SIEMENS

Technical Instructions

Document Number 155-174P25
EA GCA-2
September 15, 2003

OpenAir™

GCA Series Spring Return Rotary 24 Vac/dc 2-Position Control, 120 Vac 2-Position Control Electric Damper Actuators

Description

The OpenAir direct coupled 2-position spring return electric actuator is available in 24 Vac/dc or 120 Vac models for control of building HVAC dampers.

Features

- Brushless DC motor technology with stall protection
- Bi-directional fail-safe spring return
- Unique self-centering shaft coupling
- All metal housing
- 142 lb-in (16Nm) torque
- Manual override
- 5° preload as shipped from factory
- UL and cUL listed

Application

Used for the control of dampers requiring up to 142 lb-in (16 Nm) torque. Designed for applications that require the damper to return to its fail-safe position when there is a power failure.

Product Numbers

Table 1.

Cabling	Operating Voltage			
	24 Vac/dc		120 Vac	
	Standard	Dual Auxiliary Switches	Standard	Dual Auxiliary Switches
Standard	GCA121.1U	GCA126.1U	GCA221.1U	GCA226.1U
Plenum Cable	GCA121.1P	GCA126.1P	—	—

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	
GCA12x	24 Vac ±20% / 24 Vdc ±10%
GCA22x	120 Vac ±10%
Frequency	50/60 Hz
Equipment rating GCA12x (24V)	Class 2, in accordance with UL/CSA
Power consumption	
GCA12x (24Vac/dc)	
running	8 VA/6W
holding	3 VA/3W
GCA22x (120Vac)	
running	9 VA
holding	9 VA

Auxiliary features

Dual auxiliary switches

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 UL-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

Function	Running/spring return torque	
	24 Vac, 120 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 (replacing UL873)
		cUL certified to Canadian Standard C22.2 No. 24-93
Miscellaneous	Pre-cabled connection	18 AWG
	Cable length	3 feet (0.9m)
	Life cycle	Designed for over 60,000 full strokes at rated torque and temperature
	Noise level	<45 dBA (running)
	Dimensions	See Figure 16
	Weight	4.85 lb (2.2 kg)

Accessories

NOTE: The auxiliary switches cannot be added in the field. Order the product number which includes the option.

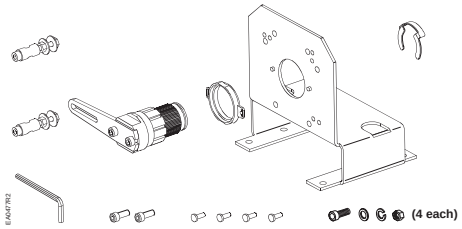


Figure 1. Floor Mount Kit.

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

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

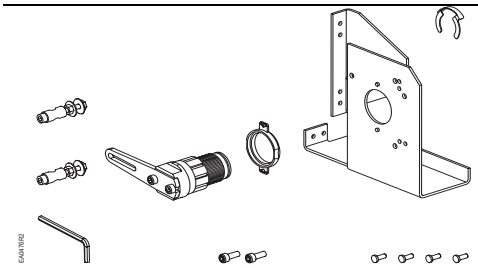


Figure 2. Frame Mount Kit.

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

- Crank arm to change angular rotation to linear stroke.
- Support bearing ring to minimize side loading.
- Mounting bracket.
- Required mounting fasteners.

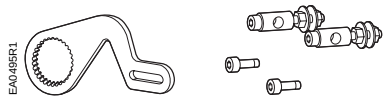


Figure 3. Crank Arm Kit.

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 to attach to splined hub of shaft adapter.
- Other required mounting fasteners.

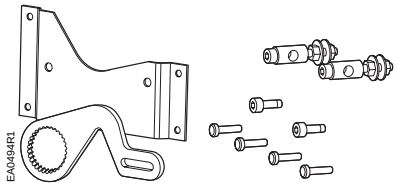


Figure 4. Crank Arm Kit with Mounting Bracket.

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

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

Accessories, continued

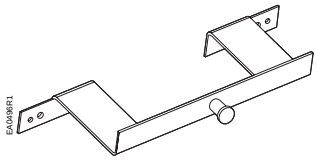


Figure 5. Tandem Mount Bracket.

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

For use with two- and three-position actuators.

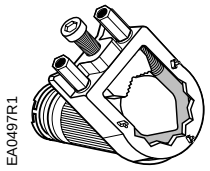


Figure 6. Special Shaft Adapter.

ASK74.1U Will attach to a 1.05 inch (26.6 mm) diameter shaft; whereas, the standard self-centering adapter accepts up to a one-inch (25.4 mm) diameter shaft.

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

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

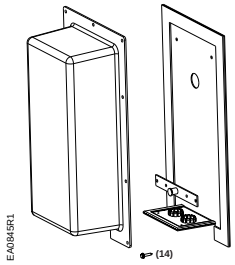


Figure 7. Weather Shield.

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 in the vertical position.

For dimensions, see Figure 15.

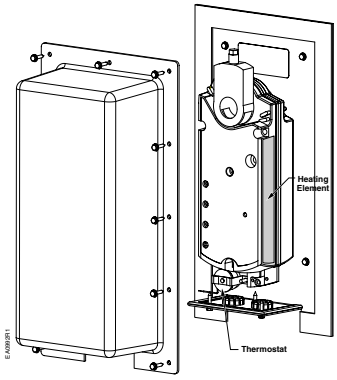
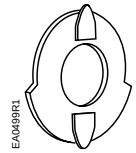


Figure 8. Heater/Weather Shield Assembly.

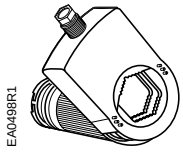
985-106 Provides protection for GCA, GIB and GBB OpenAir actuators down to temperatures of –58°F (-50°C) when used with the ASK75.1U Weather Shield. Assembly includes:

- Weather Shield
- Heater Kit

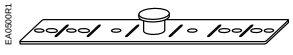
Service Parts



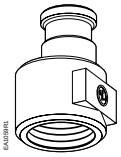
985-003
Position Indicators (10/pkg)



985-004
Standard Shaft Adapter



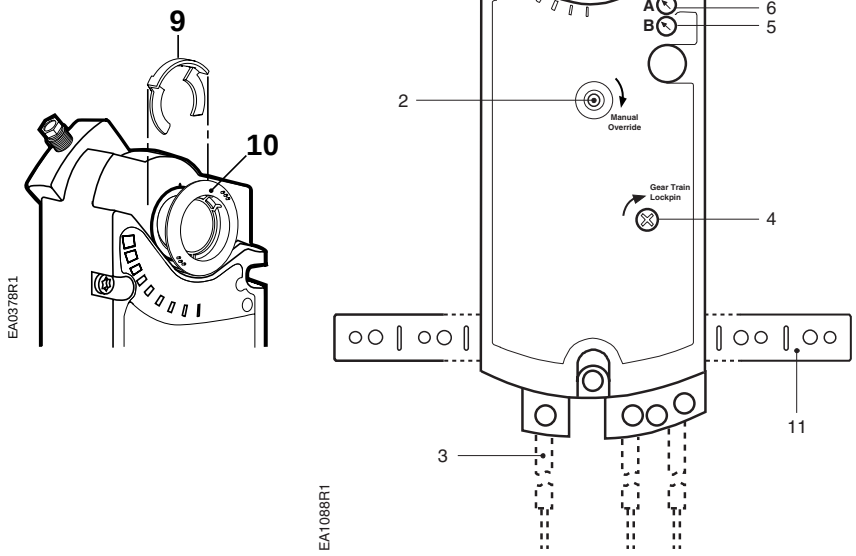
985-006
Anti-rotation (mounting) Bracket



985-008
Conduit adapter 1/2-inch (12 mm) for 1/2-inch 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. Two-position Actuator.

Operation

When power is applied, the actuator coupling moves toward the open position "90°".

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

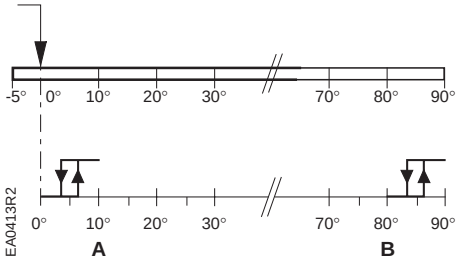
In the event of a blockage in the damper, the actuator is overload protected over the full range to prevent damage to the actuator.

Life expectancy

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

Dual auxiliary switch

GCA126 and GCA226



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:

1. Make sure the actuator is in the "0" position. The scale is valid only in the "0" position.
2. 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°

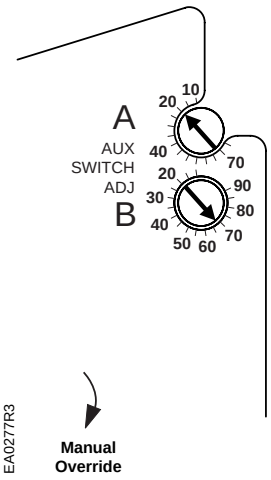


Figure 11. Dual Auxiliary Switch Dials.

Sizing

The type of actuator required depends on several factors.

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: • GCA15x actuators • GCA16x actuators*

*Only with revision 2 of GCA15x (2 to 10 Vdc).

Mounting and Installation

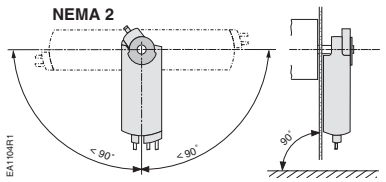
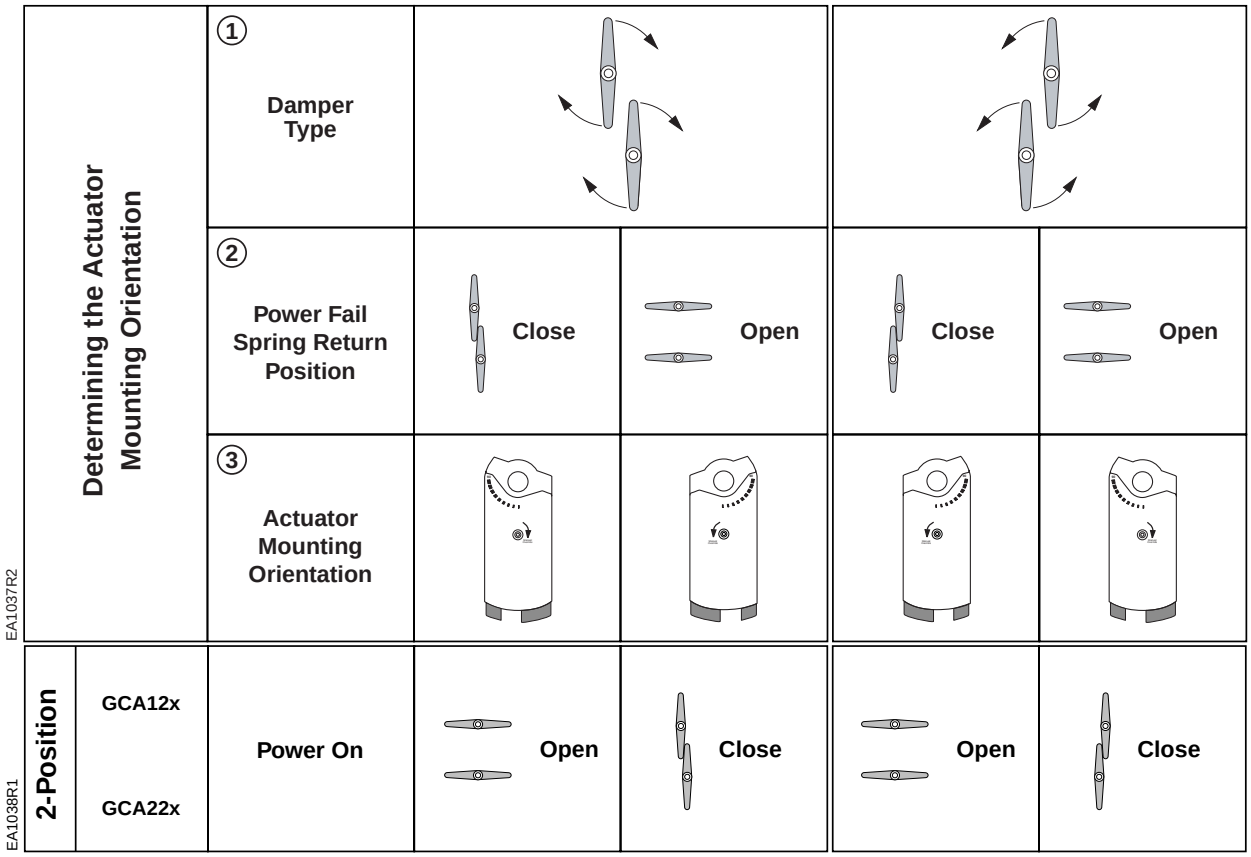


Figure 12. Acceptable NEMA 2 positions.

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

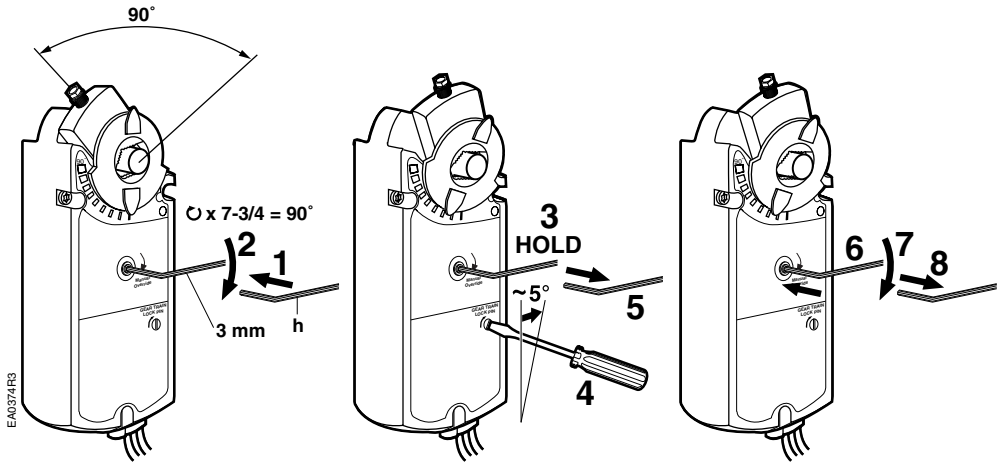


Figure 13. Manual Override.

Always turn the key in the direction of the arrow.

CAUTION:

When engaging the gear train lock pin, be careful to turn only about five 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.

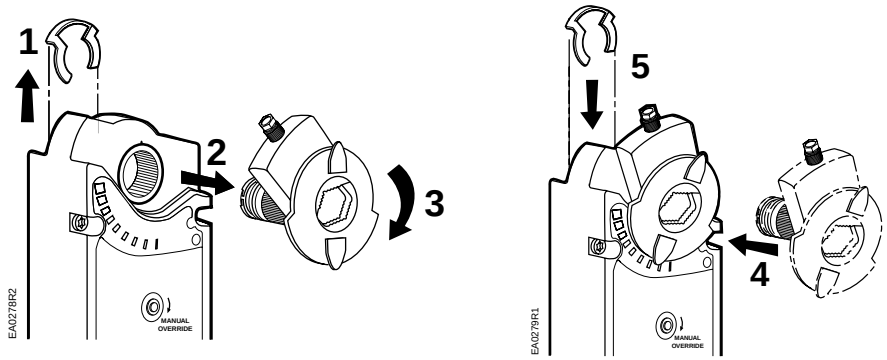


Figure 14. Mechanical Range Adjustment.

Wiring

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

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.

Wiring For 24 Vac

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

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).

Wire Designations

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

24 Vac/dc

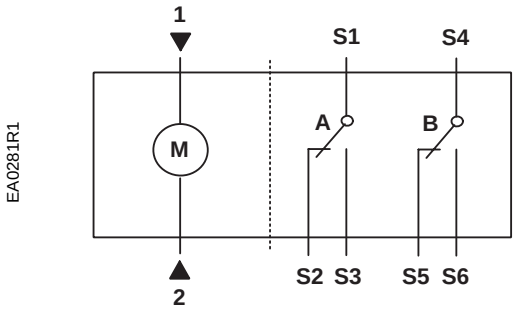


Table 4. Wire Designations.

Standard Symbol	Function	Terminal Designations	Cabling
1	Supply (SP)	G	Red
2	Neutral (SN)	G0	Black
S1	Switch A Common	Q11	Gray/red
S2	Switch A N.C.	Q12	Gray/blue
S3	Switch A N.O.	Q14	Gray/pink
S4	Switch B Common	Q21	Black/red
S5	Switch B N.C.	Q22	Black/blue
S6	Switch B N.O.	Q24	Black/pink

Start-Up/ Commissioning

24 Vac/dc

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

2. Check Spring Return:
   a. Connect wire 1 (red).
   b. Allow the actuator shaft coupling to rotate halfway.
   c. Disconnect wire 1 (red).

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

3. Check the Auxiliary Switch A:
   a. Set the DMM dial to ohms (resistance) or continuity check.
   b. Connect wires S1 and S3 to the DMM. The DMM should indicate open circuit or no resistance.
   c. Connect wire 1 (red).

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
   d. Connect wires S1 and S2 to the DMM. The DMM should indicate open circuit or no resistance.
   e. Disconnect wire 1 (red).

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.

4. 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 open circuit or no resistance.
   c. Connect wire 1 (red).

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
   d. Connect wires S4 and S5 to the DMM. The DMM should indicate open circuit or no resistance.
   e. Disconnect wire 1 (red).

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.

Wire Designations

Each wire has the standard symbol printed on it. See Table 5.

120 Vac

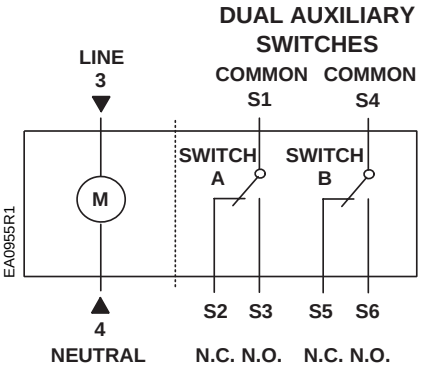


Table 5. Wire Designations.

Standard Symbol	Function	Terminal Designations	Color
3	Line	L	Black
4	Neutral	N	White
S1	Switch A Common	Q11	Gray/red
S2	Switch A NC*	Q12	Gray/blue
S3	Switch A NO**	Q14	Gray/pink
S4	Switch B Common	Q21	Black/red
S5	Switch B NC	Q22	Black/blue
S6	Switch B NO	Q24	Black/pink

* NC = Normally Closed
** NO = Normally Open

Start-Up/ Commissioning

120 Vac

WARNING: Switch off 120 Vac power before connecting the GND wire (green/yellow), the 3 wire (black) and the 4 wire (white).

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

      The actuator shaft coupling will return to the "0" position.

2. 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.

3. Check the Auxiliary Switch A:
   a. Set the DMM dial to ohms (resistance) or continuity check.
   b. Connect wires S1 and S3 to the DMM.

      The DMM should indicate an open circuit or no resistance.
   c. Switch on 120 Vac power.

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
   d. Connect wires S1 and S2 to the DMM.

      The DMM should indicate open circuit or no resistance.
   e. Switch off 120 Vac power.

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.

4. 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 open circuit or no resistance.
   c. Switch on 120 Vac power.

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
   d. Connect wires S4 and S5 to the DMM.

      The DMM should indicate open circuit or no resistance.
   e. Switch off 120 Vac power.

      The DMM should indicate contact closure as the 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 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

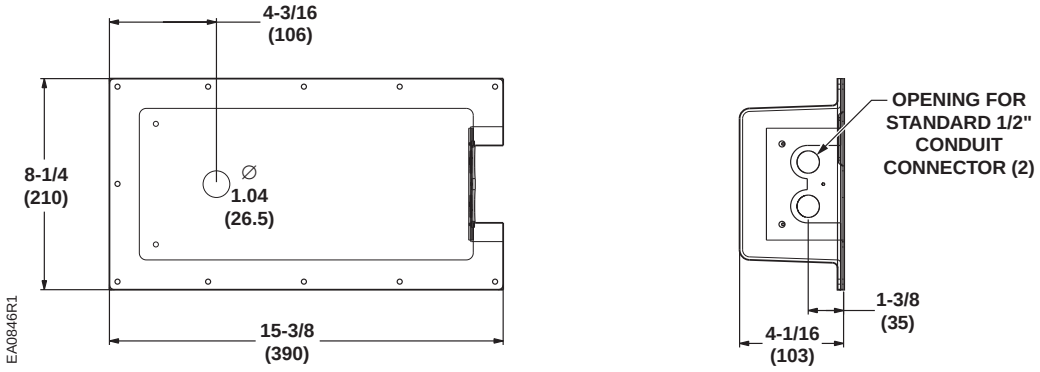


Figure 15. Dimensions of the ASK75.1U Weather Shield in Inches (Millimeters).

Dimensions, Continued

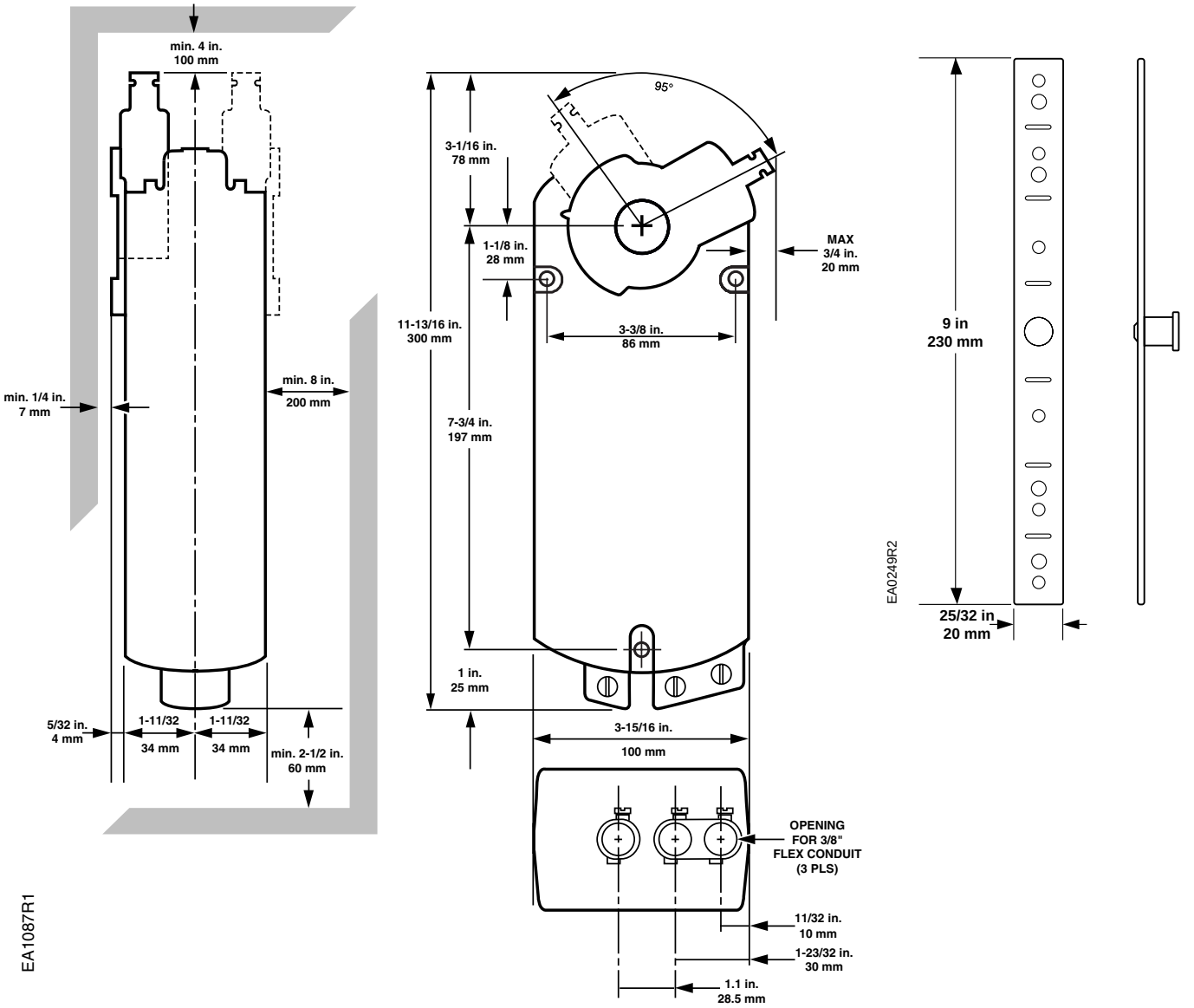


Figure 16. Dimensions of the GCA Actuator and Mounting Bracket.

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