MS-22353

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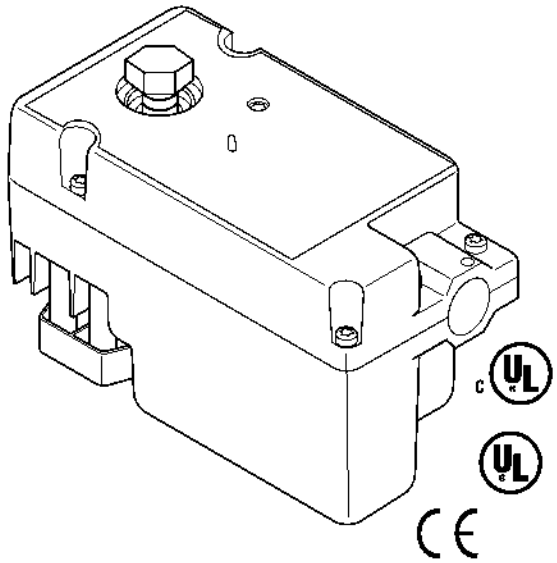
Proportional Valve Actuator
General Instructions

Application

The MS-22353 Proportional Valve Actuator is a non-spring return actuator used with proportional 2 to 10 Vdc or 4 to 20 mA controllers and standard 1/2" to 1-1/4" two-way and three-way valve bodies for control of heating and cooling coils. Typical applications include VAV terminals with reheat coils, fan coil units, and unit ventilators.



Features

- Proportional actuator controlled by 2 to 10 Vdc or 4 to 20 mA
- 45 pounds (200 newtons) of output force with automatic load limit for self-adjusting travel and long motor life
- Synchronous motor for consistent timing
- Manual override with automatic release
- 2 to 10 Vdc actuator position feedback signal
- Integral linkage for all standard 1/2" to 1-1/4" SEC two-way stem-up open and three-way valve bodies for a wide variety of applications
- Compact size for application flexibility
- Rugged construction with die cast housing
- 100Ω input impedance for the 4 to 20 mA input

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Applicable Literature

F-Number	Description	Audience	Purpose
F-23638	Siebe Environmental Control Cross-Reference Guide	– Sales Personnel – Application Engineers – Service Personnel	Provides a listing of Siebe Environmental Control HVAC component products to assist in the selection of product replacement. The components are cross referenced to compatible older components and/or competitive components.
F-21683	Siebe Environmental Control Reference Manual	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	A collection of currently published component General Instruction literature in a two volume format.
F-21335	Siebe Environmental Controls Application Manual	– Application Engineers – Service Personnel	Provides theory of operations for numerous HVAC applications.
F-26363	EN-206 Guidelines for Powering Multiple Full-Wave and Half-Wave Rectifier Devices from a Common Transformer	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the proper wiring guidelines associated with full-wave and half-wave rectifier devices from a common transformer to avoid equipment damage.
F-26302	VS-7XXX Series Valve Selection Guide for the MS-22353 Actuator	– Sales Personnel – Application Engineers – Service Personnel	Provides a listing of VS-7XXX Series valve bodies and their characteristics as used with the MS-22353 actuator. This document assists in the selection of appropriate valve body for product ordering or replacement.
F-26075	VB-7213 Series 1/2" to 2" Screwed NPT Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7213 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-25675	VB-7214 Series 1/2" to 2" Union Sweat, Solder Joint Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7214 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-26077	VB-7215 Series 15 mm to 50 mm Screwed Rp Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7215 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-24388	VB-7253 Series 1/2" to 2" Screwed NPT Stainless Steel Trim with Teflon Disc Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7253 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-24390	VB-7273 Series 1/2" to 2" Screwed NPT Stainless Steel Trim Stem Up Open, Two-Way Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7273 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-24392	VB-7312 Series 5/8" O.D., 45° SAE Flared Three-Way Mixing Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7312 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-26074	VB-7313 Series 1/2" to 2" Screwed NPT Three-Way Mixing Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7313 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-24394	VB-7314 Series 1/2" to 2" Union Sweat, Solder Joint, Three-Way Mixing Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7314 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.

F-Number	Description	Audience	Purpose
F-26078	VB-7315 Series 15 mm to 50 mm Screwed Rp Three-Way Mixing Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7315 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-24396	VB-7332 Series 5/8" O.D. 45° SAE Flared Three-Way Sequencing Valves General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the VB-7332 Series valve features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.
F-26261	AV-642 Valve Linkage Kit for Controlli Valve Bodies	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the AV-642 valve linkage kit features, specifications, and possible application. Also provides step-by-step mounting, installation, and checkout instructions.

SPECIFICATIONS

Inputs

Operating Range:
2 to 10 Vdc or 4 to 20 mAdc, Proportional control signals (fixed span and start point).
Input Impedance,
100kΩ minimum for voltage input.
100Ω for current input.
Power Input: See Table-1.
Connections: 4 foot (1.2 m) color coded 18 AWG, plenum cable rated for UL.

Outputs

Position Feedback Signal: 2 to 10 Vdc non-adjustable.
Connections, 4 foot (1.2 m) color coded 18 AWG, plenum cable rated for UL.
Mechanical:
Force , 45 pounds (200 N) minimum with automatic load limit. See Table-3.
Stroke, Up to 9/16" (14.3 mm) maximum, self-adjusting.
Timing, See Table-1.
Manual Operator: Allows actuator to be manually set at any position upon loss of power. Releases automatically when power is restored.

Environment

Ambient Temperature Limits:
Shipping and Storage, -40 to 160°F (-40 to 71°C).
Operating,
Minimum 40°F (4°C).
Maximum See Table-2.
Fluid Temperature Limits: See Table-2.
Humidity: 5 to 95% RH, *non-condensing.* See Table-2 for maximum dew point temperature.
Location: NEMA Type 1.
Enclosure Protection Class: IP31 according to EN 60529, BS EN 60529.

Agency Listings

UL 873: Underwriters Laboratories (File # E9429 Category Temperature-Indicating and Regulating Equipment).
CUL: Certified for use in Canada by Underwriters Laboratories. Canadian Standards C22.2 No. 24-93.
European Community: EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC).

Table-1 Actuator Model Chart.

Part Number	Application	Actuator Power Input				Feedback	Typical Timing in Sec. @ 75°F for 1/2" (12.7mm) Stroke		Max. Stroke in in. (mm)
		Voltage (+20%, -15%)	Hz		VA	2 to 10 Vdc[a]	60 Hz	50 Hz	
MS-22353	Chilled/Hot Water/Steam[b]	24 Vac (Class 2 Power Supply)	50	60	4	Yes	126	151	9/16 (14.3)

[a] Running or manually adjusting the actuator before it is mounted to a valve changes the potentiometer setting and could also cause damage.
[b] Refer to Table-2 for maximum allowable temperature.

Table-2 Restrictions on Ambient Temperature for Valve Actuators.

Actuator Part Number	Temperature of Media in the Valve Body (Check Rating of the Valve)		Maximum Ambient Temperature of Actuator	Dew Point Temperature[a]
	Minimum	Maximum		
MS-22353	40°F (4°C)[b]	281°F (138°C)	115°F (46°C)	88°F maximum with 40°F fluid (31°C maximum with 4°C fluid)[b]
		220°F (104°C)	140°F (60°C)	

[a] Dew point temperature applies only to chilled water applications.
[b] The dew point temperature cannot be more than 48°F (26.7°C) above the fluid temperature.

Table-3 Close-off Pressure Ratings.

Valve Body Part Number[a]	Valve Sizes	Close-off Pressure (psi)[b] Nominal
Two-Way Valves VB-7211 VB-7212 VB-7213 VB-7214 VB-7215[c]	1/2"	130
	3/4"	80
	1"	40
	1-1/4"	25
Three-Way Mixing Valves VB-7312 VB-7313 VB-7314 VB-7315[c]	1/2"	130
	3/4"	80
	1"	40
	1-1/4"	25

[a] MS-22353 actuators may also be used with VB-9000 valves. Refer to **Siebe Environmental Controls Catalog, F-25683**, for available valves.
[b] Close off ratings describe only the differential pressure which the actuator can close with adequate seating force. Consult valve body specifications for other limitations, see "Applicable Literature" for document listing.
[c] Metric thread 15 to 32 mm (Rp 1/2 to Rp 1-1/4).

ACCESSORIES

AV-641	Valve linkage kit (replacement parts only, order separately, see F-26588)
AV-642	Four-way valve linkage kit for Controlli valve bodies (see F-26261)
AV-644	Valve linkage kit (included with MS-22353 actuator) (see Figure-6)
FRAC-255	Metric male 20 mm conduit fitting (m20 x 1.5 - 8g) 11 mm nominal thread length

Note: If the actuator drive screw (Figure-7) has a round opening in the center, then the center section of the stem extension should also be round to match. AV-641 Valve Linkage Kit contains the round stem extension. (Valve/actuator assemblies using the AV-641 valve linkage kit are assembled similar to the AV-644 illustration shown in Figure-6.)

TYPICAL APPLICATION (wiring diagrams)

Basic Actuator

The MS-22353 actuator provides a 2 to 10 Vdc position feedback output to indicate the actuator's stroke position. Figure-1 and Figure-2 illustrate typical wiring diagrams, Figure-3 illustrates a typical wiring configuration using multiple MS-22353 actuators with one controller, and Figure-4 illustrates a typical wiring configuration for multiple actuators in parallel.

Note: When the MS-22353 is assembled on a valve, the feedback signal may not reach exactly 2 Vdc (0%) or 10 Vdc (100%) at the ends of valve stroke.

Caution:

- This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies. Refer to **EN-206, Guidelines for Powering Multiple Devices from a Common Transformer, F-26363** for detailed information.
- Each MS-22353 actuator can accept either a 2 to 10 Vdc or 4 to 20 mA signal.
- The unused control input lead (White or Brown) must be taped, capped with a wire nut, or cut off to provide only one input signal.
- If the actuator position feedback signal lead (Blue) is not used, the lead must be taped, capped with a wire nut, or cut off.

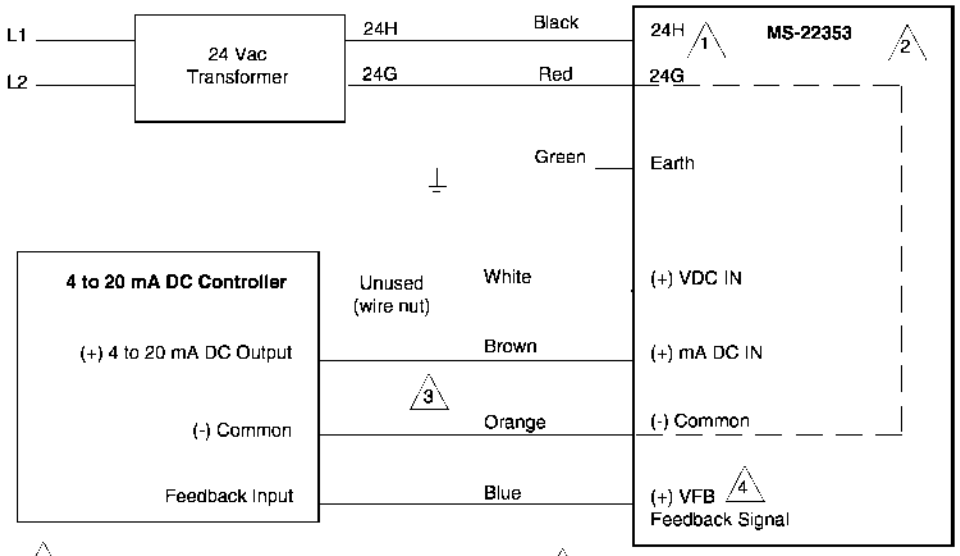
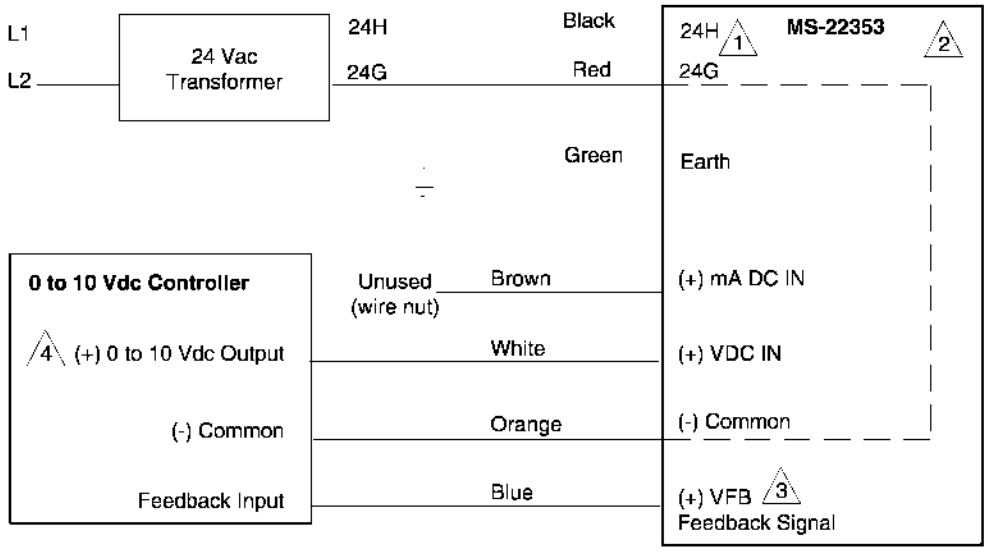


Figure-1 Wiring Diagram for 4 to 20 mA DC Proportional Control.



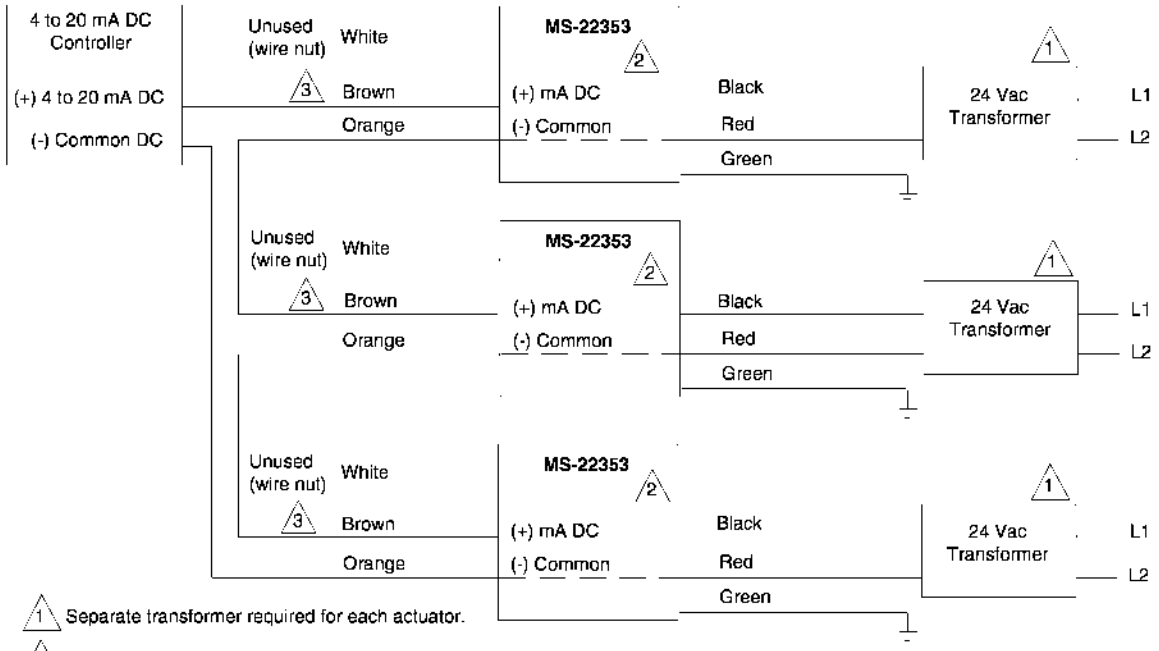
1 The MS-22353 actuator contains a half-wave rectifier power supply. When connecting multiple devices to a common transformer connect 24H and 24G with half-wave rectifier or isolated power supplied devices, only.

2 For actuator models manufactured prior to date code 991X (e.g. 9910, 9911, etc.), see Table 4 for wire colors and numbers.

3 Optional connection for controllers with feedback input.

4 Although the controller in this example has an output of 0 to 10 Vdc, the MS-22353 only operates over its input span of 2 to 10 Vdc.

Figure-2 Wiring Diagram for 2 to 10 Vdc Proportional Control.



1 Separate transformer required for each actuator.

2 For actuator models manufactured prior to date code 991X(e.g. 9910, 9911, etc.), see Table 4 for wire colors and numbers

3 The input impedance between Brown and Orange for each actuator is 100 ohms nominal.

Figure-3 Wiring Diagram for Series Combination of MS-22353 Actuators Using One 4 to 20 mA Control Input.

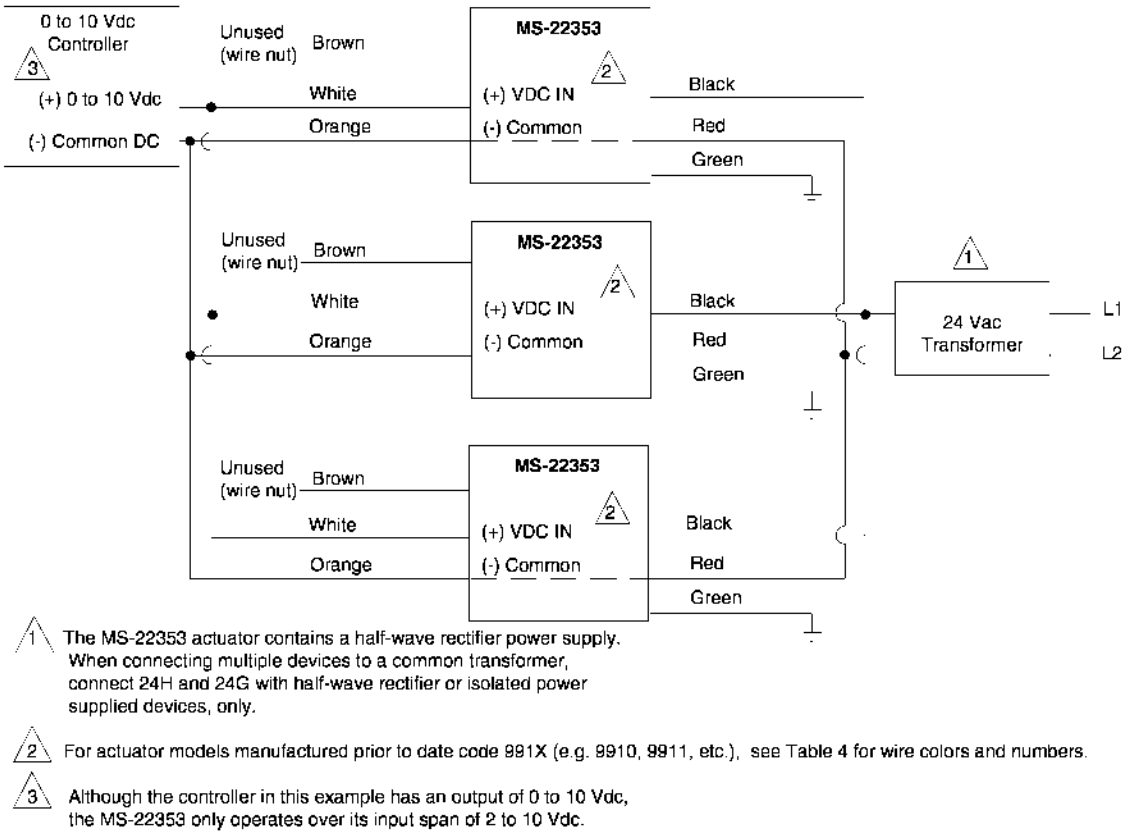


Figure-4 Wiring Diagram for Parallel Combination of MS-22353 Actuators Using One 2 to 10 Vdc Control Input.

INSTALLATION

Inspection

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

Requirements

- Job wiring diagrams
- Tools (not provided):
  - 5/32" (4 mm) Allen wrench
  - Appropriate wrenches for stem extension and lock nut
  - TOOL-37, 1-5/8" (42 mm) open-ended wrench
  - Volt-ohm meter
  - Caliper or 1/2" (12 mm) wide scale

Training: Installer must be a qualified, experienced technician

Warning: Disconnect the power supply (24 Vac power) before installation to prevent electrical shock and equipment damage.

Caution:

- Make all connections in accordance with the wiring diagram and in accordance with national and local electrical codes. *Use copper conductors only.*
- Do not remove cover of actuator. There are no user serviceable parts inside.
- Do not exceed ratings of the device(s).
- Avoid locations where excessive moisture, corrosive fumes, or vibration is present.

Mounting

Position the actuator above center line of valve to prevent damage from condensation and dripping water.

1. Allow 3" (76 mm) above the actuator valve assembly for removal and reattachment of actuator to installed valve.
2. Install all two-way valves so that they close against the flow. An arrow on the valve body or tag indicates proper flow direction.
3. Always install three-way mixing valves with two inlets and one outlet.
4. Always install three-way diverting valves with one inlet and two outlets.
5. Always install four-way Controlli valves per manufacturers instructions.
6. Valve actuators are to be mounted in any upright position above the center line of the valve body. For steam applications only, position the valve body so the valve stem and actuator are at least at 45° from vertical.

Wiring Requirements

Power and Control Leads

See Table-4 for lead identification.

Table-4 Power and Control Wiring Color Codes.

	Actuator Label	Description	Wire Codes	
			Color Only (Current Models)	Color with Numbers (Older Models[a])
Actuator Power	Earth	Earth Ground	Green	Green (—)
	24 H	24 Vac	Black	Black (1)
	24 G	24 Vac	Red	Red [b] (2)
Proportional Control Signals	+VDC (IN)	2 to 10 Vdc Input	White	White/Green (3)
	-COMMON	DC Common Ground	Orange	White/Orange (4)
	+mADC (IN)	4 to 20 mADC Input	Brown	White/Brown (6)
Feedback Control Signal	+VFB	Actuator Feedback	Blue	White/Blue (5)

[a] Actuator models manufactured prior to date code 991X (e.g. 9910, 9911, etc.) have multi-color, numbered wires.
[b] Actuator power wire may be Violet on some models.

Make all electrical connections in accordance with the job wiring diagram and in compliance with national and local electrical codes. See Table-5 and Table-6 for maximum wiring lengths.

Table-5 Proportional Control Wiring Data (Leads Orange, White, Brown, Blue).

Wire Size (GA)	Maximum Wire Run in ft. (m)
20	500 (152)
18	1000 (305)
16	2250 (686)
14	4000 (1219)

Caution: Use multi-conductor twisted shielded cable when it becomes necessary to install the input, common, and feedback signal leads in the same conduit with power wiring or when RFI/EMI generating devices are near.

Table-6 Power Wiring Data (Green, Red, Black).

Wire Size (GA)	Maximum Wiring Run in ft. (m) (5% voltage drop)
14	5500 (1672)
16	3600 (1094)
18	2100 (638)

Low voltage actuators installed to NEC (National Electrical Code) codes may use Class 2 wiring.

The total length of power wiring [black , red leads] should not exceed the maximum length shown for given wire size in Table-6.

Wiring Connections

Note: Use flexible conduit only. Rigid conduit cannot be used. Actuator housing must be free to move.

Assembly/Adjustment Instructions

Caution: Damage could occur if an actuator is run or manually adjusted without being mounted to a valve. This will also cause the potentiometer output to be out of specification and will require the actuator position to be re-established. If an actuator is run or adjusted without being mounted to a valve, see "Re-establishing Actuator Position" below.

Re-establishing Actuator Position

If an actuator is run or adjusted without being mounted to a valve, the actuator position can be re-established by applying 24 Vac to the actuator (refer to Figure-5 and Table-4):

1. Remove actuator position indicator nut and stem extension.
2. Apply 9.0 Vdc between +VDC (IN) and COMMON. When the actuator has stopped moving remove power from the actuator.

   or

   Depress the manual override button and turn the manual override screw so that the position feedback voltage, (VFB), is 9.0 Vdc. Then remove power from the actuator before releasing the override button. Now follow the assembly steps listed below.

Actuator Assembly

See Figure-5 for parts identification.

1. Position the valve stem in the down position. Place the lock nut onto the valve stem.
2. Remove the stem extension from the actuator. Screw the stem extension onto the valve stem. Adjust the height of the stem extension to 1-3/32" (27.8 mm). This dimension is the distance from the top of the packing nut to the shoulder of the stem extension (see Figure-5).

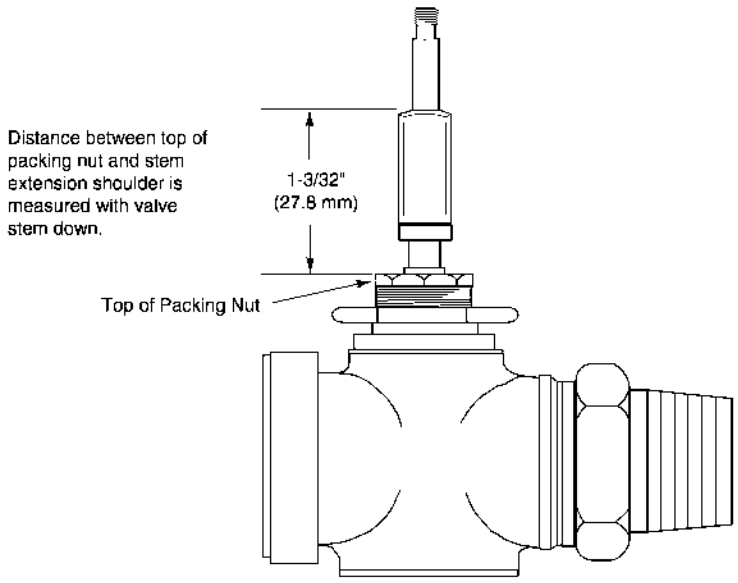


Figure-5 Valve and Stem Extension Assembly.

3. Tighten the lock nut against the stem extension to make the stem extension secure to the valve stem.

4. Position the valve stem in the fully down position.

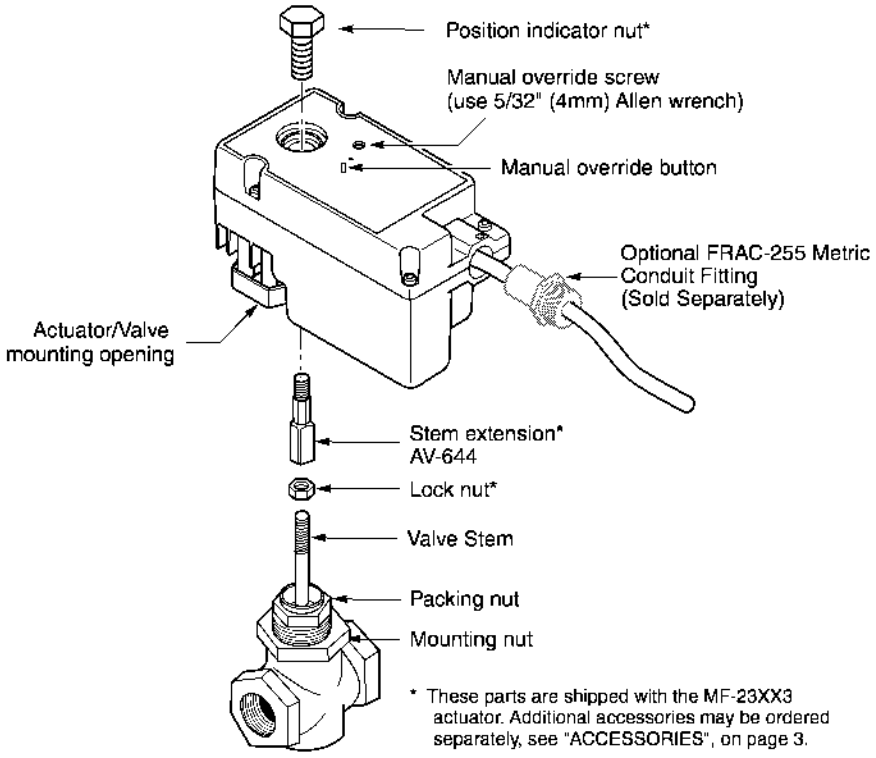


Figure-6 MS-22353 Assembly Diagram.

5. Confirm that the drive screw is at the required distance from the top of the actuator case. See Figure-7. If the drive screw is not in position, insert a tapered pencil or pen into the drive screw and rotate.

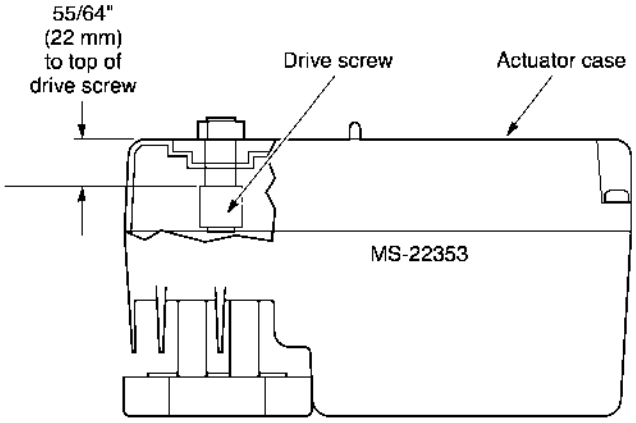


Figure-7 Proper Drive Screw Position Before Mounting.

6. Insert the valve stem extension through the bottom of the actuator. If necessary, rotate the drive screw slightly to align the hex in the drive screw to the square in the lower bearing to match the stem extension hex and square.
7. Screw the valve mounting nut into the actuator and tighten.
8. Insert the position indicator nut into the hole at the top of the actuator.
9. Position the indicator nut on top of the actuator and tighten against the shoulder on the stem extension.

Caution: The hex shaped interface between the stem extension and drive screw does not require high indicator nut tightening torque. Do not tighten the indicator nut beyond the hex shoulder on the stem extension or a reduction in the actuator output may result. See Figure-6 for parts identification.

Manual Override Operation

All models are provided with a means of manual positioning the valve without power to the actuators. See Figure-6 for the location of the manual override button and manual override screw. Rotating manual override screw clockwise as seen from the top of the actuator, extends the actuator shaft.

1. Disengage the gear train by depressing the manual override button.
2. While holding the button turn manual override screw with 5/32" or 4 mm hex Allen wrench until the desired valve stem position is obtained, then release the manual override button.

Note: When power is applied to the actuator/valve assembly control is automatically resumed. No manual reset required.

CHECKOUT

After the entire system has been installed and the actuator has been powered up, the following checks can be made for proper system operation.

Positioning with Controller

If the sensed media is within the controller's setpoint range, the actuator can be positioned by adjusting the controller setpoint up and down. Check for correct operation of valve while the actuator is being stroked.

Go, No Go Test

1. Override the controller's output to 10 Vdc or 20 mA and the actuator should extend.
2. Override the controller's output to 2 Vdc or 4 mA and the actuator should retract.

MAINTENANCE

The actuator requires no maintenance. Regular maintenance of the total system is recommended to assure sustained optimum performance.

Note: When the MS-22353 is installed in an exceptionally dirty environment, the internal feedback potentiometer may, after several years of use, exhibit some error due to contamination. The performance of the potentiometer can be restored to its original quality by manually cycling the actuator for 10 full-stroke cycles. This procedure is only necessary in those applications where normal control action does not frequently operate the actuator over its full stroke of travel.

FIELD REPAIR

Caution: Do not remove cover of actuator. No user serviceable parts inside.

Replace with a functional actuator. The AV-641 valve linkage kit can be ordered separately as a replacement part for the parts that were included with the actuator. The following instructions are for disassembling the actuator from the valve for actuator replacement or valve repacking. See Figure-6.

Disassembly Instructions

1. Turn off power to the actuator and disconnect wires at the junction box.

Warning: Disconnect the power before disassembly to prevent electrical shock.

Note: Do not remove actuator cover to disconnect wires.

2. Unscrew the position indicator nut.
3. Unscrew the mounting nut and lift the actuator from the valve.

DIMENSIONAL DATA

Dimensions for Figure-8 are shown in inches with millimeters in brackets.

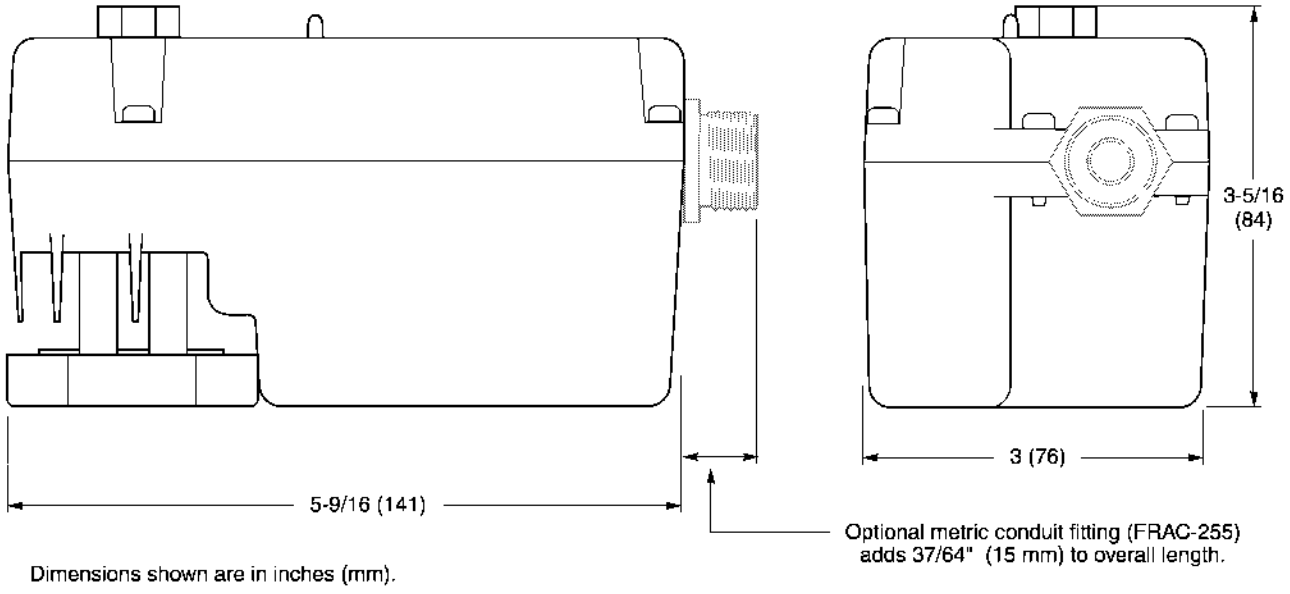


Figure-8 MS-22353 Actuator Dimensions