch and stranded cable only.

Start-Up/ Commissioning

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

2. Check Spring Return:
   a. Apply a control signal (24 Vac/dc) to wire 6 (violet).
   b. Allow the actuator shaft coupling to rotate half way.
   c. Disconnect wire 1 (red).
   d. The spring returns the actuator shaft coupling to the fail "0" position.
   e. Connect wire 1 (red). The actuator shaft coupling begins to move.

3. Check Feedback:
   a. Set the digital multimeter (DMM) dial to ohms.
   b. Connect wires P1 and P2 to the DMM. The DMM should indicate a resistive value.
   c. Apply a control signal (24 Vac/dc) to wire 6 (violet).
      The reading of the DMM should increase.
   d. Stop applying a control signal to wire 6 (violet).
   e. Connect wires P2 and P3 to the DMM. The DMM should indicate a resistive value.
   f. Apply a control signal (24 Vac/dc) to wire 7 (orange).
      The reading of the DMM should increase.

4. Check the Auxiliary Switch A:
   a. Set the DMM dial to ohms (resistance) or continuity check.
   b. Connect wires S1 and S3 to DMM. The DMM should indicate an open circuit or no resistance.
   c. Apply a control signal (24 Vac/dc) to wire 6 (violet).
      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
   d. Stop applying a control signal to wire 6 (violet).
   e. Connect wires S1 and S2 to the DMM. The DMM should indicate an open circuit or no resistance.
   f. Apply a control signal (24 Vac/dc) to wire 7 (orange).
      The DMM should indicate contact closure as the actuator actuator-shaft coupling reaches the setting of switch A.

5. Check the Auxiliary Switch B:
   a. Set the DMM dial to ohms (resistance) or continuity check.
   b. Connect wires S4 and S6 to the DMM. The DMM should indicate an open circuit or no resistance.
   c. Apply a control signal (24 Vac/dc) to wire 6 (violet).
      The DMM should indicate contact closure as the actuator actuator-shaft coupling reaches the setting of switch B.
   d. Stop applying a control signal to wire 6 (violet).
   e. Connect wires S4 and S5 to the DMM. The DMM should indicate an open circuit or no resistance.
   f. Apply a control signal (24 Vac/dc) to wire 7 (orange).
      The DMM should indicate contact closure as the actuator actuator-shaft coupling reaches the setting of switch B.

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.
- 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

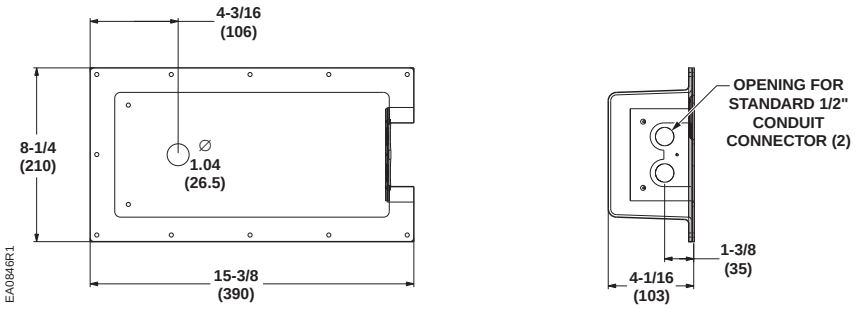


Figure 15. Dimensions of the ASK75.1U Weather Shield in Inches (Millimeters).

Dimensions, continued

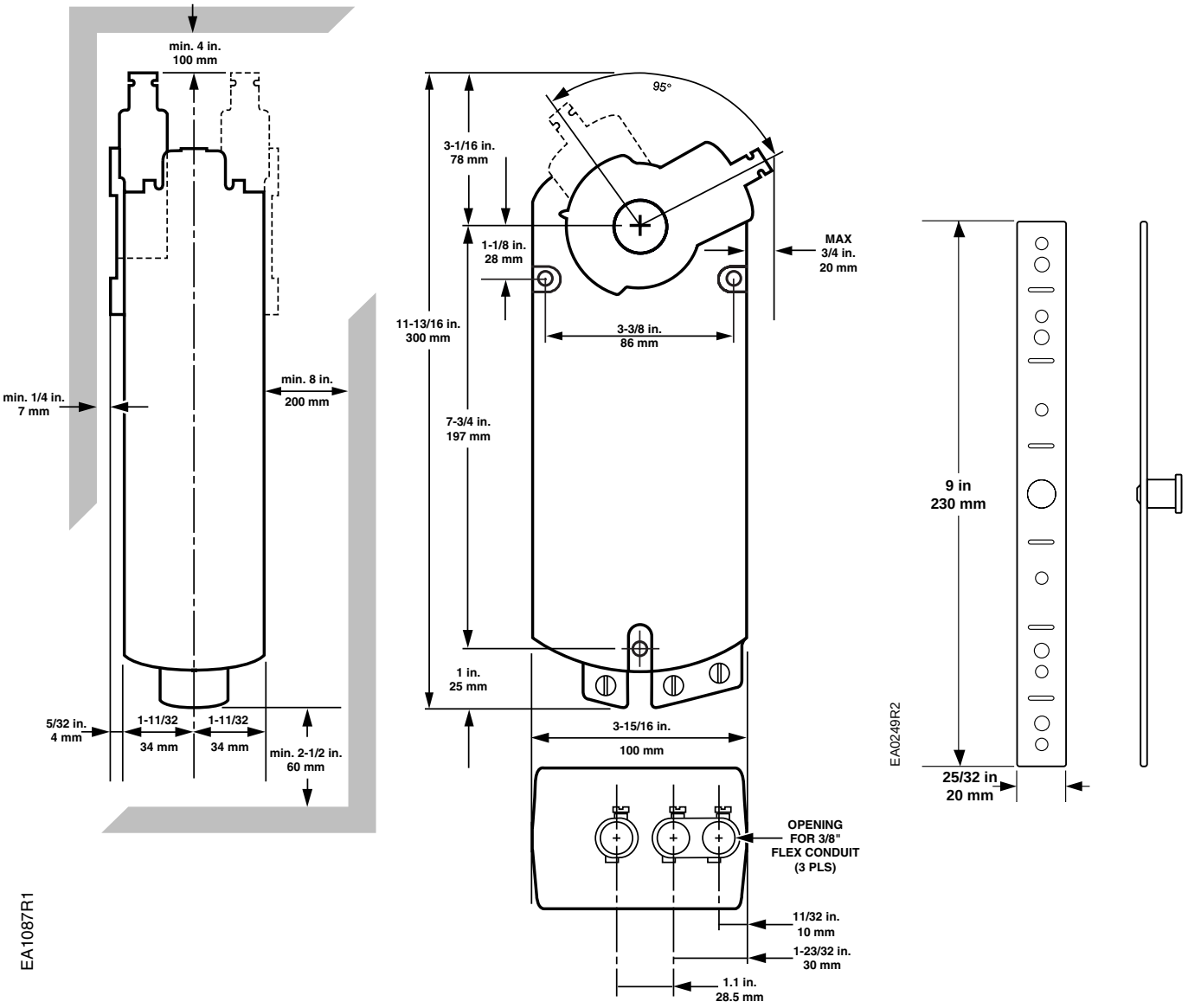


Figure 16. Dimensions of the GCA Actuator and Mounting Bracket.