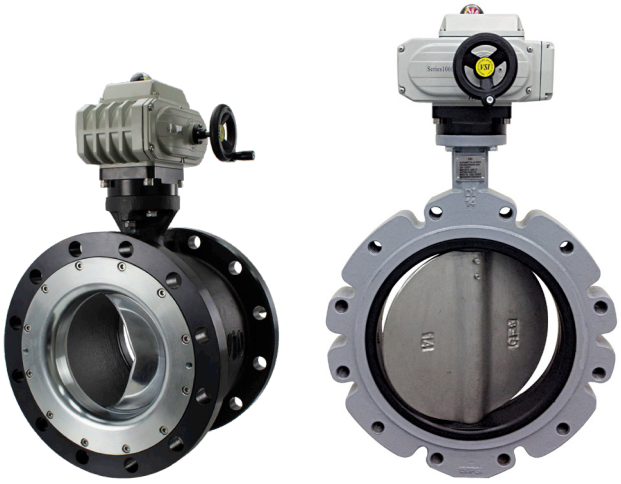
VSI

SERIES 1000-X
INDUSTRIAL ELECTRIC VALVE ACTUATORS

DOC-00000111(A)
MAR 2022



Implementations

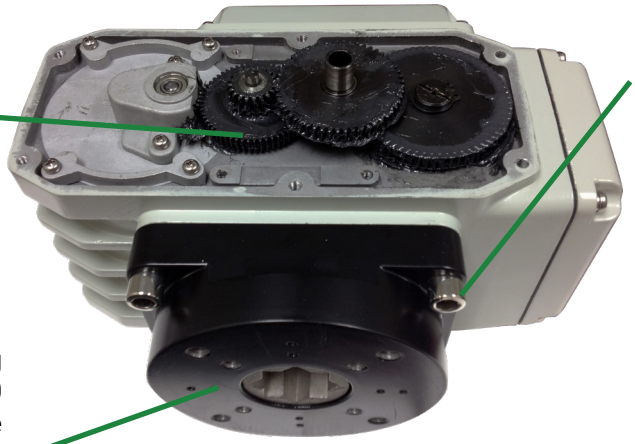
The Series 1000-X actuator is designed to be the most robust, space efficient, and easy to install package possible. The compact enclosure minimizes interference problems common in modern piping and control rooms. The actuator base conforms to international standards, and female drive allows the direct mounting on most valves without expensive and space hogging custom brackets. The heavy die cast aluminum alloy housing with large cooling fins ensure a life span that will exceed that of most valves.

An Actuator For Every Application

With 8 unit sizes from 443inlbs all the way to 22,127inlbs the Series 1000-X is the perfect solution to most valve actuation applications or other automation such as dampers. Everything from 1/4" ball valves all the way to 24" or larger butterfly valves can easily be automated with the Series 1000-X. The NEMA 4X housing can be used in control rooms or exposed to harsh sunlight and driving rain on building rooftops. Infrequently operated or typical isolation valves can use the economical open/close units while flow control applications operating at duty cycles of up to 80% are easily handled with the servo controlled modulating option.

Every application is different, and VSI or your authorized reseller are here to help you with an actuator to fit your needs. The Series 1000-X is available with simple options such as auxiliary limit switches all the way to project specific accommodations such as local controls, prewired cable connectors, battery backups, or special linkages for installations such as 3-way butterfly valves. We can help you find your Valve Solution.

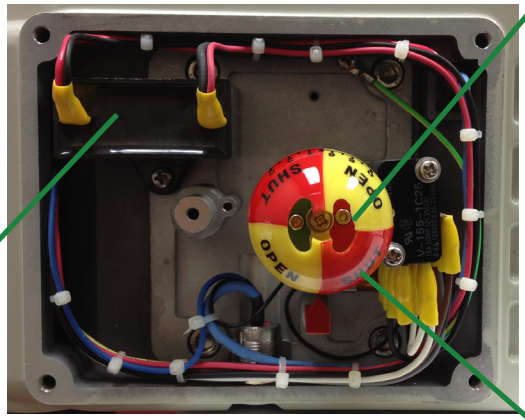
Valve Solutions, Inc
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com



DURABLE DRIVE GEARS
The alloy steel spur gears and bronze worm gear are permanently lubricated and fully supported by bearings and bushings, designed to outlive the life of any attached valve

ISO 5211 MOUNTING
Each unit has multiple mounting patterns, each conforming to ISO 5211. This, combined with the female drive allows for the direct mounting on a wide variety of valves. Adapters are available for common valve shafts

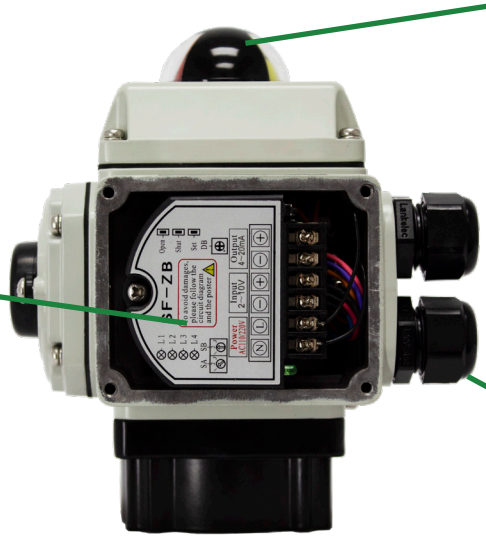
CORROSION RESISTANT
Along with all stainless external hardware, the entire enclosure is polyester powder painted to ensure long life in extreme environments



EASY FIELD SETTING
Open/Close units feature an easy to adjust cam operated limit switch set. Two Allen screws are turned from above to adjust position of limit switches

POWERFUL MOTOR
The induction type motor and run capacitor are specifically designed for valve actuator service and tested to CSA C22.2 No 139-13. There are no brushes to wear out and the duty cycle is rated up to 80%

HIGH VISIBILITY INDICATOR
Designed to be seen at a distance, the red and yellow position indicator provides positive visual position indication of the valve and actuator



UNIQUE SERVO CONTROL
The Series 1000-X family of servo controllers for modulating service are fully self contained, replaceable without disturbing the installation of the actuator. By isolating the delicate control electronics in a fully potted enclosure it is protected from accidental moisture ingress and easily replaceable in the event of failure by power surge or other unforeseen circumstances.

EASY FIELD WIRING
Each unit features two threaded conduit entries, one for power and one for control wiring. The wiring for Open/Close units terminate in an easy to access terminal block. Modulating unit servo controllers connect to the actuator wiring with push-to-connect connectors.

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ON-OFF ROTARY ELECTRIC ACTUATOR FEATURES

Standard Design Features

Torque Output Range	443 in-lb to 22,127 in-lb
Housing	NEMA 4/4X and IP67 watertight, corrosion-resistant, powder coated, robust die cast aluminum
Mounting	ISO 5211 Standard mounting configurations
Electric Motors	120VAC, single phase, 60Hz totally enclosed, non-ventilated, high starting torque, reversible capacitor run induction type with Class F insulation
Thermal Overload Motor Protection	Automatically resetting thermal switch permanently embedded in the motor winding - trips when the maximum winding temperature is exceeded and resets once temperature normalizes
Auxiliary Limit Switches	2x SPDT limit switches for Open and Close travel limit - easily adjustable. Switches are cam operated, direct coupled to output for accurate positioning. Adjustment of standard auxiliary limit switches is tied to end of travel switch adjustment. Rated 15A/250VAC and 0.6A/125VDC. (3A/250VAC for 1005-X model)
Position Indicator	Mechanical dome type with high visibility red/yellow colored open/close indicator
Terminal Strip	Heavy duty clamp type with Phillips head screw down, refer to wiring diagram
Conduit Entries	Two separate 1/2" NPT, one for power and one for control signal. Shipped with removable cable gland adapters to prevent environmental damage during short term storage
Power Gears	Alloy steel spur gears drive an aluminum bronze worm sector gear anti-backdrive final stage.
No Motor Brake Required	The anti-backdrive worm gear prevents back driving, hunting, and eliminates the need for a motor brake.
Bearings	All drive gears are supported by ball bearings, high quality alloy steel sleeve bushings, and bronze sleeve bushings
Manual Override	All units shipped with an Allen Handle manual override. A declutchable hand-wheel is an available option on 1010-X to 1250-X units
Ambient Temperature Rating	-22^{0}F to +140^{0}F (-30^{0}C to +60^{0}C)
Internal Heater	Internal heater prevents condensation buildup inside actuator
Certifications and Approvals	CE, NEMA 4/4X, NRTL, CSA File 226201, CSA C22.2 and UL 429

Optional Features

220VAC	220VAC 50/60Hz Power Option for all units
24VAC	24VAC 50/60Hz Power Option for models 1005-X thru 1040-X
24VDC	24VDC Power Option for select models
Torque Switches	Adjustable torque limit switches for close direction of travel
Feedback Potentiometer	Option for 1000ohm passive feedback potentiometer
Auxiliary Limit Switches	4x SPDT limit switches for Open and Close travel limit - Independently adjust-able from end of travel limit switches
Handwheel Override	Declutchable handwheel override with speed handle (not available on 1005-X models)

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ON-OFF TECHNICAL SPECIFICATIONS

MODEL	1005-X	1005-XL	1010-X	1020-X	1040-X	1060-X	1100-X	1160-X	1250-X
Output Torque (in-lbs)	443	443	885	1,770	3,540	5,310	8,851	14,616	22,127
Output Torque (Nm)	50	50	100	200	400	600	1000	1600	2500
Duty Cycle[1]	80%	80%	80%	80%	80%	80%	70%	70%	70%
Travel Speed @ 60Hz (Sec)	17	21	25	25	25[2]	37	25	40	63
Motor Power (W)	10W	10W	25W	40W	90W[3]	90W	140W[4]	140W	140W
Max Current (Amp @110 VAC)	0.34	0.34	0.81	1.68	3.41	3.60	3.80	3.93	3.95
Run Current (Amp @110 VAC)	0.27	0.27	0.64	0.73	1.22	1.27	2.39	2.36	1.73
Max Current (Amp @220VAC)	0.28	0.28	0.47	0.78	1.78	1.87	2.12	2.16	2.20
Run Current (Amp @220VAC)	0.19	0.28	0.32	0.45	0.64	0.66	1.16	1.18	1.19
Max Current (Amp @24VAC)	2.08	2.08	3.12	5.30	7.25	N/A	N/A	N/A	N/A
Run Current (Amp @24VAC)	1.56	1.56	2.16	3.24	4.55	N/A	N/A	N/A	N/A
Run Current (Amp @ 24VDC)	-	-	2.0	-	-	N/A	N/A	N/A	N/A
Enclosure Rating	WATERTIGHT NEMA 4/4X, IP67								
Turning Angle	90^0 Adjustable ± 5^0								
Ambient Temperature	-22^0F to $+140^0$F (-30^0C to $+60^0$C)								
Ambient Humidity	≤ 95% Relative Humidity								
Insulating Resistance	100MΩ/250VDC for 24V Units, 100/MΩ/500VDC for 110/220V Units								
Weight (lb)[2]	6.4	6.6	10	21	22	22	37	41	42
Weight (kg)	2.9	3.0	4.5	9.5	10	10	17	18.5	19

1. Duty cycle of 24VDC units are 70%
2. Run time of 1040-X 24VAC is 37 seconds
3. Motor power of 1040-X 24VAC is 40W
4. Motor power of 1100-X 110VAC is 120W

* Refer to the IOM for additional information

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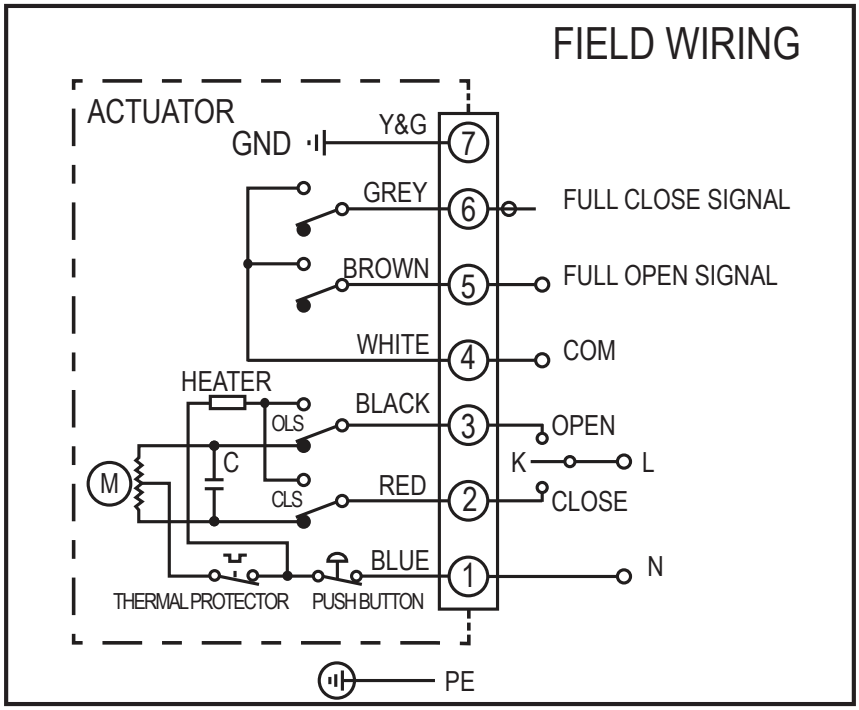
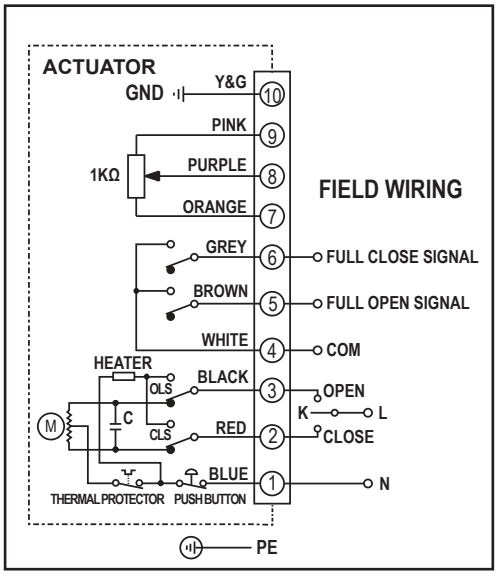
ON-OFF WIRING DIAGRAMS

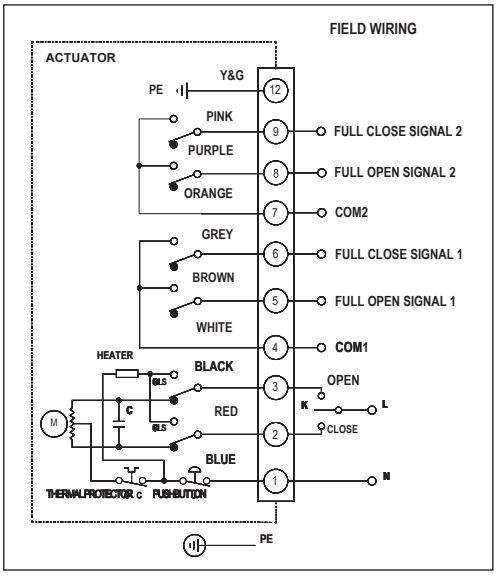
STANDARD EQUIPMENT



WITH POTENTIOMETER OPTION



WITH EXTRA SWITCH OPTION



1. Pushbutton disconnect not available on 1005-X or 24VAC models
2. Capacitor not present in 24VDC models

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MODULATING ROTARY ELECTRIC ACTUATOR FEATURES

Standard Design Features

Servo Control Module	Direct analog control input 4-20mA or 2-10VDC to controller for position control. Analog output of 4-20mA. Signals are reversible for direct or reverse acting
Torque Output Range	443 in-lb to 22,127 in-lb
Housing	NEMA 4/4X and IP67 watertight, corrosion-resistant, powder coated, robust die cast aluminum
Mounting	ISO 5211 Standard mounting configurations
Electric Motors	120VAC, single phase, 60Hz totally enclosed, non-ventilated, high starting torque, reversible capacitor run induction type with Class F insulation
Thermal Overload Motor Protection	Automatically resetting thermal switch permanently embedded in the motor winding - trips when the maximum winding temperature is exceeded and resets once temperature normalizes
Resolution	80 steps (0.2mA/1.1^0 for 4-20mA) or 200 steps (0.04VDC/0.5^0 for 2-10VDC) through 90^0 travel
Power at Rest	2VA
Position Indicator	Mechanical dome type with high visibility red/yellow colored open/close indicator
Control Pack	Refer to control pack information for details
Conduit Entries	Two separate 1/2" NPT, one for power and one for control signal. Shipped with removable cable gland adapters to prevent environmental damage during short term storage
Power Gears	Alloy steel spur gears drive an aluminum bronze worm sector gear anti-backdrive final stage.
No Motor Brake Required	The anti-backdrive worm gear prevents back driving, hunting, and eliminates the need for a motor brake.
Bearings	All drive gears are supported by ball bearings, high quality alloy steel sleeve bushings, and bronze sleeve bushings
Manual Override	All units shipped with an Allen Handle manual override. A declutchable hand-wheel is an available option on 1010-X to 1250-X units
Ambient Temperature Rating	-22^{0}F to +140^{0}F (-30^{0}C to +60^{0}C)
Internal Heater	Internal heater prevents condensation buildup inside actuator
Certifications and Approvals	CE, NEMA 4/4X, NRTL, CSA File 226201, CSA C22.2 and UL 429

Optional Features

220VAC	220VAC 50/60Hz Power Option for all units
24VAC	24VAC 50/60Hz Power Option for models 1005-X thru 1040-X
24VDC	24VDC Power Option for select models
Torque Switches	Adjustable torque limit switches for close direction of travel
Auxiliary Limit Switches	2x SPDT limit switches for Open and Close travel limit
Handwheel Override	Declutchable handwheel override with speed handle (not available on 1005-X models)

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MODULATING TECHNICAL SPECIFICATIONS

MODEL	1005/S-X	1005/S-XL	1010/S-X	1020/S-X	1040/S-X	1060/S-X	1100/S-X	1160/S-X	1250/S-X
Output Torque (in-lbs)	443	443	885	1,770	3,540	5,310	8,851	14,616	22,127
Output Torque (Nm)	50	50	100	200	400	600	1000	1600	2500
Duty Cycle[1]	80%	80%	80%	80%	80%	80%	70%	70%	70%
Travel Speed @ 60Hz (Sec)	17	21	25	25	25[2]	37	25	40	63
Motor Power (W)	10W	10W	25W	40W	90W[3]	90W	140W[4]	140W	140W
Max Current (Amp @110 VAC)	0.34	0.34	0.81	1.68	3.41	3.60	3.80	3.93	3.95
Run Current (Amp @110 VAC)	0.27	0.27	0.64	0.73	1.22	1.27	2.39	2.36	1.73
Max Current (Amp @220VAC)	0.28	0.28	0.47	0.78	1.78	1.87	2.12	2.16	2.20
Run Current (Amp @220VAC)	0.19	0.19	0.32	0.45	0.64	0.66	1.16	1.18	1.19
Max Current (Amp @24VAC)	2.08	2.08	3.12	5.30	8.40	N/A	N/A	N/A	N/A
Run Current (Amp @24VAC)	1.56	1.56	2.16	3.24	6.80	N/A	N/A	N/A	N/A
Run Current (Amp @ 24VDC)	-	-	2.0	-	-	N/A	N/A	N/A	N/A
Input Signal	(5)	(5)	Switchable 2-10VDC or 4-20mA[5]						
Output Signal	4-20mA								
Enclosure Rating	WATERTIGHT NEMA 4/4X								
Turning Angle	90^0 Adjustable ± 5^0								
Ambient Temperature	-22^0F to $+140^0$F (-30^0C to $+60^0$C)								
Ambient Humidity	≤ 95% Relative Humidity								
Insulating Resistance	100MΩ/250VDC for 24V Units, 100/MΩ/500VDC for 110/220V Units								
Weight (lb)	6.6	6.8	10	21	22	22	37	41	42
Weight (kg)	3	3.1	4.5	9.5	10	10	17	18.5	19

1. Duty cycle of 24VDC units are 70%
2. Run time of 1040-X 24VAC is 37 seconds
3. Motor power of 1040-X 24VAC is 40W
4. Motor power of 1100-X 110VAC is 120W
5. Series 1005/S-X and 1005/S-X models and all Series 1000/S-X 24VAC units have specific control packs for either 2-10VDC or 4-20mA control signals. Control signal must be specified at time of order.

* Refer to the IOM for additional information

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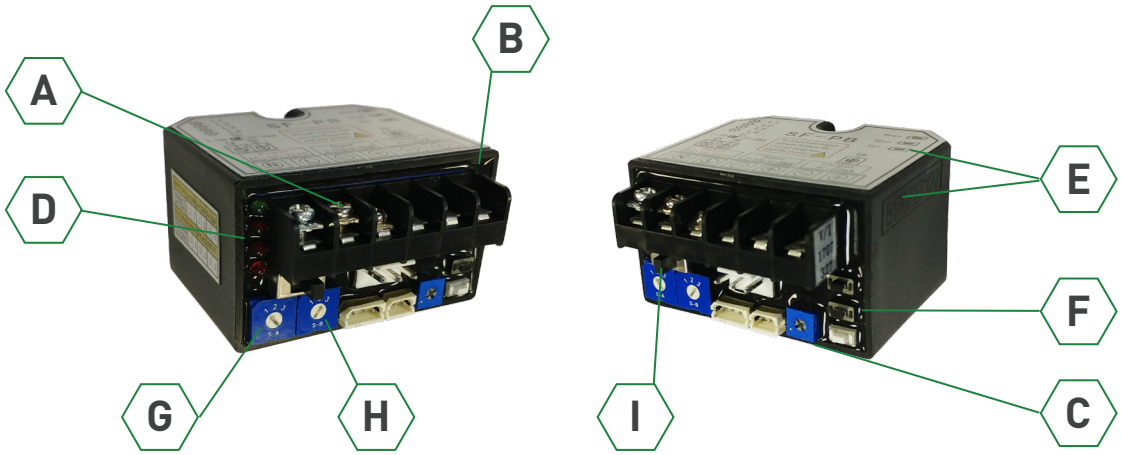
MODULATING SERVO CONTROLLERS

All modulating Series 1000/S-X units feature a removable/replaceable fully encapsulated digital servo control pack. The servo control pack vary by the actuator size and voltage, however all units feature:

A) Screw clamp terminals
B) Fully potted for vibration resistance and extended life
C) Adjustable control signal dead-band from 0.5% to 5%
D) Four diagnostic LED lights for troubleshooting
E) Permanent printed label and laser etched unique serial number
F) Setup buttons to move and program actuator
G) A switch, SA, to change the actuator to reverse or direct acting and enter setup mode
H) A switch, SB, to designate fail open or close on loss of control signal

Additionally the SF-PB, SF-PB-24VAC, and SF-ZC servo control pack features a switch, SC (I), to switch between acceptance of 4-20mA or 2-10VDC control signals.



Servo Controller Table

POWER	24VAC		110VAC/220VAC	
CONTROL	2-10VDC	4-20mA	2-10VDC	4-20mA
1005/S-X	SF-ZB-2-24VAC	SF-ZB-4-24VAC	SF-ZB-2	SF-ZB-4
1005/S-XL	SF-ZC-2-24VAC[1][3]	SF-ZC-4-24VAC[2][3]	SF-ZC	
1010/S-X			SF-PC[4]	
1020/S-X				
1040/S-X				
1060/S-X	NA			
1100/S-X				
1160/S-X				
1250/S-X				

1. Older 1010/S-X may utilize SF-ZB-2-24VAC
2. Older 1010/S-X may utilize SF-ZB-4-24VAC
3. Older 1020/S-X and 1040/S-X may utilize SF-PB-24VAC
4. Older units may utilize SF-PB

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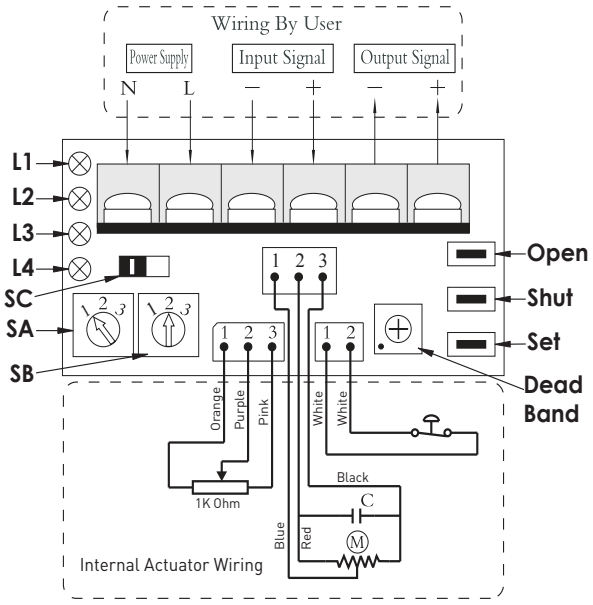
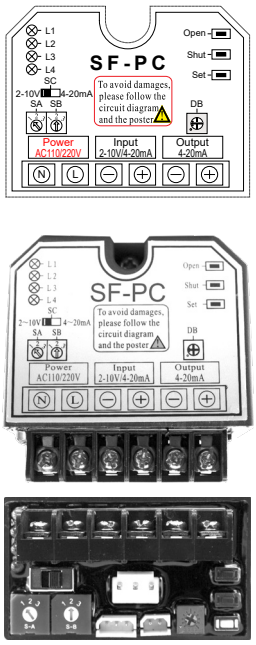
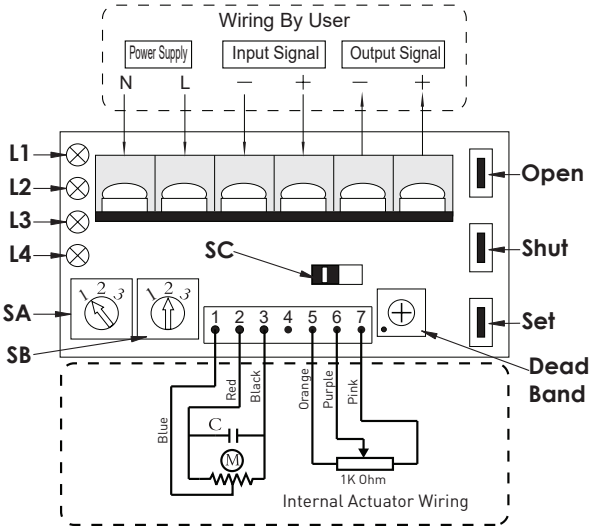
MODULATING SERVO CONTROLLERS (Cont.)

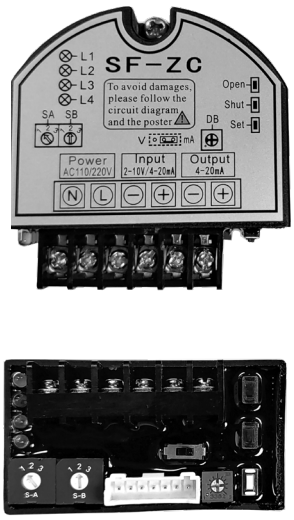
SF-PC for 1010/S-X thru 1250/S-X, 110VAC or 220VAC





SF-ZC for 1005/S-XL, 110VAC or 220VAC





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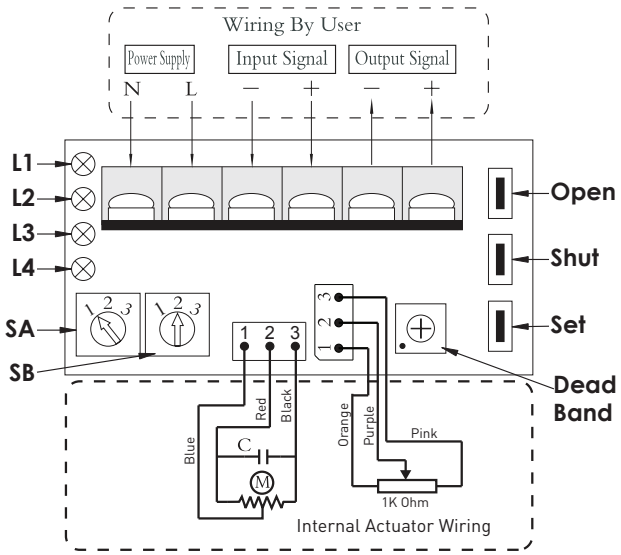
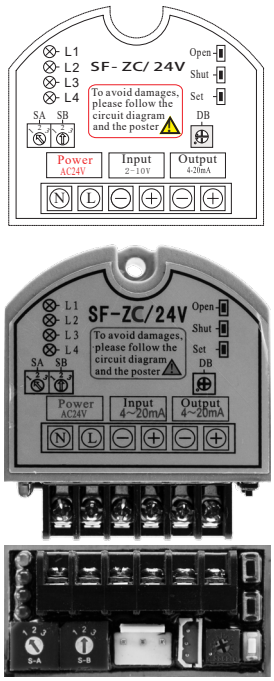
MODULATING SERVO CONTROLLERS (Cont.)

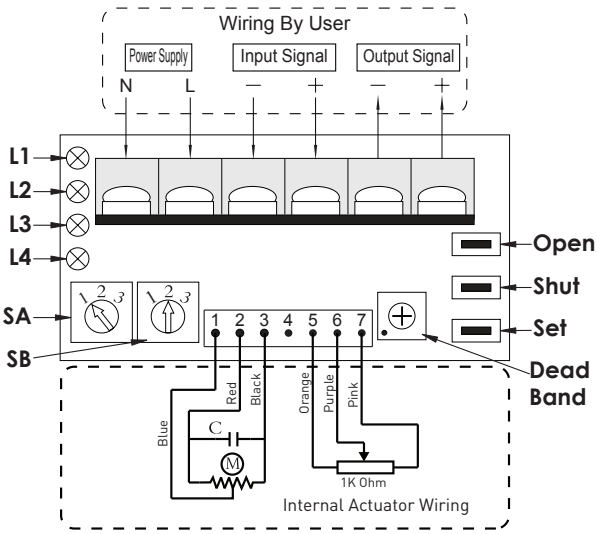
SF-ZC-24VAC, ALL 24VAC UNITS

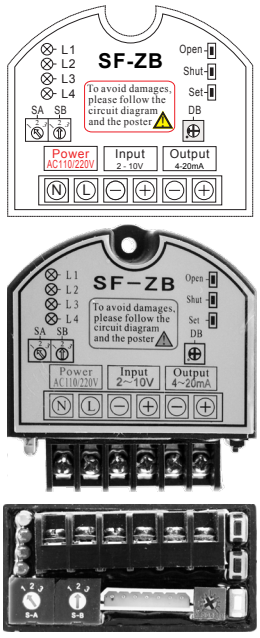




Part Num. SF-ZC-2-24VAC for 2-10VDC Input
Part Num. SF-ZC-4-24VAC for 4-20mA Input

SF-ZB for 1005/S-X, 110VAC or 220VAC





Part Num. SF-ZB-2 for 2-10VDC Input
Part Num. SF-ZB-4 for 4-20mA Input

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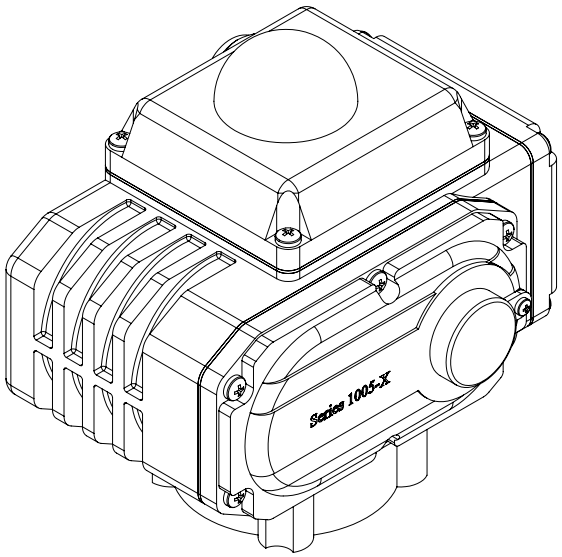
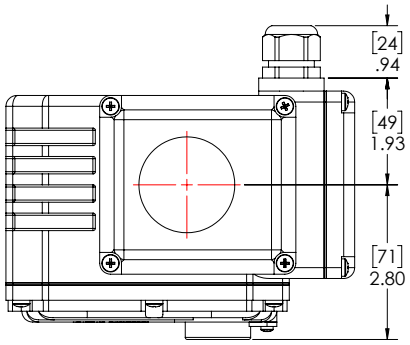
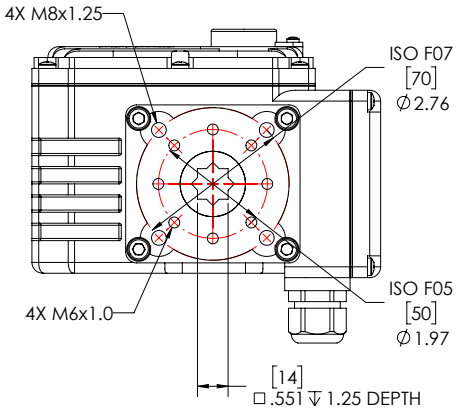
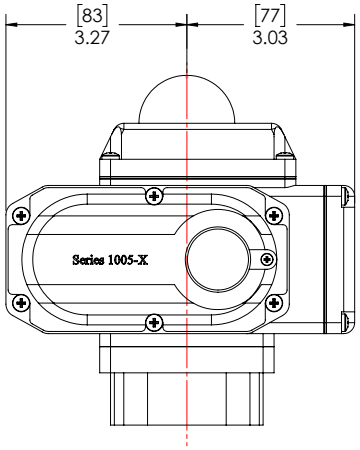
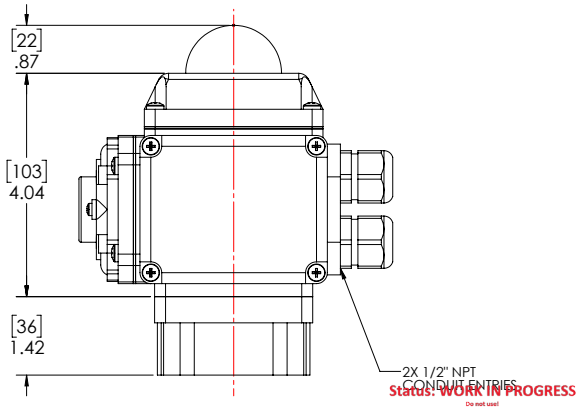
1005-X AND 1005/S-X DIMENSIONS











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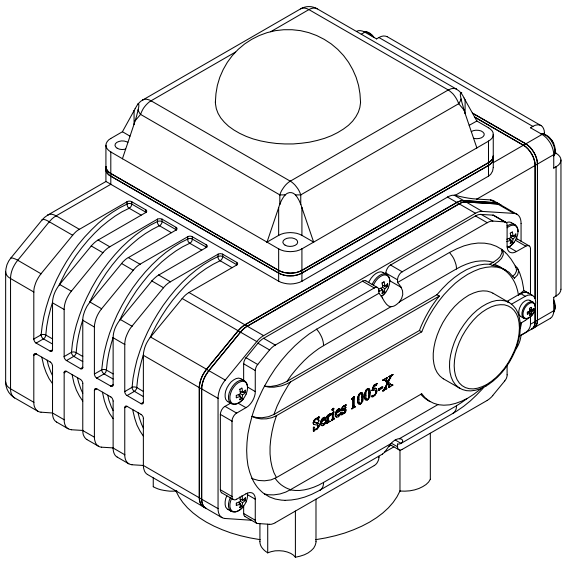
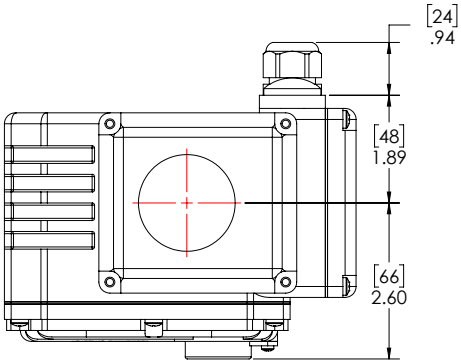
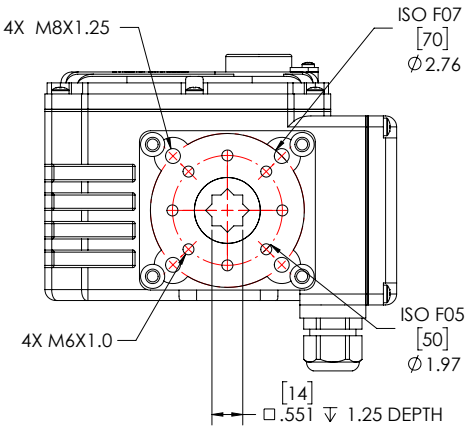
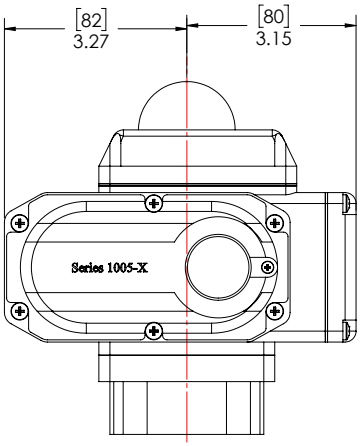
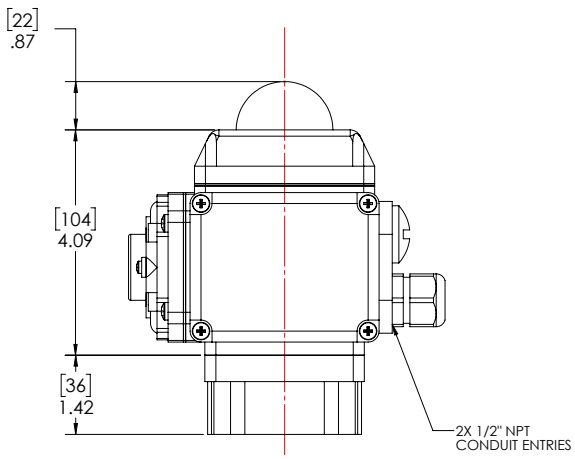
1005-XL AND 1005/S-XL DIMENSIONS





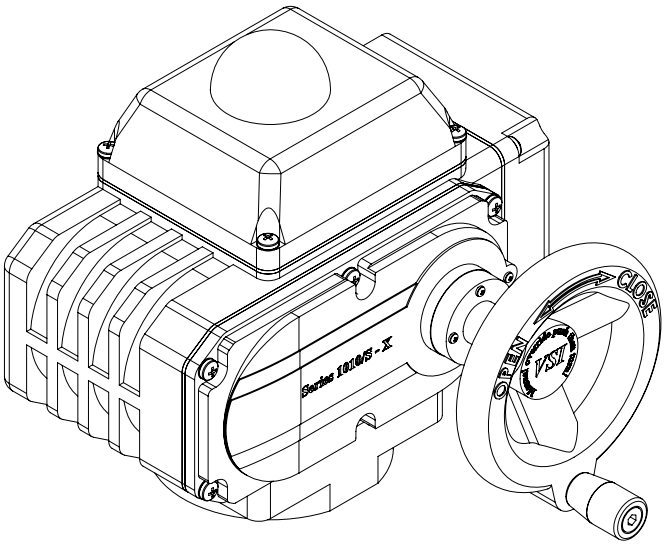


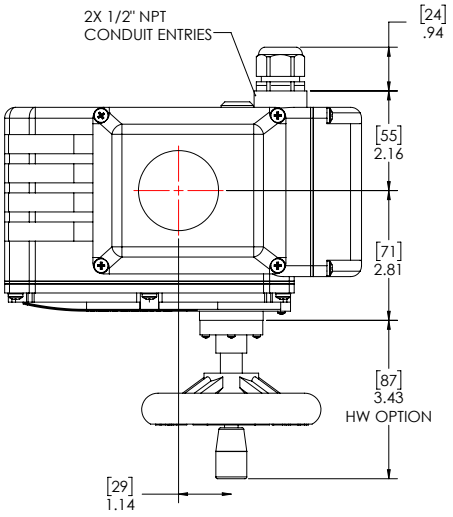


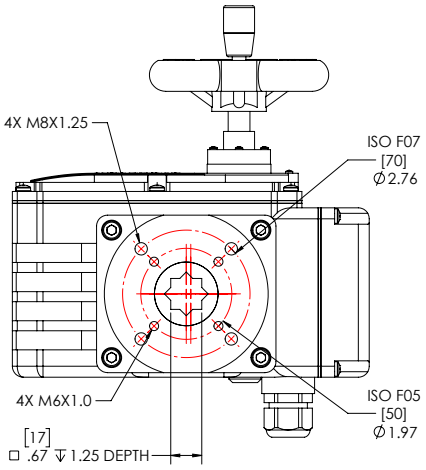


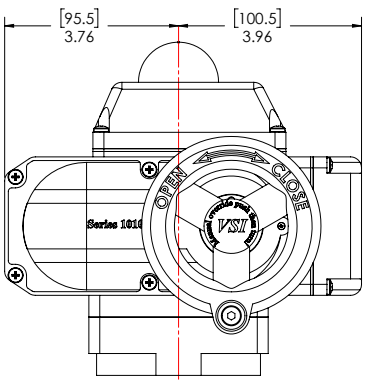
Valve Solutions, Inc
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com

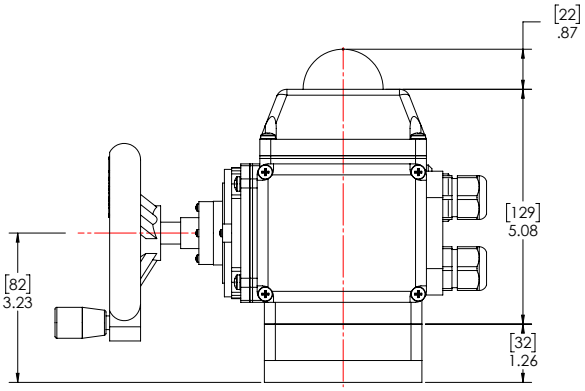
1010-X AND 1010/S-X DIMENSIONS











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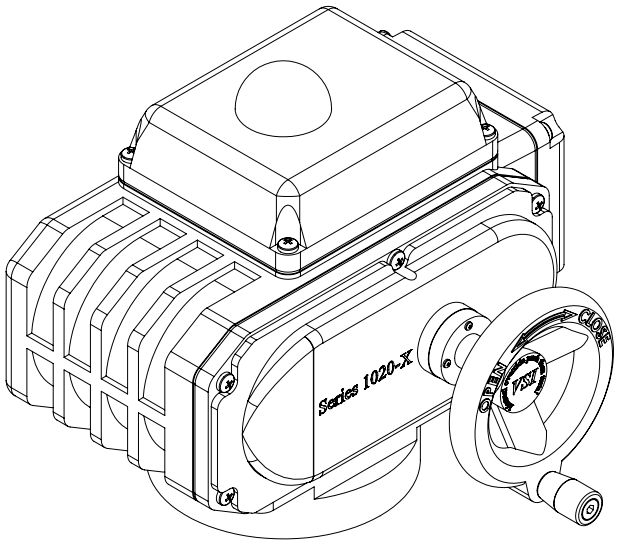
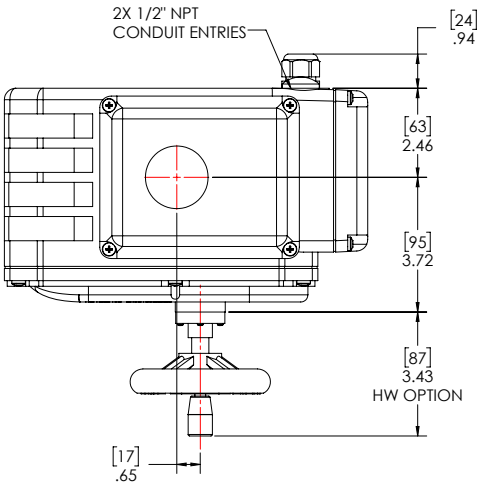
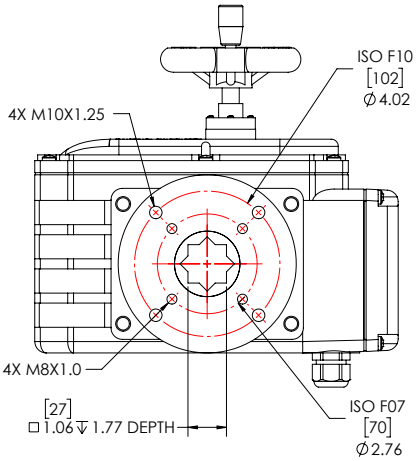
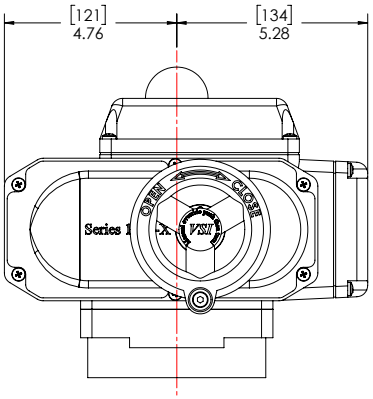
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com

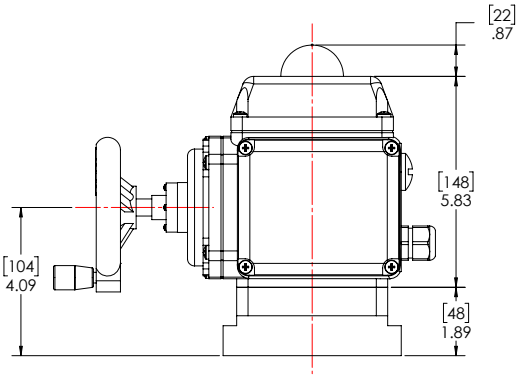
1020-X AND 1020/S-X DIMENSIONS
1040-X AND 1040/S-X DIMENSIONS
1060-X AND 1060/S-X DIMENSIONS





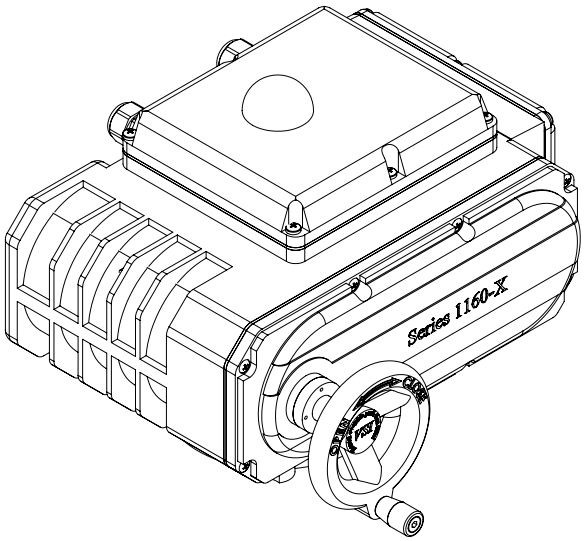


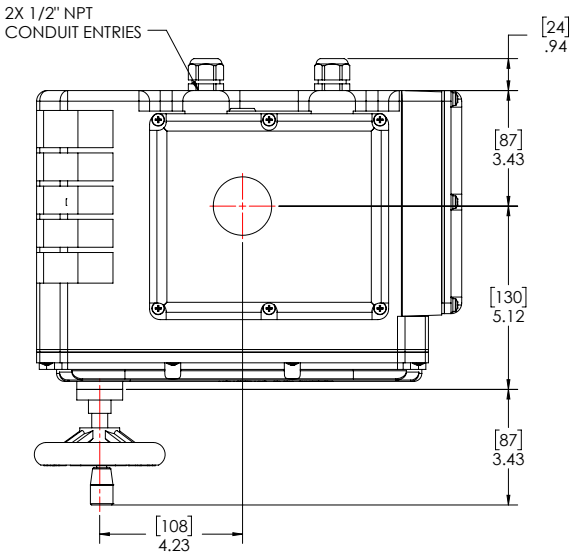


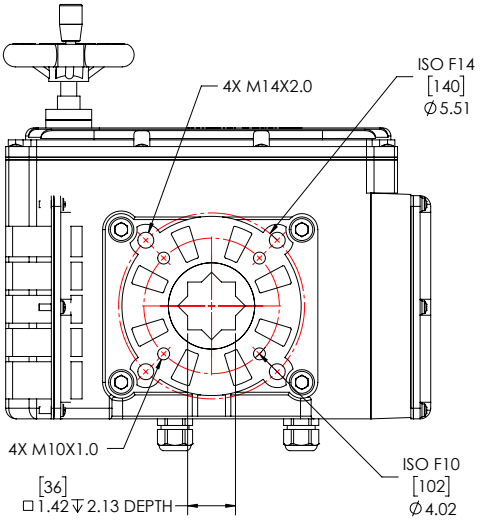


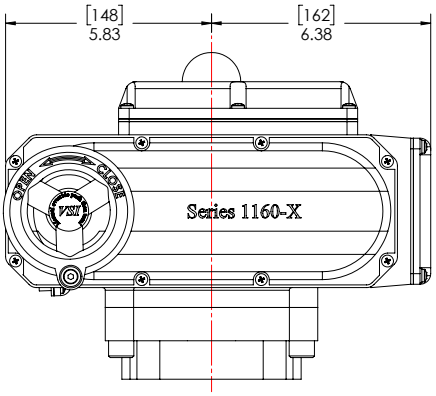
Valve Solutions, Inc
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com

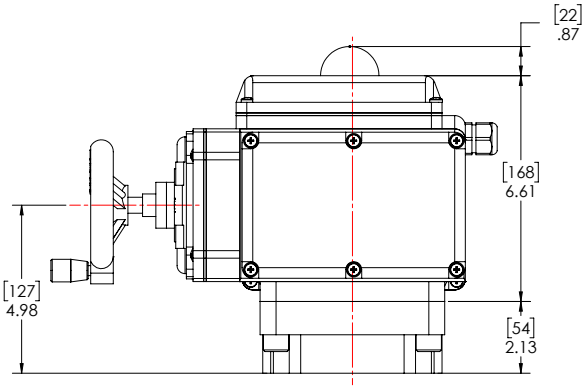
1100-X AND 1100/S-X DIMENSIONS
1160-X AND 1160/S-X DIMENSIONS
1250-X AND 1250/S-X DIMENSIONS











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Sample Specification

1. ELECTRIC ACTUATORS FOR QUARTER-TURN VALVES

1.1. This specification covers the design, manufacture, and testing of electric actuators for quarter turn valves.
1.2. Actuators shall be of the quarter turn type with a compact low profile design to minimize space requirements.
1.3. All actuators shall be designed to provide easy access for field wiring, setup, and inspection

2. ENCLOSURE

2.1. The enclosure shall be die-cast aluminum and anodized inside and out before painting and assembly
2.2. All actuator enclosures shall be coated with a heat cured polyester powder coating.
2.3. All access covers for wiring or adjustment shall be provided with captive cover bolts designed to stay coupled to the cover to prevent loss of hardware when the covers are removed.
2.4. The enclosure shall be rated NEMA 4 and 4X and IP67. All units shall be 100% tested by applying a positive internal pressure and submerging the entire actuator enclosure. Any bubbles shall deem the actuator defective
2.5. The actuator enclosure shall be supplied with a minimum of two threaded conduit entries, one for power wiring and one for control wiring. All conduit entries shall be fitted with a sealed plug during shipment and storage to ensure no moisture ingress before field wiring is installed.

3. MOTOR

3.1. The motor shall be of the single phase, permanent split capacitor induction type with Class F insulation. The motor shall be of the capacitor run type fitted with a capacitor designed specifically for motor control applications.
3.2. The motor shall have an automatic reset thermal overload protector embedded in the motor winding to prevent motor damage during stall conditions.
3.3. Motors shall be a minimum of 70% duty cycle, IEC S3-70%
3.4. Motor operating voltage shall be 120V-1-60Hz, 220V-1-60Hz, or 24V-1-60Hz as specified or required for the installation.

4. GEAR TRAIN

4.1. The actuator gear train shall consist of a set of alloy steel spur gears carried in bushings that drive a hardened alloy steel worm. The worm gear output shall be hard bronze alloy and shall be self-locking to prevent back-driving and eliminate the need for a motor brake.
4.2. The entire gear train shall be designed to withstand both locked rotor conditions or stalling of the connected valve with sufficient safety factor to prevent any actuator damage.
4.3. The actuator gear-train shall be equipped with adjustable mechanical stops. The stops shall positively stop the rotation of the actuator whether driven by the motor or the manual override. Mechanical stops shall be capable of being field adjusted without the need to disassemble any part of the actuator. A locking mechanism in the form of a jam nut shall be provided to prevent unintended changes in the mechanical stop adjustment.
4.4. The quarter turn actuator gearing shall be completely self contained. The use of secondary gearboxes for actuator outputs less than 22,000 inlbs shall not be accepted.

5. CONTROL OF OPEN/CLOSE APPLICATIONS

5.1. For open/close or floating applications the actuator shall be equipped with adjustable limit switches in the open and close directions, independently adjustable
5.2. Activation of limit switches shall be by a cam direct coupled to the output of the actuator. Use of gear sets, threaded rod, Oldham couplings, or any other mechanism other than direct coupling may impose hysteresis and shall not be accepted.
5.3. Each actuator shall be equipped with a SPDT limit switch for each direction wired in series with the motor winding to positively disconnect the motor from power at end of travel. An auxiliary SPDT limit switch shall be supplied in each direction for remote position indication.
5.4. All wiring shall terminate in a pre-wired terminal black for ease of access and field wiring

6. CONTROL OF MODULATING APPLICATIONS

6.1. For modulating applications the actuator shall be controlled by a servo controller. The controller shall be completely self contained and replaceable. The servo controller shall be housed in an ABS enclosure and fully potted. The use of exposed circuit boards shall not be allowed.
6.2. The servo controller shall accept either a 4-20mA or a 2-10VDC analog control command signal and output a 4-20mA analog feedback signal representing relative position of the actuator.
6.3. The servo controller shall feature a minimum of four diagnostic LED lights to indicate the presence of power, control signal out of range/missing, improper calibration, or an over-torque. The dead-band shall be adjustable by rotary dial.
6.4. The actuator shall be able to be configured by means of switches to be either direct acting or reverse acting.
6.5. The actuator shall be capable of being configured to fail in place, fail open, or fail close on loss of control signal.

7. MOUNTING

7.1. All actuators shall feature an integral mounting base complying with ISO 5211 to mount directly to valves without the need for any specialized brackets or couplings.

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T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com

Sample Specification (Cont.)

7.2. The output drive of each actuator shall be female. The output shall be in a star pattern to allow rotation of square stems at 45 degree increments.

6. OTHER FEATURES
   - 6.1. All units shall be capable of being driven by manual override. Override shall be by hex Allen key. Units over 500inlbs operating torque shall feature a declutchable handwheel option, where required by engineer.
   - 6.2. All units over 500inlbs for 110V or 220V shall feature a external mounted pushbutton to electrically isolate the actuator from moving for maintenance or manual override operation.
   - 6.3. All units shall have an integral self-regulating condensation heater
   - 6.4. Each actuator shall be equipped with a high visibility dome position indicator. The indicator shall have color flags red for shut and yellow for open to indicate at a distance the actuator position from any orientation.
   - 6.5. Each unit shall have a permanent data plate with the actuator model number, the power voltage rating, the current rating, and the actuator speed. Additionally each unit shall be laser etched with a unique traceable serial number.
7. OPTIONAL FEATURES
   - 7.1. Open/close units shall be capable of being supplied with a 1000 ohm passive potentiometer where required by the engineer.
   - 7.2. Open/close units shall be capable of being supplied with additional (total 4) auxiliary feedback switches where required by the engineer.
   - 7.3. Where required by the engineer, actuators shall be capable of being supplied with adjustable torque switches in the clockwise close direction.
   - 7.4. Modulating units shall be capable of being supplied with auxiliary feedback switches(2) where required by the engineer.
8. MANUFACTURER
   - 8.1. Quarter turn electric valve actuators shall be VSI Series 1000-X as manufactured by Valve Solutions, Inc., Alpharetta, GA USA or approved equal
   - 6.2. All valves shall be warranted by manufacturer for a minimum of 24 months.

WARRANTY

This limited warranty applies in the United States to products manufactured by VSI, LLC. VSI, LLC. warrants the product purchased from it or its authorized reseller to be free from defects in material and workmanship under normal use during the two year warranty period from the date of its purchase. Other products not manufactured by VSI, LLC. which are provided as part of an assembly may carry additional warranties from that manufacturer or supplier.

During the warranty period, VSI, LLC. will repair or replace defective parts of the product, or, at VSI, LLC. sole option, issue a credit for the original purchase price of the product. Repaired or replaced product will be warranted hereunder only for the remaining portion of the original warranty period. All exchanged products under this Limited Warranty will become the property of VSI, LLC. A proper Return Material Authorization (RMA) number will have to be obtained for all products to be returned under this Limited Warranty. Any claim under this Limited Warranty must include a description of the problem encountered and any relevant information that may assist VSI, LLC. in the replication or resolution of the problem.

This Limited Warranty is transferable during its term to the end user of the product. Any transfer shall not extend or alter the terms of this Limited Warranty.

This Limited Warranty extends only to products purchased from VSI, LLC. or its authorized reseller and does not extend to any product that has been damaged or rendered defective as a result of (a) modification, repair, alteration or improper installation by any person other than VSI, LLC. or its authorized representative; (b) unreasonable or improper use or storage, use beyond rated conditions, operation other than per VSI, LLC. or the manufacturer's instructions, or being otherwise subjected to improper maintenance, negligence or accident; or (c) any use of the product after purchaser has knowledge of any defect in the product.

The warranties provided above are in lieu of and exclude all other warranties, statutory, express or implied, including without limitation any warranty or merchantability or fitness for a particular purpose. VSI, LLC. expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited to the terms of this limited warranty.

VSI, LLC. warranty liability shall not exceed the original purchase price of the defective product. VSI, LLC. is not liable for any damages caused by the product or other products or the failure of the product or other products to perform, including any lost profits, lost savings, incidental or consequential damages. VSI, LLC. is not responsible for charges resulting from the removal and/or replacement of the product. VSI, LLC. is not liable for any claims made by third parties or by the purchaser for a third party. This limitation applies whether damages are sought, or a claim is made, under the Limited Warranty or as a tort claim, product liability claim, contract claim, or any other claim. This limitation cannot be waived by any person. This limitation of liability will be effective even if VSI, LLC. or its authorized representative has been advised by the purchaser of the possibility of such damages.

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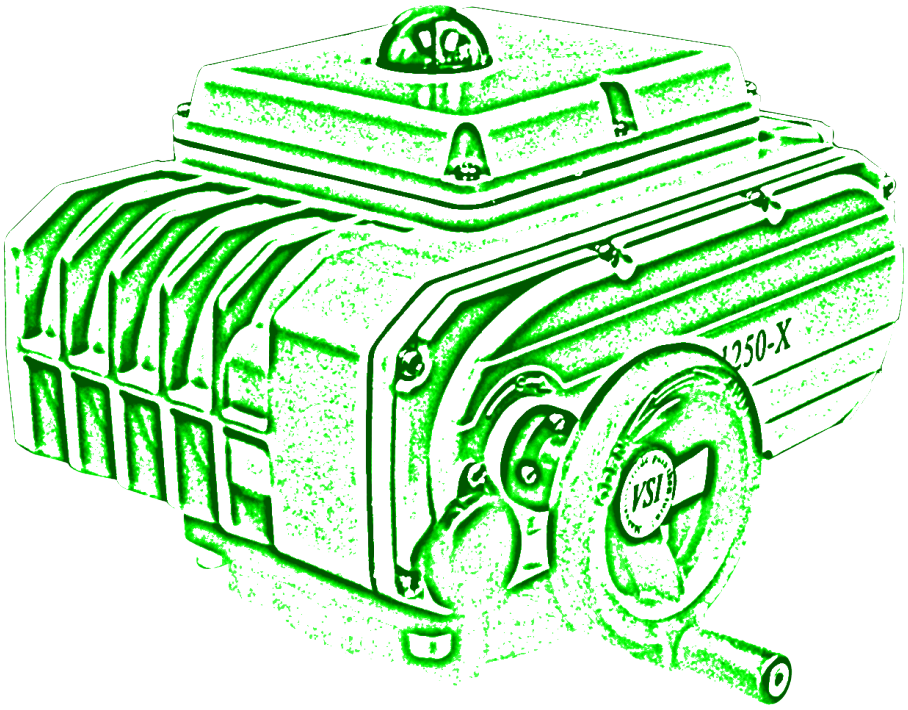
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com



Valve Solutions, Inc
tel: 1 (770) 740 0800
fax: 1 (770) 740 8777
email: sales@valvesolutions.com

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