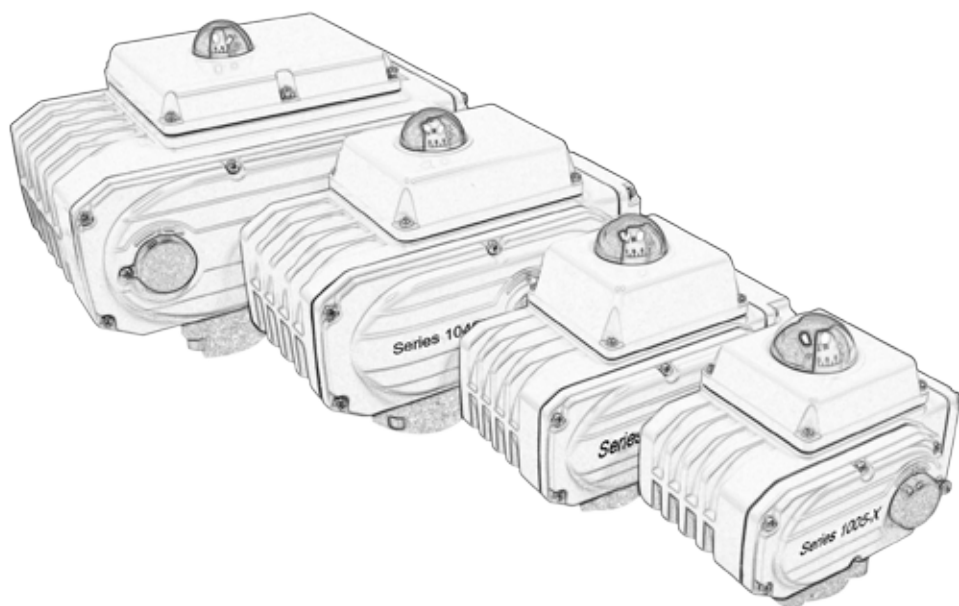


# ***VSI SERIES 1000/S-X***

## **MODULATING SERVICE ELECTRIC ACTUATORS OPERATION AND MAINTENANCE MANUAL**

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### **COMMERCIAL AND INDUSTRIAL VALVES AND AUTOMATION**

Publication S1000X-111

VER0415-1

*For information on this product and other VSI products please visit our web page - [www.valvesolutions.com](http://www.valvesolutions.com)*

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SAFETY INSTRUCTIONS AND WARNINGS



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death



NOTICE

Indicates a potential situation which, if not avoided, may result in undesirable results or property damage



NOTICE

Do not manually operate the actuator without de-energizing actuator with factory installed push button or by external disconnect such as a circuit breaker.

- Actuators are equipped with an internal overheat protection device. When the motor exceeds the temperature of 257°F (125°C), the overheat protection device will automatically switch off the motor.
- Take proper leakage protection steps when installing actuator and its associated wiring, and when putting it into service. Cables connected to the actuator conduit entries must utilize proper waterproof cable ends. Tube conduit should come from below and up to the actuator to keep fluid from draining into the actuator.
- Confirm input voltages and signal polarity corresponds with those shown for the actuator's associated data.
- Only qualified service personnel who are familiar with the installation, commissioning and operation of the actuator should perform installation and servicing.
- All actuators have the proper wiring diagram affixed to the inside of the Front Wiring Cover (#4); all wiring should follow these diagrams.



NOTICE

The servo controller pack must be wired and adjusted according to the instructions in this manual to prevent damage from occurring.



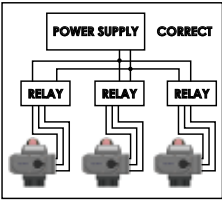
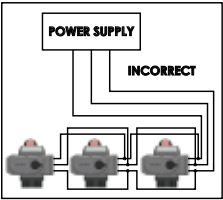
NOTICE

For 24VAC servo controller packs the power common and signal common must be isolated. Additionally the 120/24VAC transformers must be ungrounded.

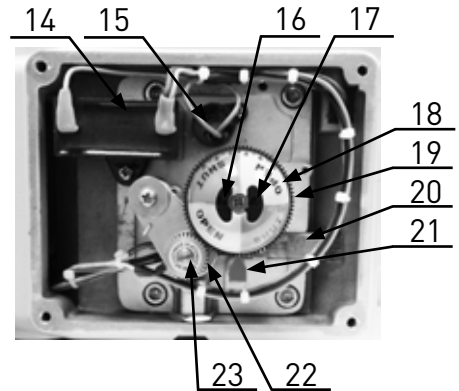
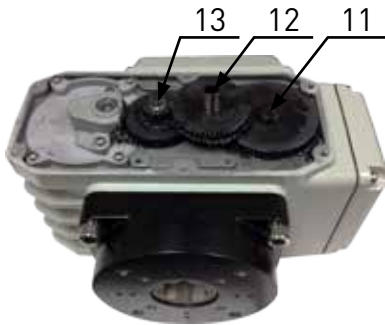
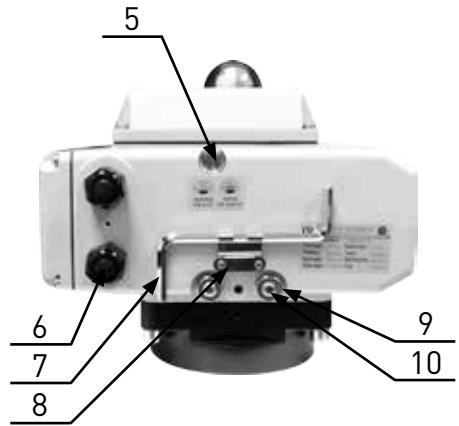
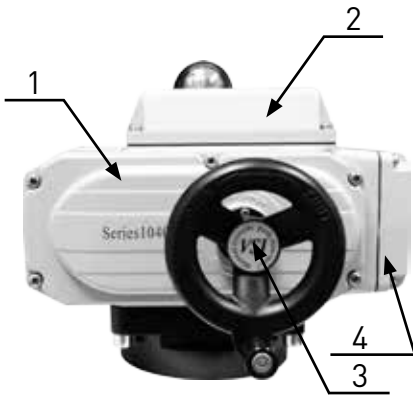


NOTICE

To prevent reduced or erratic performance a single isolated relay is required for each actuator; refer to diagram.



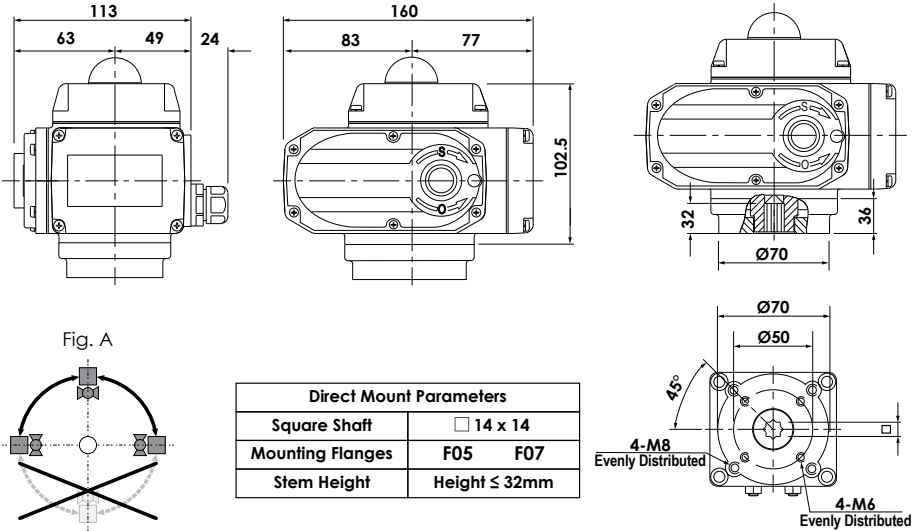
## COMPONENT NAMES



1	Side Gear Cover	13	Reducing Gear Group
2	Top Wiring Cover	14	Capacitor
3	Handwheel*	15	Inductor (Legacy Only)
4	Front Wiring Cover	16	Open Cam Lock Screw
5	Push Button*	17	Close Cam Lock Screw
6	Conduit Plugs	18	Position Indicator
7	Hex Handle	19	Opening Gear
8	Hex Handle Bracket	20	Heater
9	Travel Stop Nut	21	Position Pointer
10	Travel Stop Screw	22	Potentiometer Gear
11	Worm Shaft	23	Potentiometer
12	Override Socket		

\*Optional on select sizes/models

OVERALL DIMENSIONS AND SPECIFICATIONS FOR 1005/S-X



1005/S-X SPECIFICATIONS			
Power Supply	24 VAC	110 VAC	220 VAC
Motor Power	10W		
Rated Current	1.7A	0.24A	0.16A
Max. Current	1.9A	0.34A	0.17A
Standard Torque	443inlb/50NM		
Run Time	20.5 ± 0.5 sec		
Turning Angle	90° Adjustable ± 5°		
Total Weight*	6.00lbs/2.72kg		
Insulating Resistance	100MΩ/250VDC	100MΩ/500VDC	
Overvoltage Withstanding	500VAC - 60 sec	1500VAC - 60 sec	
Protection Class	IP67 NEMA 4X		
Installation Angle	At or above the centerline of pipe. See Fig. A		
Ambient Temperature	-22°F to +140°F (-30°C to +60°C)		
Ambient Humidity	≤ 95% Relative Humidity		
Duty Cycle	80%		
Options	Hand-crank Override		

\*Weight may vary with selected options

## OVERALL DIMENSIONS AND SPECIFICATIONS FOR 1010/S-X

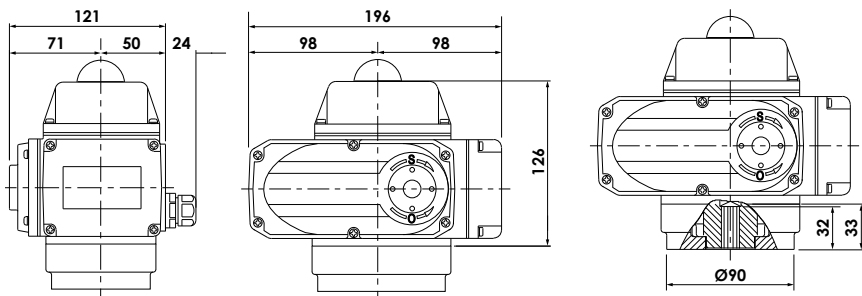
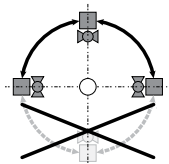
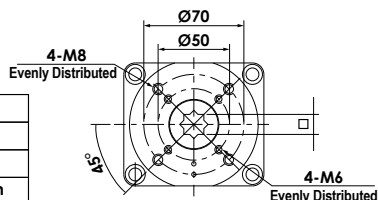


Fig. A



Direct Mount Parameters			
Square Shaft	□17 x 17		
Mounting Flanges	F05	F07	
Stem Height	Height ≤ 32mm		

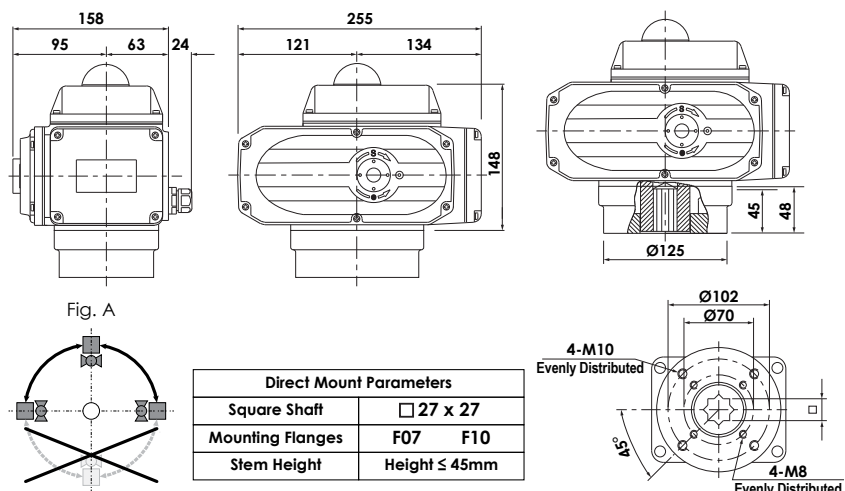


1010/S-X SPECIFICATIONS			
Power Supply	24 VAC	110 VAC	220 VAC
Motor Power	25W		
Rated Current	2.11A	0.57A	0.35A
Max. Current	2.40A	0.81A	0.52A
Standard Torque	885inlb/100NM		
Run Time	24.5 ± 0.5 sec		
Turning Angle	90° Adjustable ± 5°		
Total Weight*	9.10lbs/4.13kg		
Insulating Resistance	100MΩ/250VDC	100MΩ/500VDC	
Overvoltage Withstanding	500VAC - 60 sec	1500VAC - 60 sec	
Protection Class	IP67 NEMA 4X		
Installation Angle	At or above the centerline of pipe. See Fig. A		
Ambient Temperature	-22°F to +140°F [-30°C to +60°C]		
Ambient Humidity	≤ 95% Relative Humidity		
Duty Cycle	80%		
Options	Handwheel Override, Motor Pushbutton <sup>x</sup>		

\*Weight may vary with selected options

<sup>x</sup> NA on 24VAC Units

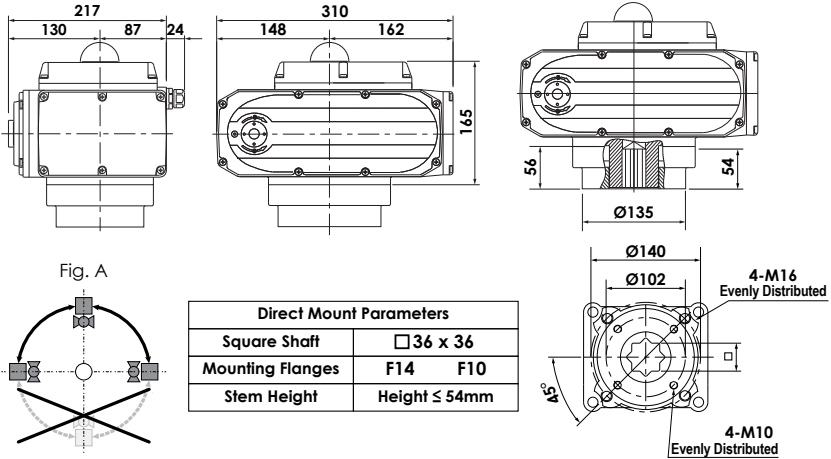
OVERALL DIMENSIONS AND SPECIFICATIONS FOR 1020/S-X THRU 1060/S-X



1020/S-X   1040/S-X   1060/S-X SPECIFICATIONS				
Power	Model	1020/S-X	1040/S-X	1060/S-X
24VAC	Motor Power	40W	40W	NA
	Rated Current	3.7A	6.8A	
	Max. Current	3.9A	7.25A	
	Total Weight*	19.9lbs/9.03kg	21.4lbs/9.71kg	
110VAC	Motor Power	40W	90W	90W
	Rated Current	0.65A	1.12A	1.18A
	Max. Current	1.68A	3.41A	3.60A
	Total Weight*	19.4lbs/8.80kg	20.9lbs/9.46kg	20.9lbs/9.463kg
220VAC	Motor Power	40W	90W	90W
	Rated Current	0.37A	0.57A	0.60A
	Max. Current	0.78A	1.78A	1.87A
	Total Weight*	19.7lbs/8.91kg	21.2lbs/9.59kg	21.1lbs/9.55kg
Standard Torque		1,770inlb/200NM	3,540inlb/400NM	5,310inlb/600NM
Run Time		28.5 ± 0.5 sec	27.5 ± 0.5 sec	34.5 ± 0.5 sec
Turning Angle		90° Adjustable ± 5°		
Insulating Resistance		24VAC: 100MΩ/250VDC 110/220VAC: 100MΩ/500VDC		
Overvoltage Withstanding		24VAC: 500VAC - 60 sec 110/220VAC: 1500VAC - 60 sec		
Protection Class		IP67 NEMA 4X		
Installation Angle		At or above the centerline of pipe. See Fig. A		
Ambient Temperature		-22°F to +140°F [-30°C to +60°C]		
Ambient Humidity		≤ 95% Relative Humidity		
Duty Cycle		80%		
Options		Handwheel Override, Motor Pushbutton*		

\*Weight may vary with selected options  
x NA on 24VAC Units

## OVERALL DIMENSIONS AND SPECIFICATIONS FOR 1100/S-X THRU 1250/S-X



### 1100/S-X | 1160/S-X | 1250/S-X SPECIFICATIONS

Power	Model	1100/S-X	1160/S-X	1250/S-X
110VAC	Motor Power	120W	140W	140W
	Rated Current	1.75A	1.93A	1.93A
	Max. Current	3.80A	3.95A	3.95A
	Total Weight*	40.8lbs/18.5kg	41.8lbs/19.0kg	41.9lbs/19.0kg
220VAC	Motor Power	140W	140W	140W
	Rated Current	0.94A	0.98A	0.98A
	Max. Current	2.12A	2.20A	2.20A
	Total Weight*	41.2lbs/18.7kg	41.9lbs/19.0kg	42.4lbs/19.2kg
Standard Torque		8,850inlb/1,000NM	14,160inlb/1,600NM	22,125inlb/2,500NM
Run Time		26.5 ± 0.5 sec	38.5 ± 0.5 sec	63.5 ± 0.5 sec
Turning Angle		90° Adjustable ± 5°		
Insulating Resistance		100MΩ/500VDC		
Overvoltage Withstanding		1500VAC - 60 sec		
Protection Class		IP67 NEMA 4X		
Installation Angle		At or above the centerline of pipe. See Fig. A		
Ambient Temperature		-22°F to +140°F (-30°C to +60°C)		
Ambient Humidity		≤ 95% Relative Humidity		
Duty Cycle		80%		
Options		Handwheel Override, Motor Pushbutton, Limit Switches		

\*Weight may vary with selected options

POWER SUPPLY REQUIREMENTS

- Power supply for the corresponding unit must meet the electrical requirements for voltage and current ratings as show in its specifications.
- The power supply tolerance shall be as follows:

Rating	24 V	110V	220V
Range	21.6V-26.4V	99V-121V	198V-242V
Frequency	60 Hz		

Circuit Breaker Fuses

Recommended fuses for circuit breakers are as follows:

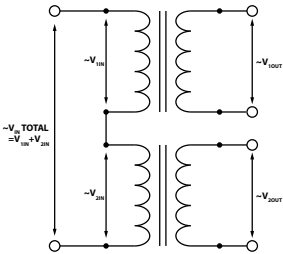
Rating	24V	110V	220V
1005/S-X	5A	3A	2A
1010/S-X	7A	5A	3A
1020/S-X & 1040/S-X	10A	7A	5A
1060-X	NA	7A	5A
1100/S-X, 1160/S-X, & 1250/S-X		10A	7A

24VAC Transformers

Minimum recommended 120V/24V power transformer ratings are as follows:

Model	Transformer
1005-X	50VA
1010-X	50VA
1020-X	150VA
1040-X	200VA

Care should be taken sizing and wiring 120V/24V transformers, considering wiring transformer primaries in series will split voltage and in parallel will split current.



APPLICATION REQUIREMENTS

Installation Conditions

- Series 1000/S-X units may be installed in indoor or outdoor conditions up to IP67 or NEMA 4X



WARNING

Series 1000-X units are not rated for hazardous environments and caution should be taken to avoid flammable and explosive environments.

- Manual override operation and maintenance tasks should be taken into consideration when installing units.
- Ambient temperature should be within -22°F to +140°F.

Medium/Radiant Heat

- Care should be taken to prevent the heat of the working medium from raising the actuator above its rated ambient temperature limits.
- When the temperature of the working medium exceeds the actuator's rated temperature limits, a thermal coupling shall be installed to reduce heat transfer between the medium and the actuator.



WARNING

Medium temperatures above 175°F require the use of bracket and thermal isolating coupling in lieu of direct mounting to valve.



## APPLICATION REQUIREMENTS

### Conduit and Cable Installation

- Refer to Figure 1.1 and 1.2 when connecting conduit to Series 1000-X actuators.
- Conduit entries are ½" NPT. All entry fittings should be sealed watertight.
- Best practice when connecting conduit to Series 1000/S-X actuators is to run the conduit from below the actuator upward to prevent condensation from conduit working into the actuator; as shown in Figure 1.2.

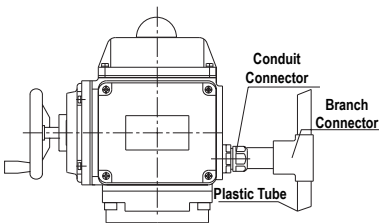


Figure 1.1

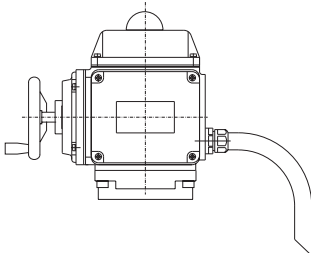
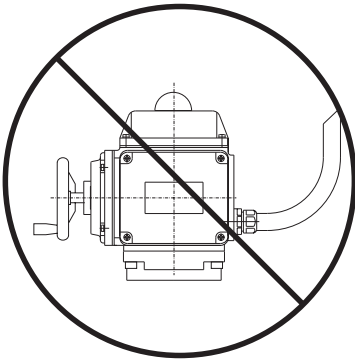


Figure 1.2

### Conduit and Cable Installation (Cont.)

- If actuator must be installed below conduit, a drip loop or drain should be provided to allow any water to exit the piping.
- Refer to Figure 2 for installation of cable directly into unit without the use of conduit.

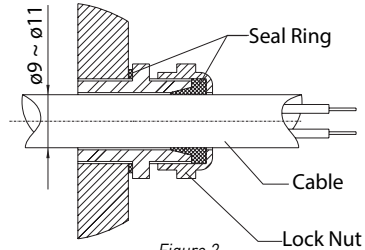


Figure 2

- The outer diameter of the cable shall be Ø9mm- Ø11mm.
- Use of cable smaller than specified may allow water to enter the unit and damage the electronics.
- When possible, power wiring and signal wiring should be routed through separate conduit entries; all units have two conduit entries.

### Electrical Disconnect



#### WARNING

Power must be removed from actuator using manual override pushbutton (or disconnect/circuit breaker for the 1005/S-X, 24VAC units, or units with LB controllers) before manual operation. If manual operation is attempted with power connected actuator handwheel or crank may rotate and cause personnel injury.

For 1005/S-X, 24VAC actuators, or actuators with LB controllers a disconnect or circuit breaker on the actuator power supply should be installed conveniently close to each actuator if it is to be manually operated frequently. If these units are manually operated without removing power the controller must be reset with Switch A to resume correct operation.

## MOUNTING ON A VALVE

### Installation of Actuator to Valve

1. NOTE: Direct mounting the actuator removes the bracket and coupling from the mounting process, but the remainder of the process remains the same.
2. Rotate valve to fully closed position. Ensure that the valve rotates freely with no obstruction.
3. Using the proper bolts attach the bracket to the valve – tighten only loosely.
4. Apply grease or anti-seize to the valve shaft and place the coupling onto the valve stem.
5. Using the manual override handle or handwheel, rotate the actuator to the fully closed position so that the position indicator displays "SHUT".
6. Apply grease or anti-seize to the coupling at the actuator interface.
7. Place the actuator onto the bracket, aligning the coupling drive and actuator.
8. Attach the bracket with proper bolts and tighten all bolts. If bolt holes are not aligned, but within

5° alignment, rotate actuator handwheel to move actuator into alignment.

9. Drive the actuator using the manual crank or handwheel and confirm that the valve rotates without obstruction. Ensure the valve is fully open as the actuator rotates to the full open position

### Mounting Tips

- If using your own bracket or one provided by third party supplier, ensure that the materials provided are manufactured professionally and meet the requirements of Figure 3.
- The coupling valve and actuator drive ends must be absolutely coaxial to prevent damage to actuator.
- Poor locating of bolt holes in the bracket may cause improper indexing of the valve and actuator, preventing the actuator from fully opening or closing the valve.
- Only tighten bolts after the actuator, bracket, and valve have been properly aligned.

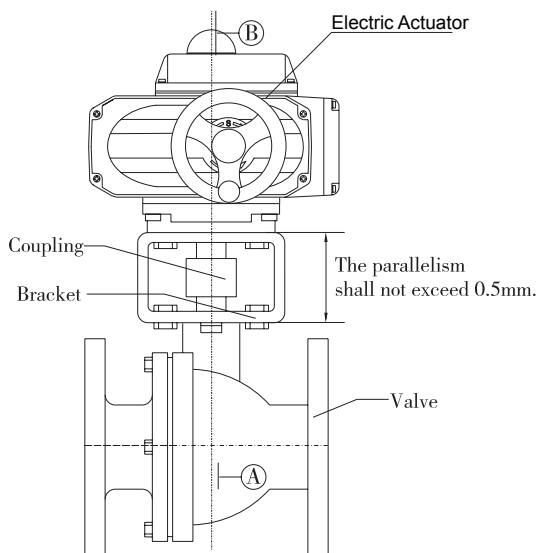


Figure 3

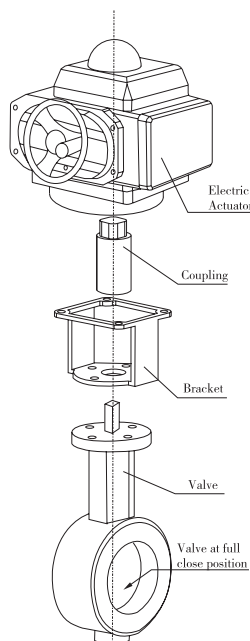


Figure 4

## ACTUATOR CONTROLLERS

Each modulating service actuator is equipped with an adjustable servo controller. The part number for the servo controller is printed on its decal.

### Switch Settings

- Switch A (SA) is used to set the desired operation action:
  - Position 1 – Direct Acting; 2V or 4mA correspond to Fully Closed
  - Position 2 – Setup Mode; used when setting Fully Closed and Fully Open end limits
  - Position 3 – Reverse Acting; 10V or 20mA correspond to Fully Closed
- Switch B (SB) is used to set the desired fail position of the actuator when control signal is lost (fail to position for loss of control signal only, not power loss):
  - Position 1 – Actuator moves to Fully Open with loss of control signal
  - Position 2 – Actuator stays put with loss of control signal
  - Position 3 – Actuator moves to Fully Closed with loss of control signal
- Switch C (SC) is used to set the desired control signal type:
  - 2-10V – Actuator position is driven by an analog 2-10V DC signal
  - 4-20mA – Actuator position is driven by an analog 4-20mA signal
  - 1005S-X actuator servo controllers do not have Switch C; control signal type must be specified at time of order.
- Dead Band (DB) is used to set the dead band of the actuator:
  - All control packs are factor set at around 3% dead band
  - Turn switch clockwise to increase dead band up to 5%; an increased dead band correlates to a larger difference between desired set point and actual position before actuator movement will occur.
  - Turn switch counterclockwise to decrease dead band down to 0.5%; a decreased dead band correlates to a smaller difference between desired set point and actual position before actuator movement will occur.

### Buttons

- Open – When Switch A (SA) is in position 2 the Open button may be used to drive the actuator in the Open direction.
- Shut – When Switch A (SA) is in position 2 the Shut button may be used to drive the actuator in the Closed direction.
- Set- When pressed simultaneously with either the Open or Shut button sets their respective end of travel limits.

### LED Indicators

- LED #1 (L1) – A green LED that is illuminated when power is present on power input terminals.
- LED #2 (L2) – A red LED that is illuminated when there is no control signal or the polarity is reversed. LED #2 illuminates briefly when end of travel limits are set.
- LED #3 (L3) – A red LED that is illuminated when the potentiometer is not calibrated with actuator.
- LED #4 (L4) – A red Led that illuminates when the actuator encounters an over-torque condition – either improperly set mechanical limits, valve binding, or debris preventing valve travel

### Controller Table

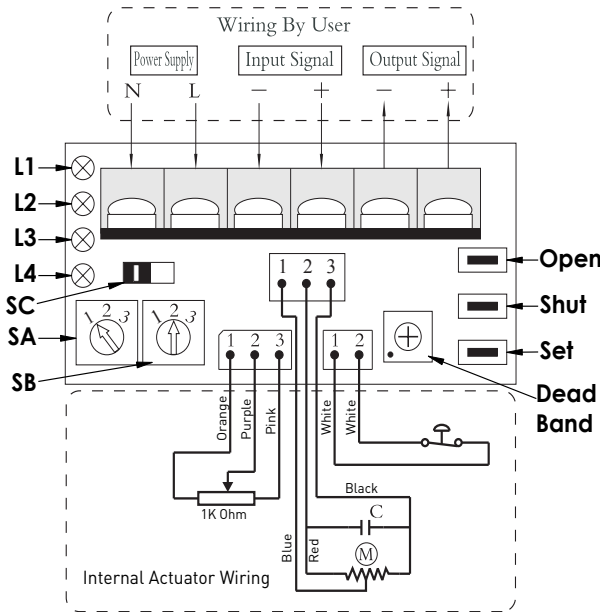
The part number for the servo controller is printed on its decal. The serial number of the controller is etched on its side. The table below shows each actuator's appropriate controller:

POWER	24VAC		110VAC/220VAC				
CONTROL	2-20VDC	4-20mA	2-20VDC	4-20mA			
1005S-X	SF-ZB-2-24VAC	SF-ZB-4-24VAC	SF-ZB-2	SF-ZB-4			
1010S-X			SF-PB*				
1020S-X	SF-PB-24VAC						
1040S-X							
1060S-X	NA						
1100S-X							
1160S-X							
1250S-X							

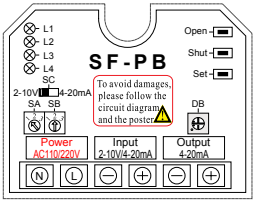
\*SF-LB Legacy Controller may be used

110/220 VAC CONTROLLERS

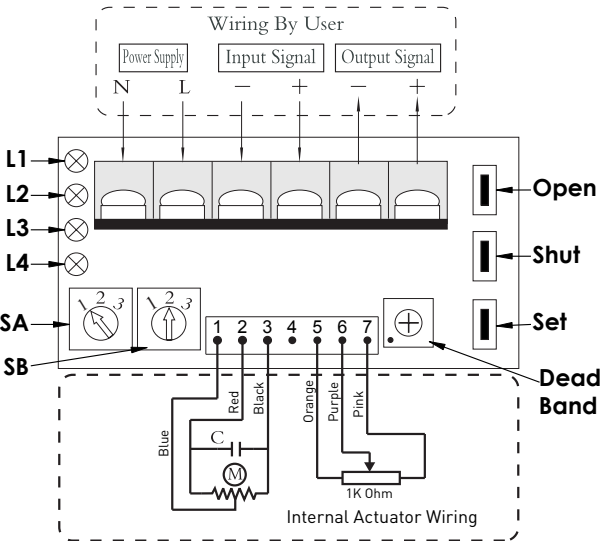
SF-PB for 1010/S-X thru 1250/S-X



Part Num. SF-PB

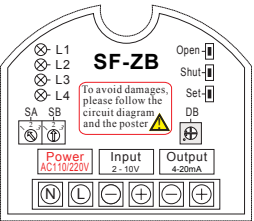


SF-ZB for 1005/S-X



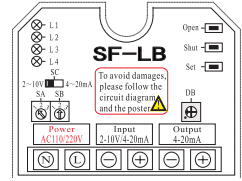
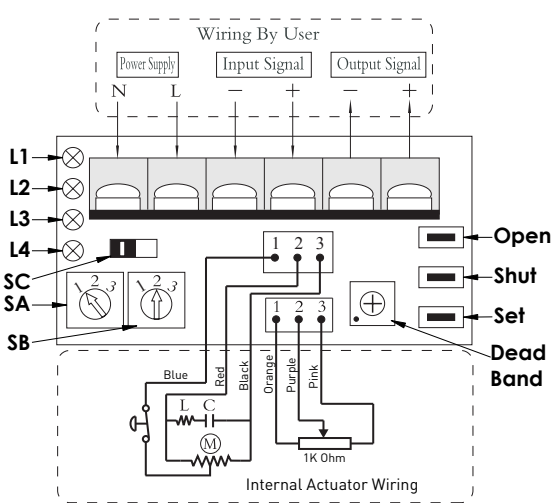
Part Num. SF-ZB-2 for 2-10VDC Input

Part Num. SF-ZB-4 for 4-20mA Input



## 110/220 VAC CONTROLLERS (Cont.)

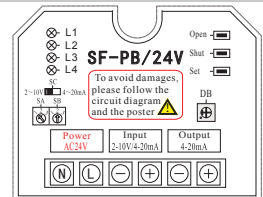
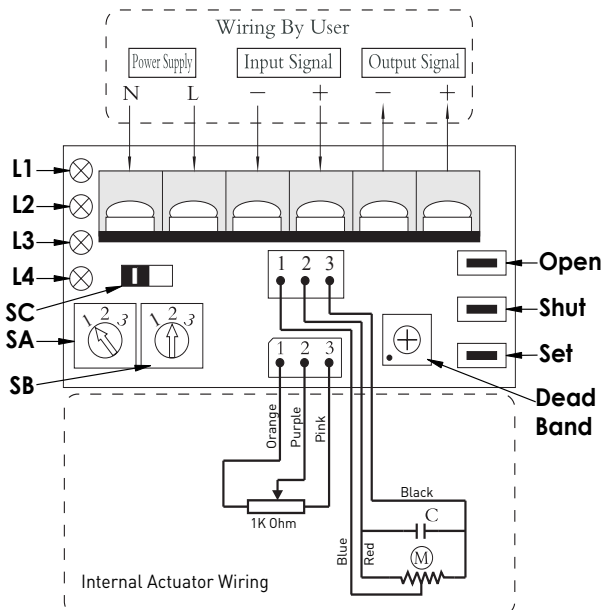
### SF-LB for 1010/S-X thru 1250/S-X



Part Num. SF-LB

## 24VAC CONTROLLERS

### SF-PB 24VAC for 1020/S-X thru 1040/S-X



Part Num. SF-PB-24VAC

**SF-ZB 24VAC for 1005/S-X thru 1010/S-X**



Part Num. SF-ZB-4-24VAC for 4-20mA Input

**SF-LB 24VAC for 1020/S-X thru 1040/S-X**



Part Num. SF-LB-4-24VAC for 4-20mA Input

## CONTROLLER ADJUSTMENT

### Setting Position Limits



#### NOTICE

The desired control signal must be applied at fully Open and Close during limit position setup

1. Determine control signal type that will be used and set Switch C (SC) to appropriate setting. (NA to 1005/S-X or SF-LB 24VAC controllers)
2. Using a small flat blade screwdriver set Switch A (SA) to position 2 to enter setup mode.
3. Press and hold the Shut button until actuator is in the desired fully closed position. Alternatively the actuator can be driven fully Closed using the manual override.
4. Once in the fully Closed position apply the desired fully closed control signal from the process controller. While pressing and holding the Set button, press the Shut button and hold both buttons down for 4 seconds. LED 2 (L2) will illuminate and then extinguish – release both buttons at the same time. Closed position of the valve is now set.
5. Press and hold the Open button until actuator is in the desired fully closed position. Alternatively the actuator can be driven fully Open using the manual override.
6. Once in the Fully Open position apply the desired fully open control signal from the process controller. While pressing and holding the Set button, press the Open button and hold both buttons down for 4 seconds. LED 2 (L2) will illuminate and then extinguish – release both buttons at the same time. Open position of the valve is now set.
7. Set Switch A (SA) to the desired operation action by switching to either 1 or 3.
8. Set Switch B (SB) to the desired fail position.
9. Increase/Decrease control signal to confirm proper operation and feedback
10. After observing operation, adjust dead band to desired characteristics

### Legacy Control Packs

Actuators produced before 2014 may utilize the legacy SF-LB servo controllers. Setup procedure is the same for SL-LB servo controllers with the following exceptions:

- **Switch A (SA) must be in position 2 or power removed from actuator to use manual override.**
- LED #4 (L4) will illuminate when the manual override has been used without removing power or placing Switch A (SA) into position 2.
- 24VAC controllers do not feature a Switch C (SC) to change control signal type.

## MECHANICAL ADJUSTMENT



#### WARNING

To prevent damage, the mechanical stops should never be used to limit the rotation of the actuator. Electrical limit switches are provided to set travel limits. Please refer to section above to set travel limit.

1. Using the manual override handle or handwheel, rotate the valve in the closed direction until the feedback indicates a current or voltage that correlates with fully closed as established in the controller adjustment section. Rotate handwheel or crank in close direction an additional 1/2 turn.
2. Loosen the lock-nut on the left side of the unit and rotate the adjusting screw clockwise using an Allen wrench until the screw comes into contact with the stopper, then back off 1/2 turn counterclockwise. Tighten lock nut to finish close mechanical stop adjustment.
3. Repeat steps 1-2 for the open direction.

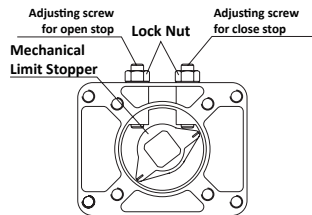


Figure 6

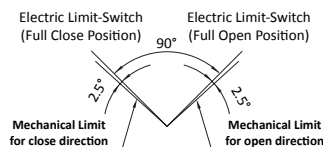


Figure 7

## OPERATION TEST

1. Connect wiring per the control circuit diagram – located in the terminal cover lid.
2. Verify that the valve rotates to the closed position by observing the dome indicator points to the red zero “shut”.
3. Verify that the valve rotates to the open position by observing the dome indicator points to the yellow zero “open”.
4. After all adjustments mentioned above, check the alignment of the dome indicator scale and pointer. If the pointer is not aligned properly on open and closed position adjust as needed by loosening the dome lock screw and re-tightening.

## MAINTENANCE AND SERVICE

- All actuators utilize high grade molybdenum based grease for their gears. No lubrication or periodic maintenance is required.
- If actuators are rarely cycled, periodic rotation operation should be scheduled to check if abnormal conditions are present.

## TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	REMEDY
Actuator fails to operate	Power is not connected	Connect power or replace circuit breaker
	Manual/Auto pushbutton is not engaged	Press manual/auto pushbutton on unit to engage power
	Voltage is too low	Check and correct voltage
	The actuator is in thermal protection mode due to over torque situation, or ambient temperature is too high	Remove over torque conditions. Check valve to ensure manual movement without sticking. Cool down ambient temperature. Ensure that mechanical limits are not keeping actuator from reaching electrical limits.
	Defective capacitor	Contact VSI
Actuator does not feedback for correct position	Potentiometer is not calibrated with actuator	Contact VSI
	Defective controller	Replace controller
Motor continues to operate after reaching control setpoint	Potentiometer is not calibrated with actuator	Contact VSI
	Control signal does not meet requirements	Confirm control signal polarity and range
	Controller improperly set up	Readjust the controller according to instructions
	Mechanical limit is out of adjustment	Readjust the mechanical limits according to instructions
Water present inside of actuator	Inlet power cables are not properly installed per instructions	Recheck conduit connections
	The dome indicator lens is broken	Contact VSI
	Housing screws are not tightened and sealed	Tighten housing screws
	Condensation heater not working or not connected	Check heater connections or Contact VSI



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