SIEMENS

Technical Instructions

Document No. A6V14174625_en_a
August 15, 2024

OpenAir® GBB/GIB16x Enhanced Electronic Damper Actuators

Non-Spring Return, 24 Vac/Vdc, Modulating Control



Description

The OpenAir, non-spring return (NSR), 24 Vac/Vdc, rotary, direct-coupled, electric actuator is designed for modulating control of building HVAC dampers.

Features

- Built-in feedback on modulating units
- Unique self-centering shaft coupling
- All metal housing
- Two torque ranges available
- Manual override
- Offset and span adjustment models available
- Independently adjustable dual auxiliary switches available
- UL, cUL and CE listed

Product Numbers

Table 1. 24 Vac/Vdc Operating Voltage

Torque	Input Signal	Cabling	Standard	Dual Auxiliary Switches only	Span/Offset Adjustable	Dual Auxiliary Switches and Span/Offset Adjustable
221 lb-in (25 Nm)	0(2)…10 Vdc	Standard	GBB161.1U	GBB166.1U	GBB163.1U	GBB164.1U
		Plenum Cable	GBB161.1P	GBB166.1P	GBB163.1P	GBB164.1P
310 lb-in (35 Nm)	0(2)…10 Vdc	Standard	GIB161.1U	GIB166.1U	GIB163.1U	GIB164.1U
		Plenum Cable	GIB161.1P	GIB166.1P	GIB163.1P	GIB164.1P

Application

These actuators are used in constant or variable air volume installations for the control of supply return air, mixed air, exhaust, rooftop units, and face and bypass dampers requiring up to 221 lb-in (25 Nm) torque or 310 lb-in (35 Nm) torque.

Warning/Caution Notations

WARNING:	⚠	Personal injury/loss of life may occur if you do perform a procedure as specified.
CAUTION:	⚠	Equipment damage or loss of data may occur if you do not perform a procedure as specified.

Specifications

Power supply	Operating voltage (G–G0)	24 Vac ±20%. 24 Vdc ±20%
	Frequency	50/60 Hz
	Power consumption	
	Running…	2.2 VA, 1.5 W (GBB16), 2.7 VA/1.9 W (GIB16)
	Holding…	0.9 VA/0.5 W (GBB16), 0.9 VA/0.6 W (GIB16)
Control Signal GBB/GIB161 and GBB/GIB166	Input signal (Y–G0)	
	voltage-input	0(2)…10 Vdc
	Input resistance	>100K ohms
	Power consumption	0.1 mA
	Max. permissible input voltage	35 Vdc – Internally limited to 10 Vdc
	Protected against faulty wiring	Maximum 24 Vac/24 Vdc
Control Signal GBB/GIB163 and GBB/GIB164	Adjustable with 2 potentiometers	
	Offset Uo	0…5 Vdc
	Span ΔU	2…30 Vdc
	Power consumption	0.1 mA
	Max. permissible input voltage	35 Vdc
	Protected against faulty wiring	Maximum 24 Vac/24 Vdc
Feedback Signal	Position output signal (U–G0)	
	Voltage-output	0…10 Vdc
	Maximum output current	DC 1 mA
	Protected against faulty wiring	Maximum 24 Vac/24 Vdc
Equipment Rating	Operating voltage, input signal and position output signal	Class 2, in accordance with UL/CSA
	Plenum type actuators as a whole device	Class 2, in accordance with UL/CSA
Auxiliary Features	**Control signal adjustment**	
	Offset (start point)	Between 0…5 Vdc
	Factory setting	0 Vdc
	Span	Between 2…30 Vdc
	Dual auxiliary switches	
	AC rating (standard cable)	24…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…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…90° with 5° intervals
	Recommended range usage	45…90°
	Factory setting	85°

Specifications, Continued

WARNING:
Apply only AC-line voltage from the same phase or only UL-Class 2 voltage (SELV for CE conformance) to the switching outputs of both auxiliary switches A and B. Mixed operation is not permissible. See *Wiring* for details.

NOTE: With plenum cables, only UL-Class 2 voltage (SELV for CE is permissible).

Function	Running Torque	
	GBB…	221 lb-in (25 Nm)
	GIB…	310 lb-in (35 Nm)
	Runtime for 90° opening or closing	150 seconds at 60 Hz
		150 seconds at 50 Hz
	Nominal angle of rotation	90°
	Maximum angular rotation	95°
Mounting	Shaft size	3/8…1-inch (8…25.6 mm) diameter
		1/4…5/8-inch (6…18 mm) square
	Minimum shaft length	3/4-inches (20 mm)
Housing	Enclosure	NEMA 1 in vertical position to 90° to the left and right of vertical
		See Figure 18
		NEMA 3R rated when installed with ASK75.1U Weather Shield in the vertical position. See *Accessories.*
		IP54 according to EN60529
	Material	Die cast aluminum alloy
	Gear lubrication	Silicone-free
Ambient Conditions	Ambient temperature	
	Operation	-25°F…130°F (-32°C…55°C)
	Storage and transport	-25°F…158°F (-32°C…70°C)
	Ambient humidity (non-condensing)	95% rh
Agency Approvals		UL listed to UL 60730
		CSA E60730
		CE conformity: Electromagnetic compatibility 2014/30/EU Low-voltage directive 2006/95/EC
Miscellaneous	Pre-cabled connection	18 AWG
	Cable length	3 feet (0.9m)
	Life cycle	Designed for over 60,000 full strokes and a minimum of 5 million repositions at rated torque and temperature
	Noise level	<45 dBA (running)
	Dimensions	See Figure 30
	Weight	4.8 lbs (2.2 kg) without switches 5.2 lbs (2.35 kg) with switches
	Country of Origin	USA

Accessories

NOTE: Neither the control signal adjustments nor the auxiliary switches can be added in the field. Order the product numbers that include these options.

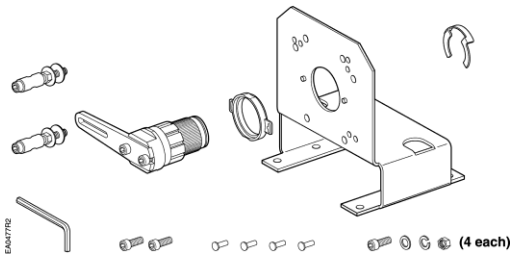


Figure 1. Floor Mount Kit.

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

- Crank arm that changes 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

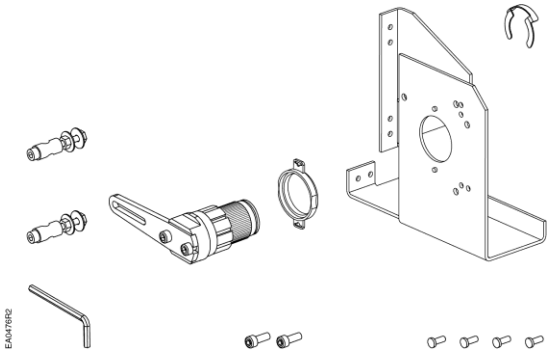


Figure 2. Frame Mount Kit.

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

Kit contains:

- Crank arm that changes 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

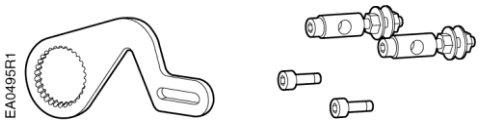


Figure 3. Crank Arm Kit.

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

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

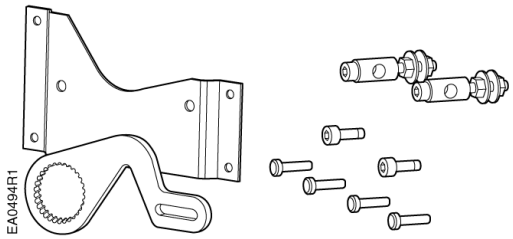


Figure 4. Crank Arm Kit with Mounting Bracket.

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

- Crank arm that attaches to the splined hub of the shaft adapter
- Mounting bracket
- Required mounting fasteners

Accessories, Continued

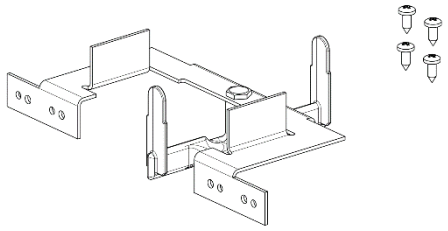


Figure 5. Tandem Mounting Bracket.

ASK73.2U: Extended anti-rotation bracket that allows two modulating GIB actuators to directly drive a single damper shaft. For any combination of GIB161x and GIB166x actuators.

Bracket must be ordered for tandem installations.

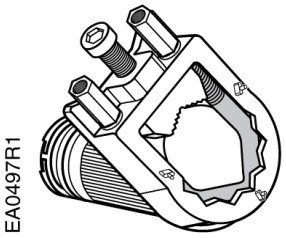


Figure 6. Special Shaft Adapter.

ASK74.1U: Shaft adapter attaches to a 1.05-inch (26.6 mm) diameter shaft, whereas the standard self-centering adapter accepts up to a 1.00-inch (25 mm) diameter shaft. This special adapter can be used for coupling to 1-inch jackshafts that are slightly oversized.

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

985-052P20: Small shaft insert (package of 20) when using the GIB actuator on a damper shaft less than 3/4-inch (20 mm) diameter.

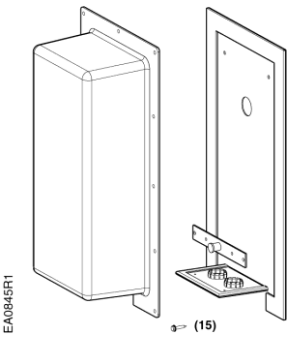


Figure 7. NEMA 3R Weather Shield.

ASK75.1U: GBB and GIB Actuators are UL listed to meet NEMA 3R requirements (a degree of protection against rain, sleet, snow 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 28.

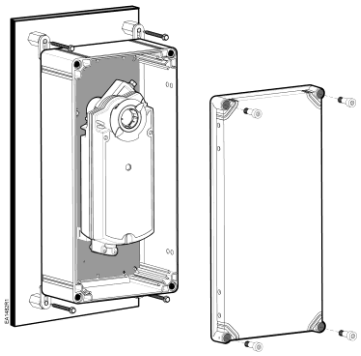


Figure 8. NEMA Type 4X Weather Shield.

ASK75.7U: GBB and GIB Actuators are UL listed to meet NEMA Type 4X requirements (a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, corrosion, and damage from external ice formation) when installed with an ASK75.7U Weather Shield and outdoor-rated conduit fittings. This weather shield may be mounted in any orientation.

For dimensions, see Figure 29.

Accessories, Continued

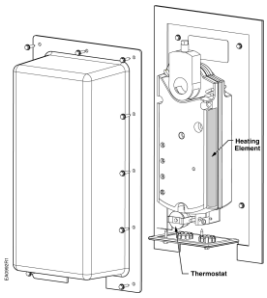


Figure 9. Heater/Weather Shield Assembly.

985-106: Provides protection for GIB, GBB and GCA OpenAir actuators in an outside low temperature. Assembly includes:

- Weather Shield (ASK75.1U)
- Heater Kit (985-105)

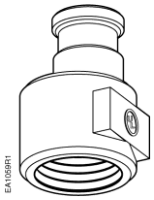


Figure 10. Conduit Adapter.

985-008: 1/2-inch (12 mm) for 1/2-inch NPT connector.

Service Parts

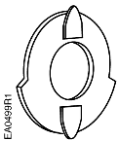


Figure 11.
Position Indicator.

985-003
(package of 10)

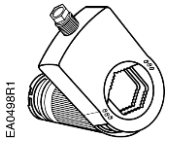


Figure 12.
Standard Shaft Adapter.

985-004

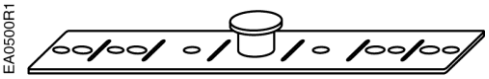
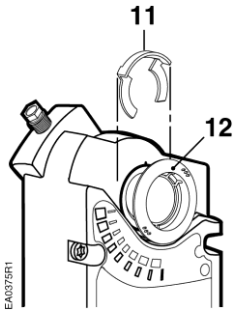
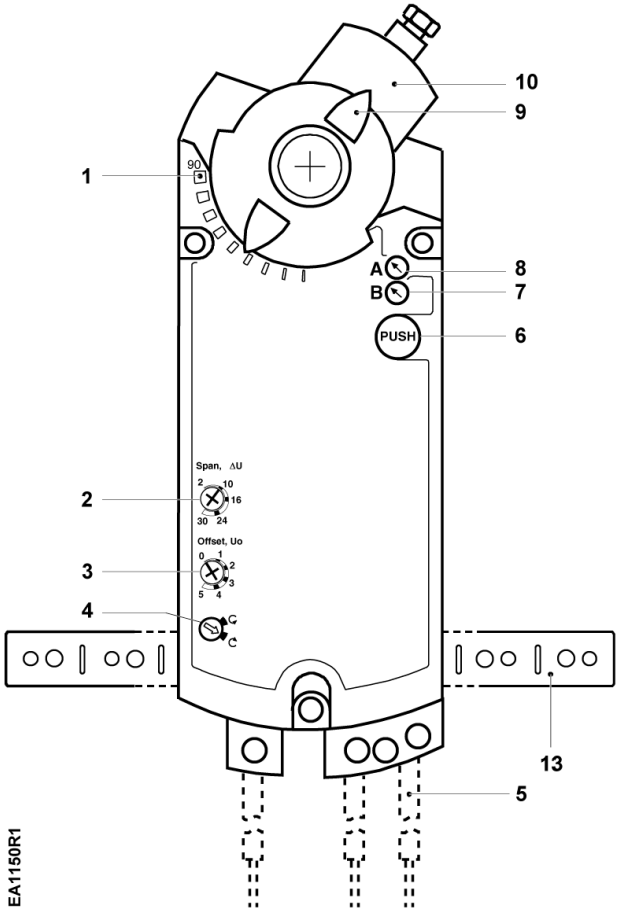


Figure 13.
Anti-rotation (Mounting) Bracket.
985-006

Actuator Components





Legend

1. Positioning scale for angle of rotation
2. Span adjustment
3. Offset (start point) adjustment
4. Direction of rotation arrow
5. Connection cables
6. Manual override
7. Auxiliary switch B
8. Auxiliary switch A
9. Position indicator
10. Self-centering shaft adapter
11. Shaft adapter locking clip
12. Position indicator adapter
13. Mounting bracket

Figure 14. Components of the Modulating Actuator.

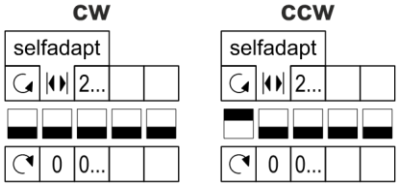
Operation

A continuous 0(2)…10 Vdc signal from a controller to wire Y operates the damper actuator. The angle of rotation is proportional to the control signal.
A 0(2)…10 Vdc position feedback output signal is available between wires U and G0 (system neutral) to monitor the position of the damper motor.

In the event of a power failure or with no control voltage, the damper actuator holds its position. In the event only the control signal is lost, 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.

Setting Rotation

Control Type	**GBB/GIB16x** Modulating Control (0(2)…10V)
Rotation	Clockwise or Counterclockwise depends on: • the setting of the DIP clockwise/ counterclockwise switch  • the positioning signal
	The actuator remains in the deployed position: • if the positioning signal is maintained at a constant value • in the event of power loss.
Position indication Mechanical	Rotation angle position indication using a position indicator
Position indication Electrical	Position indicator: Output voltage U = DC 0(2)...10 V is generated proportionally to rotation angle. The direction of rotation (inverted or non-inverted) for output voltage U is based on the DIP switch position.
Self-adaptation of rotation angle range	The actuator automatically determines the mechanical end positions of the rotation angle range. The characteristic function (Uo, ΔU) is mapped to the calculated rotation angle range. Power must be applied for the function of DIP switch 2 (self-adaptation) to be operational.

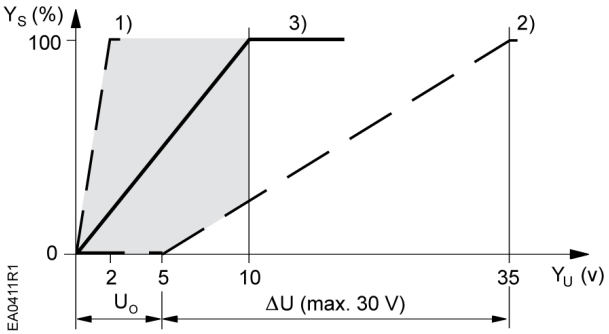
Life Expectancy

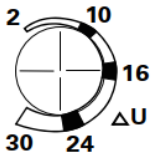
An improperly tuned loop will cause excessive repositioning that will shorten the life of the actuator.

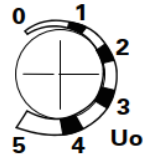
Control Signal Adjustment

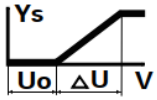
GBB/GIB 163x GBB/GIB 164x

The offset (start point) and span of the control signal can be adjusted. The offset point, U0, (start point) can be adjusted between 0 to 5 Vdc. The span, ΔU, can be adjusted between 2 to 30 Vdc.











Setting for
10V span
0 offset

Ys Mechanical positioning range (100% = angle of rotation 90°)
Yu Control signal
U0 Offset (start point)
ΔU Span

1. Uo =0V, ΔU = 2V Minimum working range for Ys = 100%
2. Uo = 5V, ΔU = 30V Maximum working range for Ys = 100%
3. Uo = 0V, ΔU ≈ 10V Factory setting

Figure 15. Minimum, Factory Setting, and Maximum Control Signal Adjustment.

Control Signal Adjustment Example

Open the actuator from 0%...50% (45°) using a control signal of Umin = 2V to Umax = 10V.

Calculating the value of ΔU:

$$\Delta U = \frac{100\ [\%] \times (U\ max - U\ min)}{\text{Working angle of rotation } [\%]} = \frac{100\% \times (10V - 2V)}{50\%} = 16\ V$$

Settings:

Uo = 2V; ΔU = 16V

Umin = minimum control signal

Umax = maximum control signal

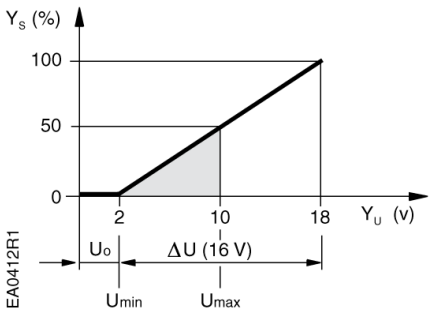
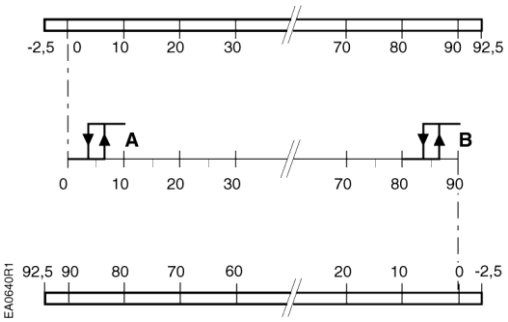


Figure 16. Example.

Dual Auxiliary Switch

GBB/GIB 164x, and **GBB/GIB** 166x



Actuator Scale: Clockwise

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

Actuator Scale: Counterclockwise

NOTE: The auxiliary switch setting shafts turn together with the actuator. The scales are valid only when the actuator is in the "0" position on clockwise motion.

To change the settings of A and B, 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°

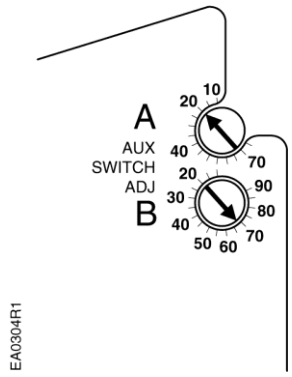


Figure 17. Dual Auxiliary Switch Dials.

Sizing

The number of actuators required depends on several factors. To determine the quantity of actuators required for the installation:

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:

   Total Torque = Torque Rating × Damper Area

4. Select the total quantity of actuators required:

$$\text{Number of actuators} = \frac{\text{Total Damper Torque required}}{\text{SF}^{1} \times \text{Actuator Torque (Refer to Specifications)}}$$

[1] Safety Factor: When calculating the number of actuators 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 (or 80% of the rated torque).

Mechanical coupling of the actuator is allowed if:

1. The same type of actuator is used.
2. The power trunk can handle added components.
3. The same power and control inputs go to both actuators (parallel wiring).
4. The ASK73.2U Tandem Mounting Bracket is used.

Mounting and Installation

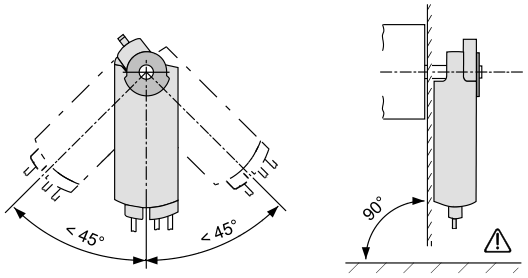


Figure 18. Acceptable IP54 Positions.

- The DIP switches must be set to match the clockwise or counterclockwise rotation of the damper shaft. The factory setting is clockwise. See Figure 14 for location on the actuator.

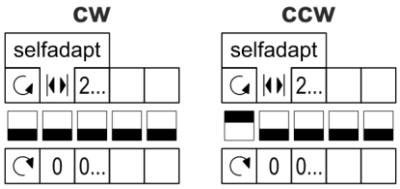


Figure 19. Direction of Rotation Switch.

- The minimum damper drive shaft length is 3/4-inches (20 mm). The shaft length determines whether the shaft adapter will be mounted on the front or back side of the actuator.
- See *Specifications* for minimum and maximum damper shaft dimensions.
- The shaft adapter can be mounted on either side of the actuator. The direction of rotation and shaft length determine how the shaft adapter will be mounted on the actuator.
- The position indicator can be mounted to show either the clockwise or counterclockwise 0…90 scale.
- The actuator is shipped from the factory with a 5° pre-load to ensure tight close off of the damper.
- The shaft adapter and mounting parts are shipped in a separate container with the actuator.
- Detailed mounting instructions are included with each actuator.
- The actuator must be placed on the damper shaft so that the front of the actuator is accessible. The label and the manual override button are on the front side.
- A mounting bracket is included with the actuator.

Mounting and Installation, continued

Manual override

To move the damper blades when power is not present:

1. Determine damper rotation: clockwise or counterclockwise.
2. Hold down the **PUSH** button.
3. Make adjustments to the damper position.
4. Release the **PUSH** button.

Once power is restored, the actuator returns to automated control.

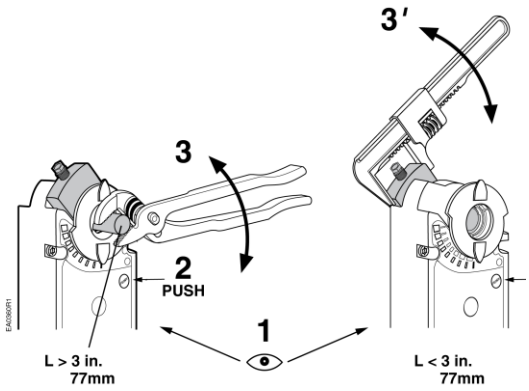


Figure 20. Manual Override.

Mechanical Range Adjustment

The angular rotation is adjustable between 0 and 90° at 5-degree intervals. The range of shaft movement is limited by mounting the shaft adapter:

Begin by loosening the shaft adapter from the damper shaft and remove the actuator from the damper shaft.

1. Remove clip.
2. Remove shaft adapter from the actuator.

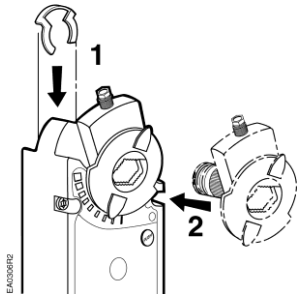


Figure 21.

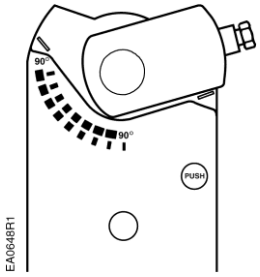


Figure 22.

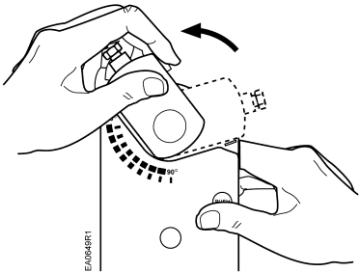


Figure 23.

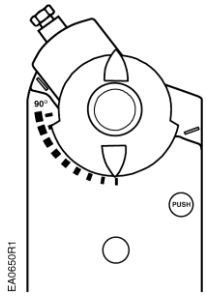


Figure 24.

Mechanical Range Adjustment, Continued

3. Return the actuator gear train to the **0**-position using the steps that follow for the clockwise or counterclockwise damper shaft rotation.

   Clockwise-to-open:

   a. Insert the shaft adapter to the right as close as possible to the raised stop. See Figure 22.

   b. Hold down the **PUSH** button and rotate the shaft adapter to the left until it stops. See Figure 23.

   c. Release the **PUSH** button.

   d. If the shaft adapter is not resting against the left raised stop, remove the adapter and insert it against the left stop.

   e. Place the position indicator to the **0** position on the outside scale. See Figure 24.

   Counterclockwise-to-open:

   a. Insert the shaft adapter to the left as close as possible to the raised stop.

   b. Hold down the **PUSH** button and rotate the shaft adapter to the right until it stops.

   c. Release the **PUSH** button.

   d. If the shaft adapter is not resting against the right raised stop, remove the adapter and insert it against the right stop.

   e. Place the position indicator to **0** on the inside scale.

4. Determine the angle of rotation for the damper blade shaft. Subtract that amount from 90°.

5. Remove the shaft adapter and insert it with the position indicator pointing to mark on the scale calculated in the previous step. See Figure 25.

6. Attach the clip.

7. Rotate the damper blade shaft to its **0** position.

8. Return the actuator to the damper shaft and tighten the shaft adapter to the damper shaft.

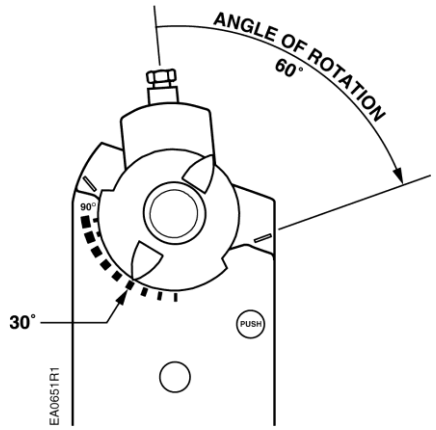


Figure 25. Mechanical Range Adjustment.

Reversing the Position Indicator

Reverse the position indicator so that the counterclockwise 0…90 scale is visible. See Figure 26.

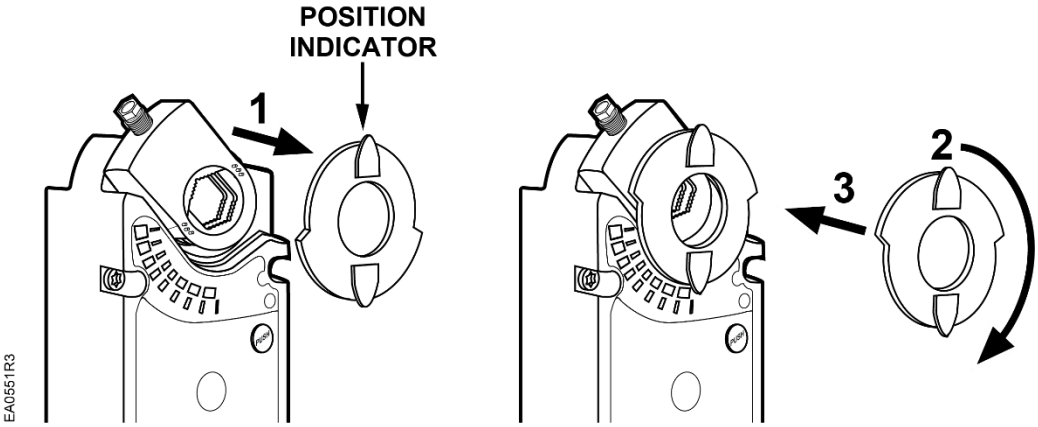


Figure 26. Position Indicator.

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).

WARNINGS:

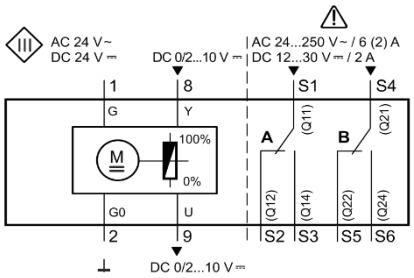
- Mixed switch operation is not permitted to the switching outputs of both auxiliary switches (A and B).
- Either AC line voltage from the same phase must be applied to all six outputs of the dual auxiliary switches, or UL-Class 2 voltage must be applied to all six outputs.

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

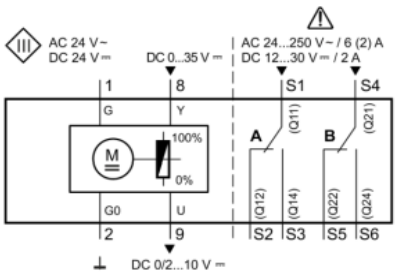
Wire Designations

Each wire has the standard symbol printed on it. See Table 2.

Y = 0(2)…10 Vdc



Y = 0…35 Vdc



NOTE: 0-20 mA control signal - add 500 Ohm resistor across 2 & 8.

Figure 27.
GBB/GIB16x Modulating Control, 24 Vac / Vdc.

Table 2. Wire Designations.

Standard Symbol	Function	Terminal Designations	Color
1	Supply (SP)	G	Red
2	Neutral (SN)	G0	Black
8	0…10 Vdc	Y	Gray
9	Output for 0…10 Vdc position indication	U	Pink
S1	Switch A – Common	Q11	Gray/red
S2	Switch A – Normally Closed	Q12	Gray/blue
S3	Switch A – Normally Open	Q14	Gray/pink
S4	Switch B – Common	Q21	Black/red
S5	Switch B – Normally Closed	Q22	Black/blue
S6	Switch B – Normally Open	Q24	Black/pink

Start-Up/ Commissioning

1. Check that offset (start point) and span are set correctly, if used.
2. Check that the direction of the rotation switch matches the rotation of the damper shaft.
3. Check the operation:
   a. Connect wires 1 (red) and 2 (black) to the actuator.
   b. Set the DMM dial to Vdc.
   c. Connect wires 2 (black) and 8 (gray) to a Digital Multimeter (DMM).
   d. Apply a full-scale input signal (10 Vdc) to wire 8 (gray).
   e. Allow the actuator shaft coupling to rotate from 0 to 90.
   f. Disconnect wire 8 (gray) and the shaft coupling returns to the “0” position.
5. Check the Feedback:
   a. Set the DMM dial to Vdc.
   b. Attach wires 2 (black) and 9 (pink) to the DMM.
   c. Apply a full-scale input signal to wire 8 (gray).

      The reading at the DMM should increase.
   e. Remove the signal from wire 8 (gray). The reading at the DMM should decrease and the actuator shaft coupling returns to the “0” position.
5. 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. Apply a full-scale input signal to wire 8 (gray).

      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. Stop the signal to wire 8 (gray).

      The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
6. 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. Apply a full-scale input signal to wire 8 (gray).

      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. Stop the signal to wire 8 (gray).

      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 the wires are connected correctly.
- Check that offset (start point) and span are set correctly, if used.
- Check that the direction of rotation switch matches the rotation of the damper shaft.
- Connect wires 1 (red) and 2 (black) to a Digital Multimeter (DMM) with the dial set at Vac 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

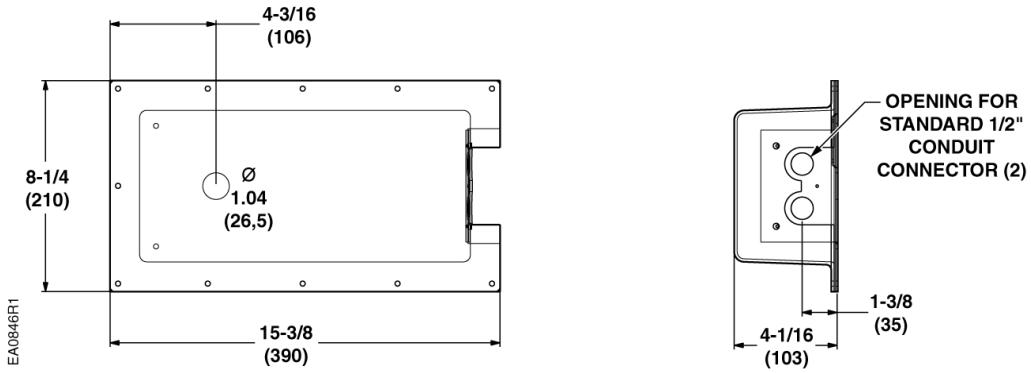


Figure 28. Dimensions of the ASK75.1U Weather Shield in Inches (mm).

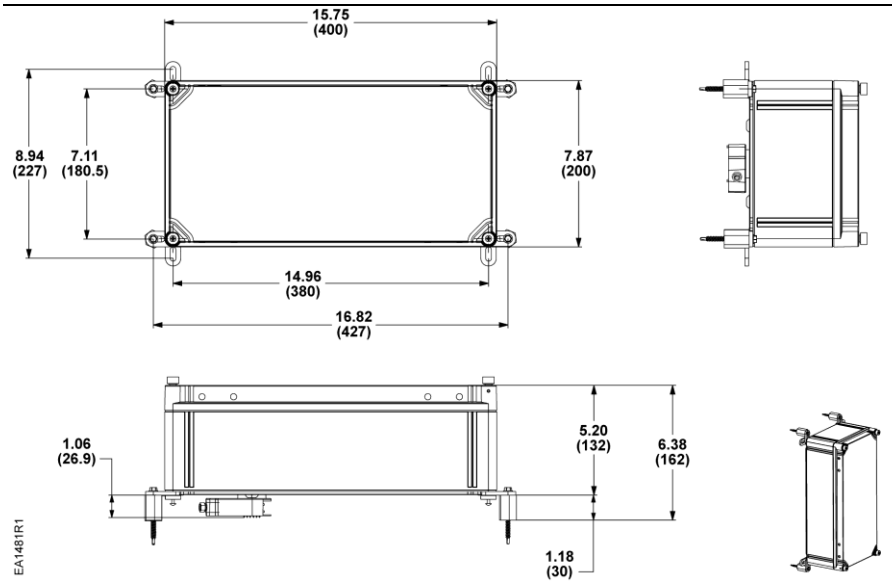


Figure 29. Dimensions of the ASK75.7U Weather Shield in Inches (mm).

Dimensions, Continued

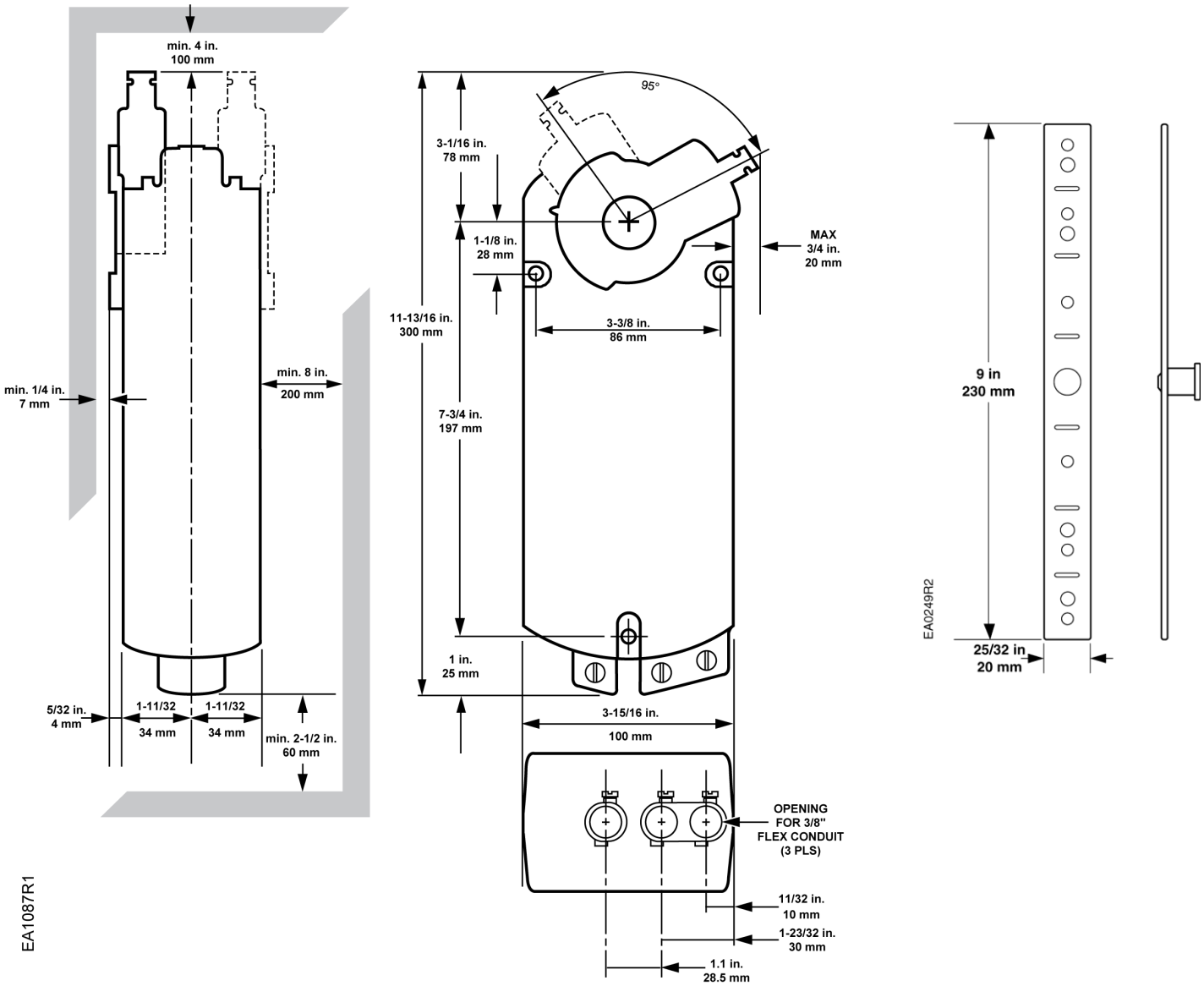


Figure 30. Dimensions of the GBB/GIB Enhanced Actuator and Mounting Bracket in Inches (mm).

Dimensions, Continued



ASK73.2U **985-006**

Figure 31. Dimensions of the Mounting Brackets used in Tandem Applications in Inches (mm).

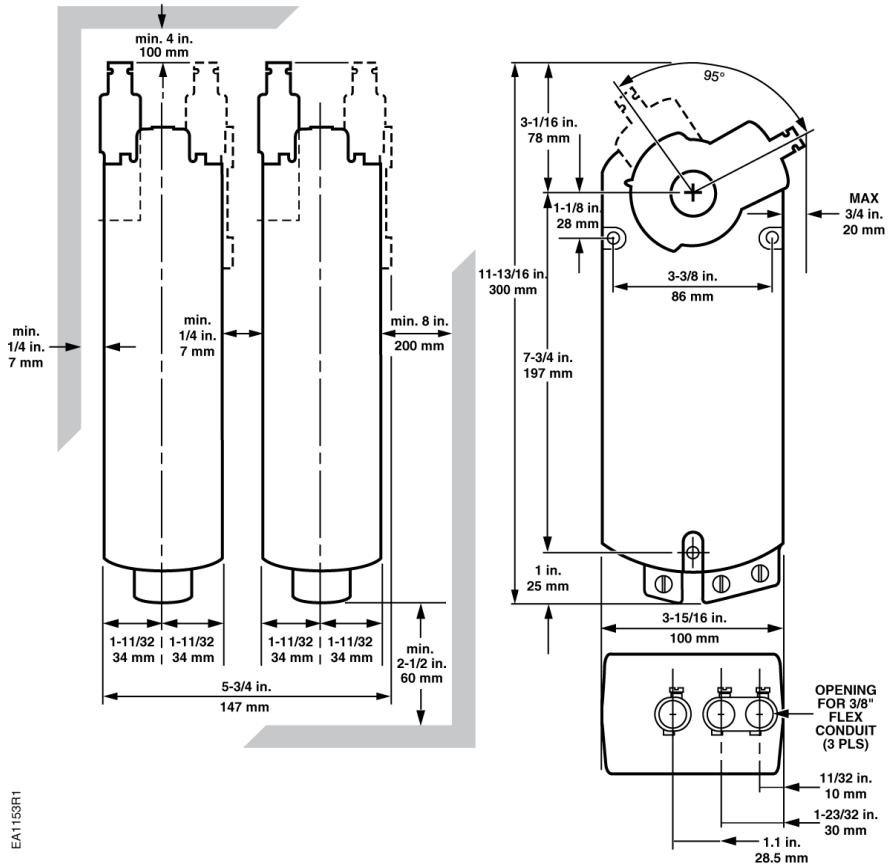


Figure 32. Dimensions and Service Envelope of the GIB Enhanced Actuators in Tandem Application in Inches (mm).

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