SIEBE ENVIRONMENTAL CONTROLS

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P.O. Box 2940
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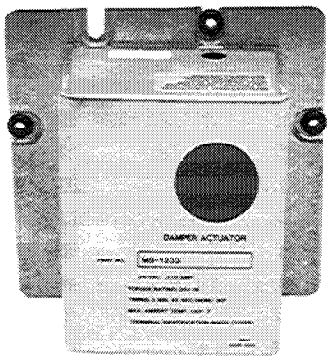
MS-1233 Series

Reversible Proportional Electronic Actuators
General Instructions



APPLICATION

For electronic proportional control of small dampers which do not require the return to normal position upon power interruption. Typically, the actuator is used with terminal units in VAV systems in conjunction with the PP-8121 controller. The actuator is also used with TP-8101 room controller for mixing boxes in constant volume double duct systems.

SPECIFICATIONS

Control Type: Reversible proportional, shaft rotation can stop at any point in the stroke.

Power Requirements:

Volts, 24 AC (+10%, −15%).

Hz, 50/60.

Full Load Amps, 0.21.

Torque: 20 lb.-in. (2.3 N-m). The damper must withstand 35 lb.-in. (4.0 N-m) of torque if the travel is less than the fixed actuator stroke as set by the internal torque switches.

Maximum Damper Size:

Parallel, 11.2 ft² (1.0 m²).

Opposed, 14.4 ft² (1.3 m²).

Damper ratings are nominal and based on standard (not low leakage) dampers at 1" (25.4 mm) W.C. pressure and 2000 FPM (10 m/s) velocity.

Output Shaft:

Rotation, Fixed at 90° (+5, −0°). Factory set CCW end, as viewed from cover side of actuator. Torque switches limit travel in CW and CCW directions, reducing the need for travel adjustment and preventing over stress on dampers.

Construction, Hollow.

No Load Timing: 3 min. 45 sec. nominal.

Auxiliary Switch: Adjustable SPDT; see Table 1 for models.

FCC: Complies with Class B testing according to the rules and regulations of part 15 radio frequency devices (including television), sub part J, computing devices.

Environment:

Ambient Temperature Limits,

Shipping and Storage −40 to 140°F (−40 to 60°C).

Operating 40 to 140°F (4 to 60°C).

Humidity, 5 through 95% non-condensing.

Vibration, Maximum 1G in any plane.

Locations, NEMA Type 1 indoor only.

Atmosphere, Avoid locations where corrosive fumes, vapors, abrasive dust or explosive conditions or where high radio frequency or electromagnetic generating devices are present.

Connections: Coded screw terminals that will accept up to 16 gage wire.

Case: Galvanized steel.

Mounting: Any position over a 1/2" (12.7 mm) dia. damper shaft [min. length 1-1/8" (29 mm)].

Dimensions: 5-1/8" high × 5-1/4" wide × 3-1/4" deep (130 mm × 133 mm × 83 mm).

ACCESSORIES

AM-111	Crank arm for 5/16" (7.9 mm) dia. damper shaft
AM-112	Crank arm for 3/8" (9.5 mm) dia. damper shaft
AM-113	Crank arm for 1/2" (12.7 mm) dia. damper shaft
AM-115	Crank arm for 7/16" (11.1 mm) dia. damper shaft
AM-122	Linkage connector, straight type
AM-125	5/16" (7.9 mm) × 20" (508 mm) damper rod
AM-132	Linkage connector, ball type
AM-165	Mounting kit, includes crank arm, 1/2" (12.7 mm) dia. shaft and bearing mounting bracket

PRE-INSTALLATION

Inspection

Inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious damage. Return damaged products.

Required Installation Items

- Wiring diagram
- Tools (not provided):
  Volt-ohm-milliamp (VOM) meter
  Appropriate screwdriver for mounting screws
  Appropriate drill and drill bit for mounting screws
- Appropriate accessories
- Mounting screws and grommets provided

TABLE 1. SPECIFICATIONS

Part Number	Control Input	Duty Cycle	Start Point	Span	Power Supply Available	SPDT Aux.* Switches (Adj.)
MS-1233	2 to 15 Vdc @ 2 mA	50%	6 Vdc (Factory Set), Adjustable 2 to 12 Vdc	3 Vdc (Fixed) for Full Actuator Stroke	+20 Vdc, 50 mA	None
MS-1233-002						2
MS-1233-100	4 to 20 mAdc		4 mAdc (Fixed)	16 mAdc (Fixed) for Full Actuator Stroke	+20 Vdc, 50 mA	None
MS-1233-102						2

*5 amps @ 24 V DC (AC 50/60 Hz), Pilot Duty 100 VA. Switches have gold contacts suitable for dry circuit switching.

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Disconnect power supply before installation to prevent electrical shock and equipment damage.
3. Make all connections in accordance with the wiring diagram, and in accordance with national and local electrical codes. *Use copper conductors only.*
4. Do not exceed ratings of the device.
5. Avoid locations where corrosive fumes, vapors, abrasive dust or explosive conditions or where high radio frequency or electromagnetic generating devices are present. NEMA Type 1 covers are intended for indoor use primarily to provide a degree of protection against contact with the enclosed components.

Direct Mounting (See Figure 1)

1. Remove actuator cover by prying outward on the two legs of the cover.
2. Rotate the damper shaft to a position that allows the damper to fully open or close in 90° of CW rotation.
3. Slide the actuator over the damper shaft until the mounting grommets contact the duct or mounting surface.

CAUTION

a. Mount actuator with only two (2) screws.
b. Grommets and spacers must be on opposite sides of the damper shaft.
c. Mount per method A or B shown below.
d. Warranty is void if actuator is mounted with three (3) or four (4) screws and not mounted per method A or B shown below.

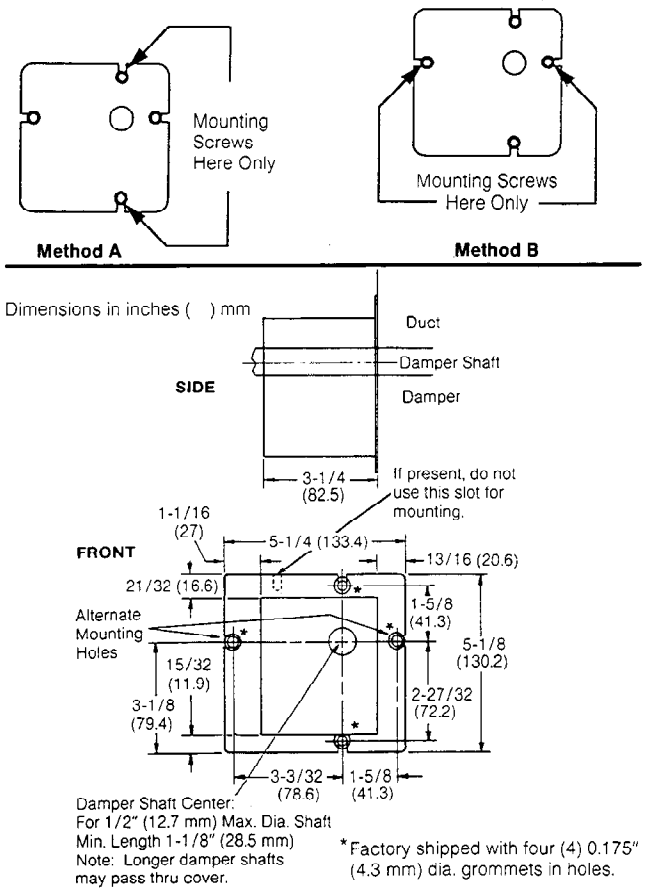


Figure 1. Mounting Dimensions

4. Drill (2) two 1/8" (3.1 mm) dia. pilot holes through the duct using the actuator grommet centers as a template. An alternate method to locate the pilot holes is to refer to the Mounting Dimensions, Figure 1.

CAUTION

Binding between the mounting surface and the base of the actuator will restrict the torque limiting feature and could damage the actuator.

5. Secure the actuator using the (2) two #8 × 1/2" slotted hex head Type A sheet metal screws and grommets provided.

CAUTION

The use of only one mounting screw or failure to use grommets may cause internal damage to the actuator.

6. Tighten the (2) two set screws on the damper shaft using standard 1/8" right angle Allen wrench (see Figure 1). The hollow actuator shaft also has (2) two keyways sized for a 1/8" (3.1 mm) wide key projecting 1/16" (1.5 mm) from the damper shaft. The keyways are located on left and right side of actuator shaft when the actuator is upright and in the CCW end of rotation.
7. Reassemble the actuator cover. In the event the damper shaft protrudes more than 3-5/16" (84 mm), remove the paper disk covering the damper shaft hole in the cover so the shaft can extend through.
8. The actuator is mounted.

Remote Mounting (See Figure 2)

AM-165 kit and damper shaft crank arm, connectors and damper rod are ordered separately. Mounting instructions are provided with AM-165 kit.

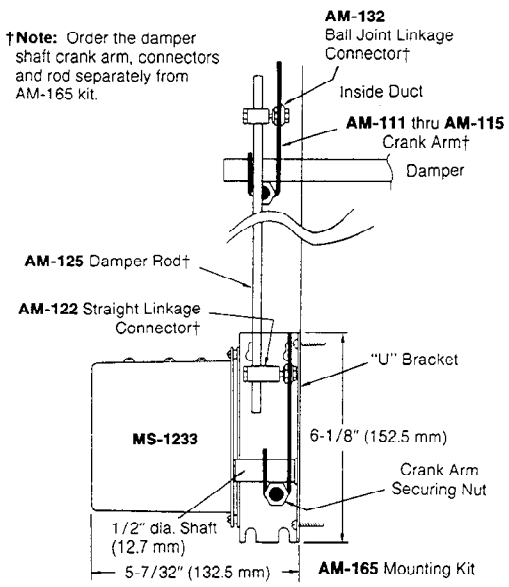


Figure 2. Remote Mounting with AM-165 Kit

Wiring

CAUTION

Provide at least 6" (152 mm) "slack" in all the leads to allow the actuator housing to move slightly so the torque switch operation is not restricted.

Control Leads Use 18 gauge 3-conductor twisted leads (Barber Colman Part Number W-103) up to 1000 ft. (305 m) between the controller and actuator. Use a larger wire size for longer runs.

CAUTION

Use 18 gauge 3-conductor shielded cable (twisted) when it is necessary to install the signal leads in the same conduit with power wiring, or when high RFI/EMI generating devices are near. Ground the shield at the controller only on the COM (-) terminal, not to earth ground.

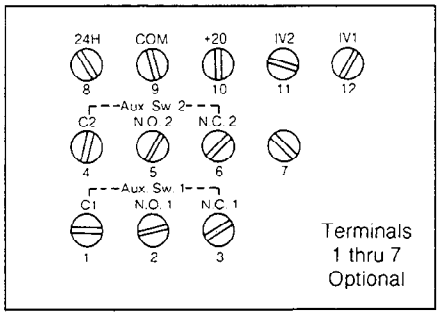
Auxiliary Switch Leads Use 18 gauge 3-conductor (Barber-Colman Part Number W-103) or 2-conductor twisted leads (Barber-Colman Part Number W-102) up to 15 ft. (4.5 m) when carrying 5 amps or per Table 2 below.

TABLE 2. AUXILIARY SWITCH LEAD LENGTHS

Amps @ 24 Volts Maximum	18 Gauge W-103 or W-102 Wire Run Ft. (Meter)
4	19 (5.7)
3	25 (7.6)
2	38 (11.5)
1	75 (22.8)
.5	150 (45.7)
.25	300 (91.4)

Power Leads Use 18 gauge 2-conductor twisted leads (Barber-Colman Part Number W-102 up to 500 ft. (152 m) between the power source and actuator.

Terminal Identification

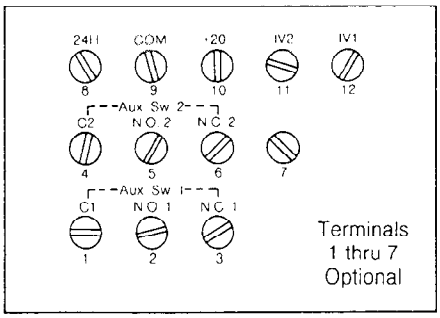


Input	Terminals Used
2 to 15 Vdc*	9 (COM), 12 (IV1), 10 (+20)
24 Vac Power	8 (24H), 9 (COM)
Override to Drive Full CW	11 (IV2), 10 (+20) or reversing connector (Fig. 13) as factory set. (Wht/Brn leads closer to terminals.)
Override to Drive Full CCW	11 (IV2), 9 (COM) or reversing connector (Fig. 13) as factory set. (Wht/Brn leads closer to terminals.)
Auxiliary** Switch 1	1 (C1), 2 (N.O. 1), 3 (N.C. 1)
Auxiliary** Switch 2	4 (C2), 5 (N.O. 2), 6 (N.C. 2)

*Signal between Terminals 9 & 12:
9 Vdc actuator rotates clockwise.
6 Vdc actuator rotates counterclockwise.
As viewed from cover side of actuator.

**Factory Setting: C1 makes to N.O. 1 approx. 5° from CCW end. C2 makes to N.O. 2 approx. 85° from CCW end.

Figure 3. MS-1233-00X (2 to 15 Vdc Input) Terminal Identification

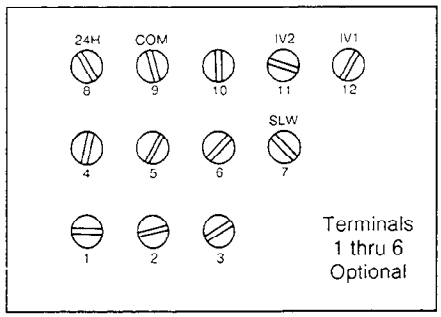


Input	Terminals Used
4 to 20 mA*	9 (COM), 12 (IV1)
24 Vac Power	8 (24H), 9 (COM)
Override to Drive Full CW	11 (IV2), 10 (+20) or reversing connector (Fig. 13) as factory set. (Wht/Brn leads closer to terminals.)
Override to Drive Full CCW	11 (IV2), 9 (COM) or reversing connector (Fig. 13) as factory set. (Wht/Brn leads closer to terminals.)
Auxiliary** Switch 1	1 (C1), 2 (N.O. 1), 3 (N.C. 1)
Auxiliary** Switch 2	4 (C2), 5 (N.O. 2), 6 (N.C. 2)

*Signal between Terminals 9 & 12:
20 mA actuator rotates clockwise.
4 mA actuator rotates counterclockwise.
As viewed from cover side of actuator.

**Factory Setting: C1 makes to N.O. 1 approx. 5° from CCW end. C2 makes to N.O. 2 approx. 85° from CCW end.

Figure 4. MS-1233-10X (4 to 20 mA Input) Terminal Identification

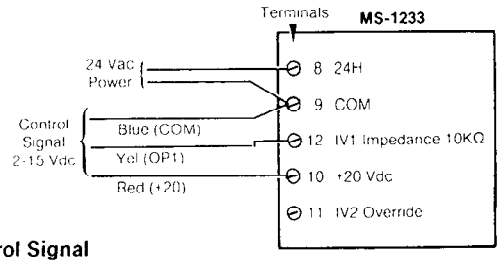


Input	Terminals Used
135Ω Slidewire*	7 (SLW), 11 (IV2), 12 (IV1)
24 Vac Power	8 (24H), 9 (COM)

*Potentiometer Wiper Position (to Terminal 11):
135Ω to terminal 7, actuator shaft clockwise.
0Ω to terminal 12, actuator shaft rotates counterclockwise.
As viewed from cover side of actuator.

Figure 5. MS-1233-200 (135Ω Slidewire Input) Terminal Identification

TYPICAL WIRING



Control Signal

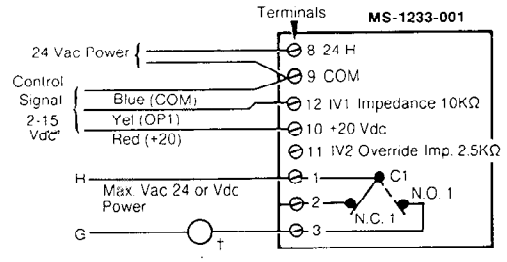
9 Vdc actuator rotates clockwise.*

6 Vdc actuator rotates counterclockwise.*

*As viewed from cover side of actuator.

- To override to full CW or CCW, refer to Figure 3.

Figure 6. Actuator Heating/Cooling with 2 to 15 Vdc Input



Control Signal

9 Vdc actuator rotates clockwise.*

6 Vdc actuator rotates counterclockwise.*

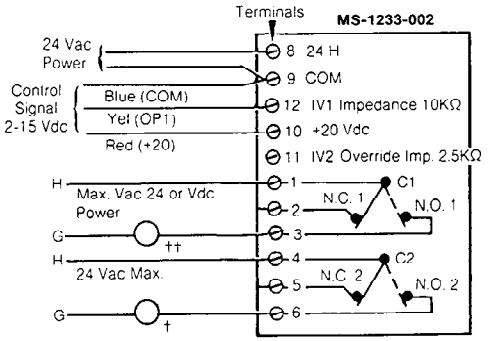
*As viewed from cover side of actuator.

†Indicating device, relay, bell, light or input to microprocessor-based controller in an energy management system or a heating/cooling device.

The auxiliary switch may be readjusted from 5° from the CCW end to the CW end or at any point between.

- For a continuous voltage signal for position indication, use terminals 9 (-) and 12 (+) which typically provide a 6 Vdc (CCW end) to 9 Vdc (CW end) signal.
- To override to full CW or CCW, refer to Figure 3.

Figure 7. Actuator — One Auxiliary Switch for Heating/Cooling or Position Indication Schemes with 2 to 15 Vdc Input



Control Signal

9 Vdc actuator rotates clockwise.*

6 Vdc actuator rotates counterclockwise.*

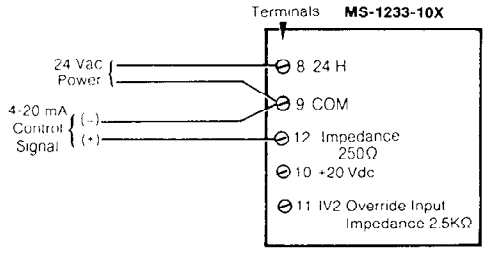
*As viewed from cover side of actuator.

†Two-position heating or cooling device. Switch #2 may be readjusted from 10° from the CW end to the CW or CCW end or at any point between.

††Indicating device, relay, bell, light or input to a microprocessor-based controller in any energy management system.

- For a continuous voltage signal for position indication, use terminals 9 (-) and 12 (+) which typically provide a 6 Vdc (CCW end) to 9 Vdc (CW end) signal.
- To override to full CW or CCW, refer to Figure 3.

Figure 8. Two Auxiliary Switches for Actuator Position Indication & Heating or Cooling Schemes with 2 to 15 Vdc Input



Signal between Terminals 9 and 12

20 mA actuator rotates clockwise.*

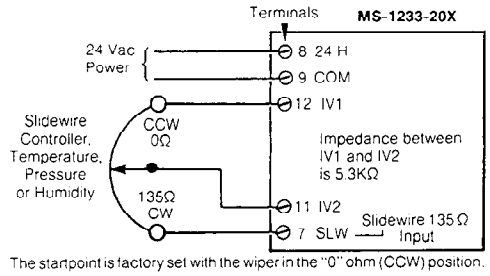
4 mA actuator rotates counterclockwise.*

*As viewed from cover side of actuator.

To change the direction of rotation, remove and reverse ends of the connector shown in Figure 13. When reversed, 20 mA input becomes the CCW end and the 4 mA input becomes the CW end of rotation. It may be necessary to readjust the startpoint slightly for an exact 20 mA startpoint.

- To override to full CCW, refer to Figure 4.

Figure 9. Actuator with 4 to 20 mA Input



The startpoint is factory set with the wiper in the "0" ohm (CCW) position.

Potentiometer Wiper Position

135Ω actuator rotates clockwise.*

0Ω actuator rotates counterclockwise.*

*As viewed from cover side of actuator.

To change the direction of rotation reverse CW, CCW connections at the slidewire controller.

Figure 10. Actuator with 135 Ohm Slidewire Controller

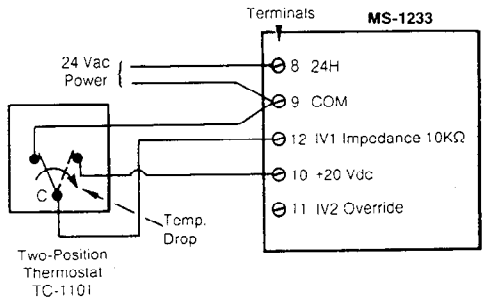


Figure 11. Typical Two-Position Control

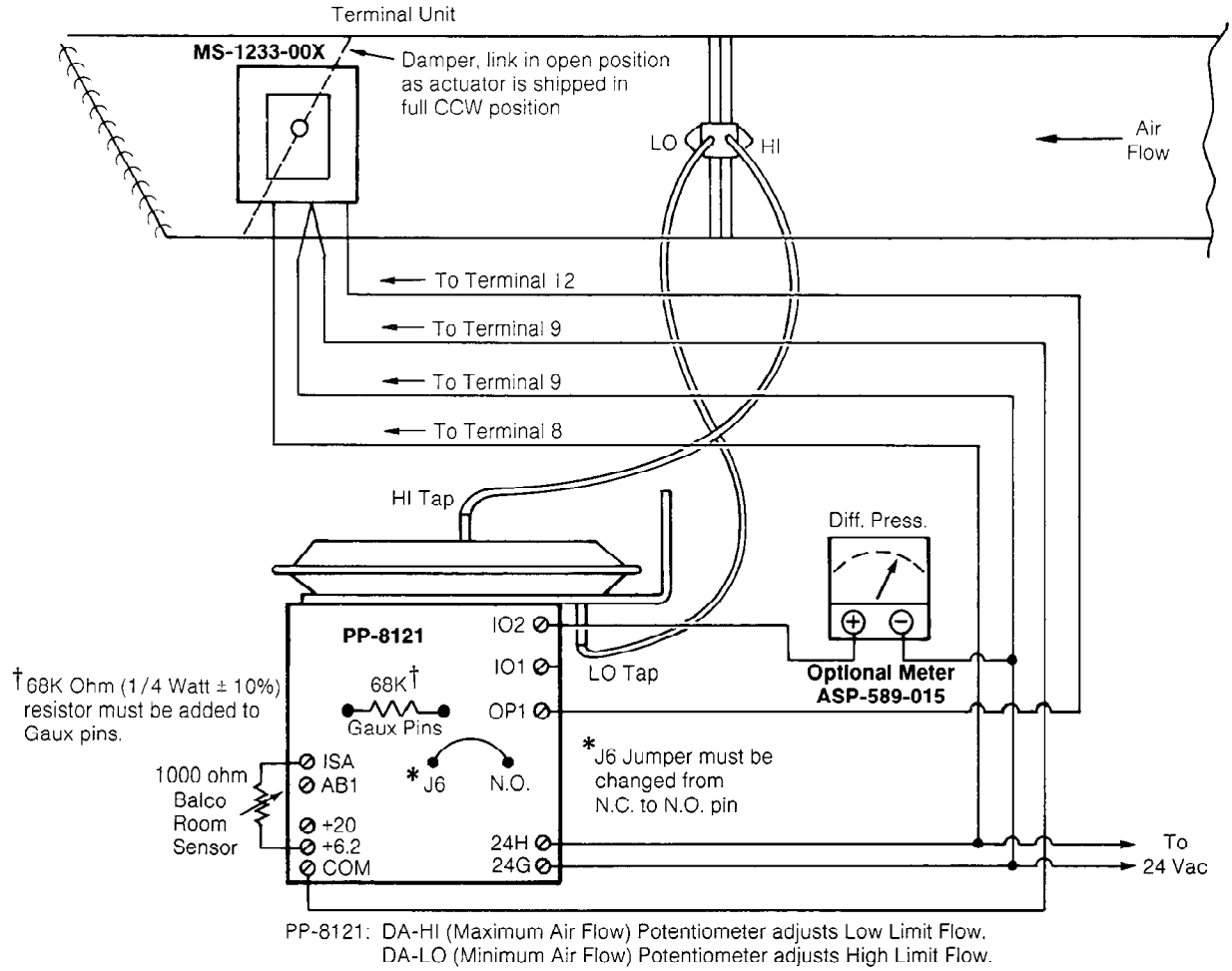


Figure 12. MS-1233-00X with PP-8121 VAV Controller

OPERATION

Power

Apply 24 Vac power to actuator terminals 8 and 9.

CAUTION

On 2 to 15 Vdc input (MS-1233-00X) and 4 to 20 mA input (MS-1233-10X) units, 2 (two) wires will always be connected to terminal 9, one for power and one for signal input.

Control

2 to 15 Vdc Input (See Figures 6 through 8)

The output shaft position is controlled by a 3 Vdc span of a 2 to 15 Vdc input signal applied between terminals 9 (COM) and 12 (IV1) of the actuator. Positive positioning (i.e., at any load a given signal voltage represents a specific shaft position) is achieved by a voltage from a feedback potentiometer. The shaft drives the damper CW or CCW until the torque switch breaks the power to the motor after 90° of rotation or when the damper torque exceeds 20 to 35 lb.-in. (2.3 to 3.5 N-m). The actuator will stop and stay at any position within the stroke when the input signal is constant.

The input voltage signal is normally proportional but two-position control is easily attainable by using a controller with SPDT switch action. See Figure 11 for typical two-position control wiring.

The startpoint of the 3 Vdc span is adjustable from 2 to 12 Vdc and is factory set at 6 Vdc.

4 to 20 mA Input (See Figure 9)

The output shaft position is controlled by a 16 mA span of a 4 to 20 mA input signal applied between terminals 9 (COM) and 12 (IV1) of the actuator. Positive positioning (i.e., at any load a given signal amperage represents a specific shaft position) is achieved by a voltage from a feedback potentiometer. The shaft drives the damper CW or CCW until the torque switch breaks the power to the motor after 90° of rotation or when the damper torque exceeds 20 to 35 lb.-in. (2.3 to 3.5 N-m). The actuator will stop and stay at any position within the stroke when the input signal is constant.

The startpoint of the 16 mA span is factory set at 4 mA.

135 Ohm Slidewire Input (See Figure 10)

The output shaft position is controlled by a 135 ohm span slidewire applied between terminals 7 (SLW), 11 (IV2) and 12 (IV1) of the actuator. Positive positioning (i.e., at any load a given signal resistance represents a specific shaft position) is achieved by a voltage from a feedback potentiometer. The shaft drives the damper CW or CCW until the torque switch breaks the power to the motor after 90° of rotation or when the damper torque exceeds 20 to 35 lb.-in. (2.3 to 3.5 N-m). The actuator will stop and stay at any position within the stroke when the input resistance is constant.

The startpoint is factory set with the slidewire wiper in the "0" ohm (CCW) position.

FIELD ADJUSTMENTS

Auxiliary Switch Adjustment (See Figures 13 & 14)

Switch adjustment is made by turning the retaining ring which actuates the switch. Use a thin nose pair of pliers [1/4" (6.3 mm) thick max.] to rotate the ring in either direction. Run the actuator to the position that the switch is to make; i.e., the switch lever is depressed making the C contact to the N.O. contact.

Switch #1 Rotate the ring CCW until the first lobe on the ring to contact the switch lever makes the switch.

Switch #2 Rotate the ring CW until the first lobe on the ring to contact the switch lever makes the switch. This switch may also be set closer to the CW end if desired.

Changing Direction of Actuator Rotation

2 to 15 Vdc Input Signal

Remove and reverse ends of the connector shown in Figure 13. For example, when the connector is reversed, 9 Vdc becomes the CCW end and 6 Vdc becomes the CW end of rotation. It may be necessary to readjust the startpoint slightly for an exact 9 Vdc startpoint.

4 to 20 mA Input Signal

Remove and reverse ends of the connector shown in Figure 13. When reversed, 20 mA input becomes the CCW end and the 4 mA input becomes the CW end of rotation. It may be necessary to readjust the startpoint slightly for an exact 20 mA startpoint.

135 Ohm Slidewire Input

To change the direction or rotation reverse CW and CCW connections at the slidewire controller or reverse connections 7 (SLW) and 12 (IV1) at the actuator terminals. See Figure 10.

Startpoint Adjustment

2 to 15 Vdc Input (See Figures 6 through 8 & 13)

The startpoint is factory set to provide a 6 Vdc startpoint from a voltage signal applied between terminals 9 [COM (-)] and 12 [IV1 (+)]. Startpoint is adjustable from 2 to 12 Vdc.

Using a 20,000 ohm per volt VOM meter, measure the voltage at terminals 9 (COM) and 12 (IV1). Apply the required startpoint to a higher voltage, turn the startpoint adjustment CW using a small screwdriver with a 1/8" wide blade until the actuator motor just energizes. To decrease the startpoint to a lower voltage, turn the startpoint adjustment CCW until the actuator motor just energizes.

4 to 20 mA Input (See Figures 9 & 13)

Factory set at 4 mA. (Slight adjustment is available by turning the startpoint adjustor.)

135 Ohm Slidewire Input (See Figures 10 & 13)

Fixed. (Slight adjustment is available by turning startpoint the adjustor.)

CHECKOUT

Use a 20,000 ohm per volt VOM meter.

Power Supply (See Figures 6 through 12)

Step 1. The actuator must be powered from a source with the proper voltage and VA rating.

Step 2. Check the 20 ±1 Vdc power supply by measuring with a VOM meter between the 10 (+20) and 9 (COM) terminals. If the 20 Vdc is not present or is out of tolerance, the actuator must be replaced.

Mid-position Setting

2 to 15 Vdc Actuator (See Figures 6 through 8 & 12)

Mid-voltage of the 3 Vdc actuator control span is normally equal to the calibration voltage of the controller (typically 7.5 Vdc). Apply the required voltage to terminals 9 (COM) and 12 (IV1). The actuator shaft should drive to mid-stroke. If position change is required, see Startpoint Adjustment.

4 to 20 mA Actuator (See Figure 9)

Mid-amperage of the 16 mA actuator control span is normally equal to the calibration amperage of the controller (typically 12 mA). Apply the required mA signal to terminal 12 (IV1). The actuator shaft should drive to mid-stroke. If position change is reuired, see Startpoint Adjustment.

135 Ohm Slidwire Actuator (See Figure 10)

Mid-resistance of the 135 ohm actuator control span is normally equal to the calibration resistance of the controller (typically 67.5 ohms). Apply the required resistance to terminals 7 (SLW), 11 (IV2) and 12 (IV1). The actuator shaft should drive to mid-stroke if the wiper arm of the controller is in mid-position. If position change is required, see Startpoint Adjustment.

Positive Positioning Action

2 to 15 Vdc Actuator (See Figures 6 through 8 & 12)

Observe the actuator output shaft position at any load. The shaft must be fully CCW at the lowest voltage of the 3 Vdc span (typically 6 Vdc) and at 90° CW at the highest voltage (typically 9 Vdc) and at mid-stroke at mid-span (typically 7.5 Vdc).

4 to 20 mA Actuator (See Figure 9)

Observe the actuator output shaft position at any load. The shaft must be fully CCW at the lowest amperage of the 16 mA span (4 mA), at 90° CW at the highest amperage (20 mA) and mid-stroke at mid-span (12 mA).

135 Ohm Slidewire Actuator (See Figure 10)

Observe the actuator shaft position at any load. The shaft must be fully CCW at 0 ohms, fully CW at 135 ohms resistance and mid-stroke at 67.5 ohms.

Auxiliary Switch (Optional) (See Figures 3 & 4)

Use a VOM meter at the proper terminals. There must be a circuit from C to N.O. on each switch when the switch lever is depressed. When not depressed, there must be a circuit from C to N.C. If this action is not present and the auxiliary switch is required for the application, the actuator must be replaced.

CAUTION

This device is limited to 50% duty cycle. To achieve maximum service life, check the system to verify proper operation. The actuator shaft should not be continuously moving. After initial start-up and system stabilization, the actuator shaft should be moving less than 50% of the time. Exceeding 50% duty cycle limit will result in reduced life.

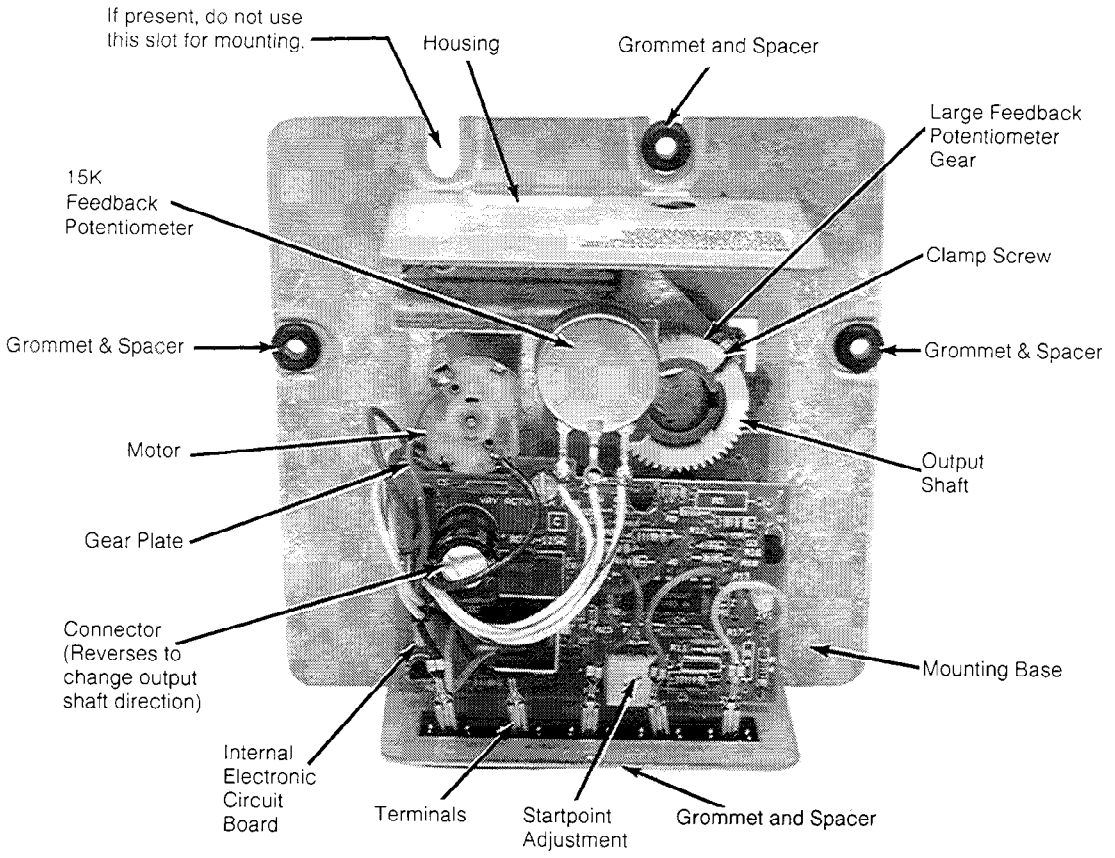


Figure 13. MS-1233-002 Front without Cover

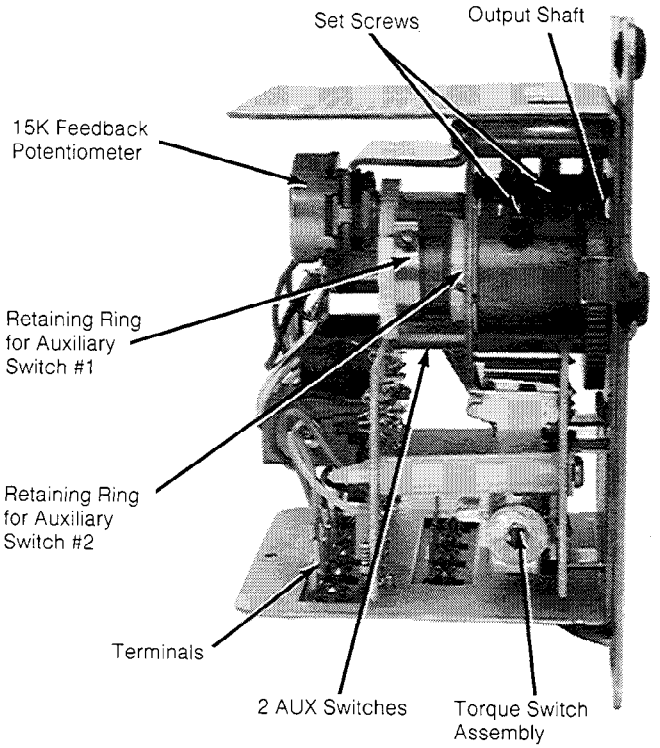


Figure 14. MS-1233-002 R.H. Side without Cover

NOTE

If the actuator shaft is continuously moving, the system may be "hunting." System instability or "hunting" can be caused by:

- Throttling range too narrow
- Integral term set too fast
- Large temperature fluctuations caused by external influences at the sensor (e.g., fork lift truck exhaust, open garage doors)
- Oversized valves or mechanical equipment
- Other control strategies which may cause continuous actuator movement

MAINTENANCE

Regular maintenance of the total system is recommended to sustain optimum performance.

Normally, no lubrication is required, but use #10 motor oil on the bearing and gears if the factory lubricant becomes thick with dust or grit.

FIELD REPAIR

None. Replace with a functional actuator.

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