

# "V" Ball Control Valve Product Range

## VSI Ball Valve Product Range B2...VB, B6...VB

Cv	Valve Nominal Size		Type		Suitable Actuators		
	Inches	DN [mm]	2-way NPT	Flange	Spring Return	Electronic Fail-Safe	Non-Spring Return
24	1	25	B2100VB-024		NF Series		
55	1½	40	B2150VB-055				
77	2	50	B2200VB-077		AF Series		
207	3	80		B6300VB-207			
350	4	100		B6400VB-350		GK Series	GM Series
507	6	150		B6600VB-507			



**2**  
YEAR  
WARRANTY

### Applications

- Water-side control of air handling apparatus in ventilation and air-conditioning systems
- Water/Steam control in heating systems

### Mode of Operation

The control valve is operated by an electronic actuator that responds to a standard voltage for on/off control, by a proportional VDC/4...20 mA, or 3-point control system. The actuator will then move the ball of the valve to the position dictated by the control signal thus change the flow.

### Product Features

Equal percentage of flow  
300:1 rangeability  
ANSI Leakage Class IV

### Actuator Specifications

Control type	On/Off, Floating Point, Proportional, 2-10 VDC Multi-Function Technology (MFT)
Manual override	GM, AM, SY, NF, AF, GK
Electrical connection	3 ft [1m] cable with ½" conduit fitting

### Valve Specifications

Service	chilled or hot water, (60% glycol) steam
Flow characteristic	equal percentage
Sizes	1" to 6"
Type of end fitting	NPT (1" to 2") flanged (3" to 6")

### Materials

Body	carbon steel
Stem	stainless steel
Ball	chrome plate stainless steel
Seats	teflon
Packing	spring loaded teflon

Pressure rating Up to 400 psig

Media temp range 400°F

### Maximum inlet pressure

Steam 250 psi

Maximum ΔP steam 100 psi

Maximum ΔP water 150 psi

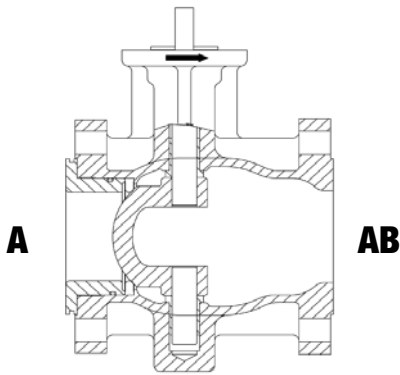
### GENERAL INFORMATION

- Carbon Steel or Stainless Steel 150/300 ANSI Rated Bodies
- Equal Percentage Flow Characteristic
- Dual Body rating on 1", 1½" & 2" (ANSI 150/300)
- ASME B16.10 Face to Face Dimensions
- ANSI Class IV Shut-off
- 250PSI 400 degree rated
- Field replaceable seat
- Maintenance free spring loaded packing

**NOTE:** Industrial ball valves have serviceable components similar to globe valves, proper maintenance of these parts will ensure longer in service life for the valves. The seats of these valves will require replacement at an interval consistent with the number of full cycles the valve has been operated, or as field condition dictates.

Ideal for replacing globe valves where high close off is required.

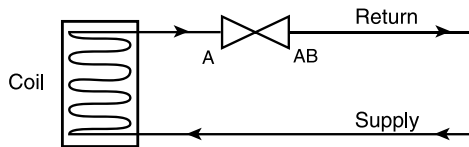
### FLOW PATTERN



### VS SERIES BALL VALVE PIPING DIAGRAMS

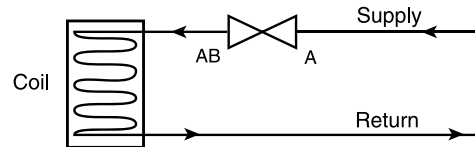
Water Application

#### 2-way Valve Piping Diagram



Steam Application

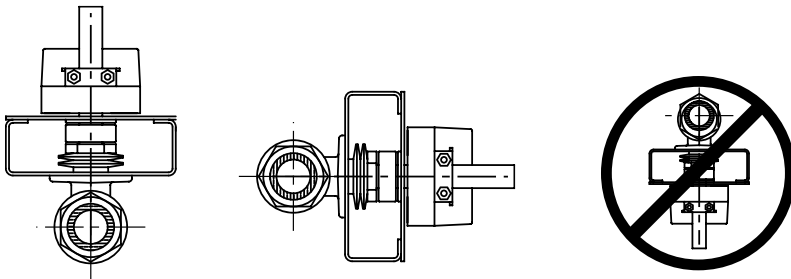
#### 2-way Valve Piping Diagram



### PIPING/MOUNTING ORIENTATION

Assembly can be mounted horizontally or vertically for water applications. For steam applications the valve can be mounted vertically but if mounted horizontally the valve must be 90° off center of the pipe.

Do not install with actuator below pipe.



Valve Size	Cv	Type	Model #	Line Size												
				1" Fp Cv	1¼" Fp Cv	1½" Fp Cv	2" Fp Cv	2½" Fp Cv	3" Fp Cv	4" Fp Cv	5" Fp Cv	6" Fp Cv	8" Fp Cv	10" Fp Cv		
1"	24	2-Way NPT	B2100VB-024	24	22.6	21.1	19.3	18.5								
1½"	55	2-Way NPT	B2150VD-055	-	-	55	50.4	46.3	43.9	41.7	-	-	-	-	-	-
2"	77	2-Way NPT	B2200VB-077				77	74.1	70.5	66.2	64.2	63				
3"	207	2-Way Flanged	B6300VB-027	-	-	-	-	-	207	191.3	177.2	168.9				
4"	350	2-Way Flanged	B6400VB-350							350	333	313.2				
6"	507	2-Way Flanged	B6600VB-507	-	-	-	-	-	-	-	-	507	491.5	475.5		

### GENERAL WIRING INSTRUCTIONS

**WARNING** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

**Always read the controller manufacturer's installation literature carefully before making any connections.** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

#### Transformer(s)

Typically actuators require a 24 VAC class 2 transformer and draw a maximum of 10 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC directive: 89/336/EEC
- Software class A: Mode of operation type 1
- Low voltage directive: 73/23/EEC

Typical transformer sizing		
Actuator Series	Voltage	Max. VA Per Actuator
AF	24	10
GK	24	20
NF	24	10
LF	24	6
GM	24	7
AM	24	6
NM	24	4
LM	24	3

**CAUTION** It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

#### Multiple actuators, one transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg. Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

#### Multiple actuators, multiple transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

#### Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with Belimo actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

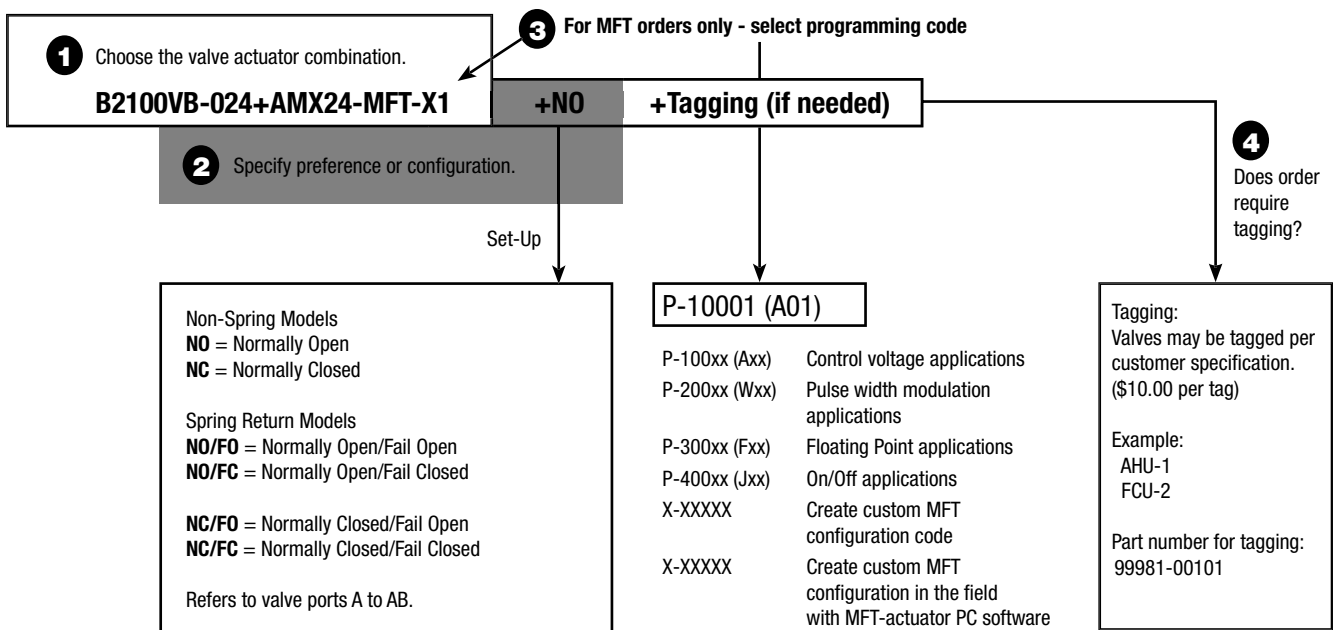
#### Wire length for actuator installation

Keep power wire runs below the lengths listed in the following tables. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator. See section 1 for specific transformer sizing information for the actuator selected.

Example: 3 actuators, 16 Ga wire  
 $350 \text{ Ft} \div 3 \text{ Actuators} = 117 \text{ Ft. Maximum wire run}$

<b>B2</b>	<b>100</b>	<b>VB</b>	<b>-024</b>	<b>AMX</b>	<b>24</b>	<b>-MFTX1</b>	
<b>Valve</b> B2 = 2-way NPT B6 = 2-way Flanged	<b>Valve Size</b> 25-50 = 1" to 2" 80-150 = 3" to 6" Flanged	<b>Industrial Construction/Material</b> VB = Chrome plated stainless steel "V" ball	<b>Cv</b>	<b>Actuator Type</b> Non-Spring Return AM... GM... SY... SY...P Mechanical Fail-Safe NF... AF... Electronic Fail-Safe... GK...	<b>Power Supply</b> 24 = 24 VAC/DC 120 = 120 VAC 230 = 230 VAC	<b>Control</b> -3-X1 = On/Off, Floating Point -MFTX1 = Multi-Function Technology -MFT95 = 0-135 Ω	-S = Built-in Auxiliary Switch

### ORDERING EXAMPLE



**5** Complete Ordering Example: **B2100VB-024+AMX24-MFT-X1+NO+A01**

# B2...VB Series, 2-Way, VBall Control Valve

## Carbon Steel Body, Hardened Chrome Plated, Stainless Steel Ball and Stem



- Fast quarter turn open or closed operation
- Stainless steel ball and stem
- Positive shut-off
- Two-piece body construction

### Application

- Water-side control of air handling apparatus in ventilation and air-conditioning system
- Water/Steam control in heating systems
- 300:1 rangeability

The dimensions and drilling of end flanges conform to the American cast iron flange standard, Class 150 (ANSI B16.1).

### Technical Data

Media	chilled or hot water, glycol, 250# steam
Flow characteristic	equal percentage
Action	90% rotation valve open CW, valve closed CCW
Sizes	1", 1½", 2"
Type of end fittings	NPT

### Materials:

Body	Carbon Steel
Ball	Stainless Steel with Hardened Chrome Plating
Seats	Teflon
Stem	Stainless Steel
Packing	Spring-loaded Teflon

Pressure rating	ANSI 300
Media temp. range	-22°F to 400°F (-30°C to 204°C)
Close-off pressure	150 psig @ 400°F
Maximum differential pressure (ΔP)	steam: 100psi water: 150psi

Cv	Valve Nominal Size		Type	Suitable Actuators		
	Inches	DN [mm]	2-way NPT	Spring	Non-Spring	
24	1"	25	B2100VB-024	NF Series	AM Series	SY Series
55	1½"	40	B2150VB-055			
77	2"	50	B2200VB-077	AF Series		



- Fast quarter turn open or closed operation
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- Two-piece body construction

### Application

- Water-side control of air handling apparatus in ventilation and air-conditioning system
- Water/Steam control in heating systems
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The dimensions and drilling of end flanges conform to the American cast iron flange standard, Class 150 (ANSI B16.1).

### Technical Data

Media	chilled or hot water, glycol, 250# steam
Flow characteristic	equal percentage
Action	90% rotation valve open CW, valve closed CCW
Sizes	3", 4", 6"
Type of end fittings	flanged

### Materials:

Body	Carbon Steel
Ball	Stainless Steel with Hardened Chrome Plating
Seats	Teflon
Stem	Stainless Steel
Packing	Spring-loaded Teflon

Pressure rating	ANSI 150
Media temp. range	-22°F to 400°F (-30°C to 204°C)
Close-off pressure	150 psig @ 400°F
Maximum differential pressure ( $\Delta P$ )	steam: 100psi water: 150psi

Cv	Valve Nominal Size		Type	Suitable Actuators			
	Inches	DN [mm]		2-way NPT	Spring	Electronic Fail-Safe	Non-Spring
207	3"	80	B6300VB-207	AF		AM Series	SY Series
350	4"	100	B6400VB-350		GK		
507	6"	150	B6600VB-507			GM	

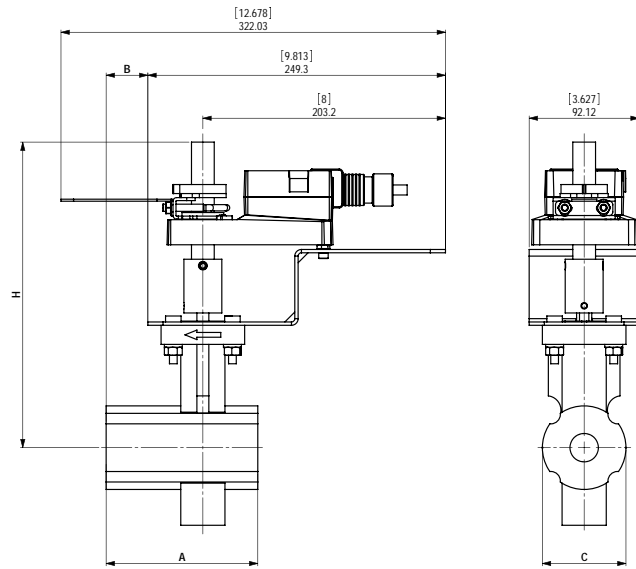
# AMB(X)24-3-X1

On/Off, Floating Point



Technical Data		AMB(X)24-3-X1
Control		on/off, floating point
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	0.2 W
Transformer sizing		5.5 VA (class 2 power source)
Electrical connection		½" conduit connector
AMB24-3-X1		3 ft, 18 GA plenum rated cable
Overload protection		electronic throughout 0° to 95° rotation
Input impedance		600 Ω
Angle of rotation		max 95°, adjustable with mechanical stop
Torque		180 in-lb [20 Nm]
Direction of rotation		reversible with  switch
Position indication		reflective visual indicator (snap-on)
Manual override		external push button
Running time		95 seconds, constant independent of load
Humidity		5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature		-22° F to 122° F [-30° C to 50° C]
Storage temperature		-40° F to 176° F [-40° C to 80° C]
Housing		NEMA type 2/IP54
Housing material		UL94-5VA
Agency listings		cULus according to UL 60730-1/-2-14, CAN/CSA C22.2 No. 24 certified, CE according to 73/23/EEC
Noise level		<45 db(A)
Servicing		maintenance free
Quality standard		ISO 9001

## Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	1.37	2.75	10.07
B2150VB-055	150	1½"	40	7.00	2.51	3.42	10.47
B2200VB-077	150	2"	50	7.00	2.51	3.93	11.14
B6300VB-207	150	3"	80	8.00	2.64	7.48	12.05



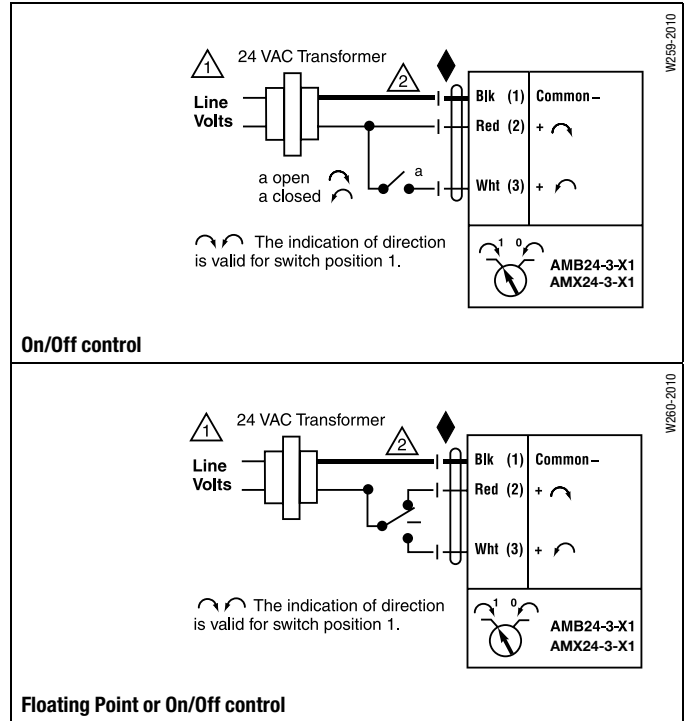
### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



#### Piping

The valve should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. Allow 6" for cover removal and 12" for complete actuator removal. The assembly can be mounted with the actuator vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

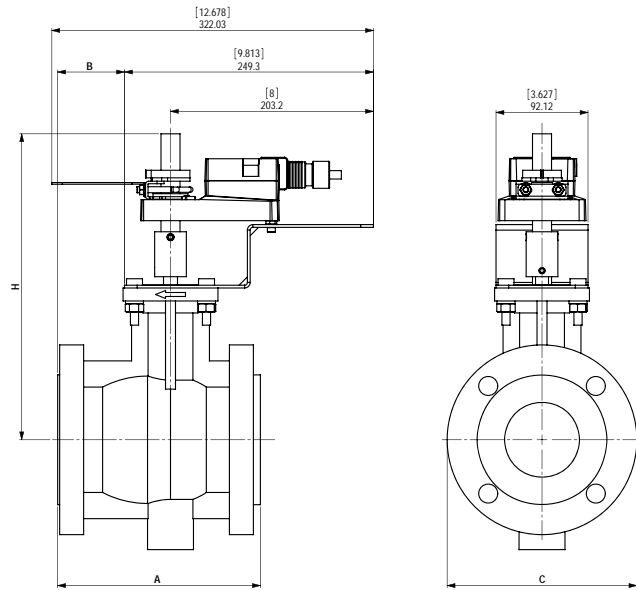
# AMX24-MFT-X1

Multi-Function Technology



Technical Data	AMX24-MFT-X1, AMX24-MFT95-X1
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4 W (1.25 W)
Transformer sizing	6 VA (class 2 power source)
Electrical connection	3 ft [1m] 10 ft [3m] 16 ft [5m] 18 GA plenum rated cable ½" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Input impedance	100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 750 Ω for PWM 1500 Ω for on/off and floating point
Feedback	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	max 95°, adjustable with mechanical stop electronically variable
Torque	180 in-lb [20 Nm]
Direction of rotation	reversible with  switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	150 seconds (default) variable (90 to 350 seconds)
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22° F to 122° F [-30° C to 50° C]
Storage temperature	-40° F to 176° F [-40° C to 80° C]
Housing	NEMA type 2/IP54
Housing material	UL94-5VA
Agency listings	cULus according to UL 60730-1/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC
Noise level	<45 db(A)
Servicing	maintenance free
Quality standard	ISO 9001

## Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	1.37	2.75	10.07
B2150VB-055	150	1½"	40	7.00	2.51	3.42	10.47
B2200VB-077	150	2"	50	7.00	2.51	3.93	11.14
B6300VB-207	150	3"	80	8.00	2.64	7.48	12.05

## Wiring Diagrams

- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 6 ZG-R01 may be used.
- 7 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
- 8 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.



## APPLICATION NOTES

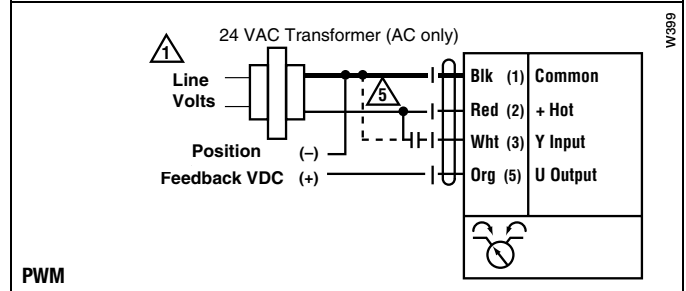
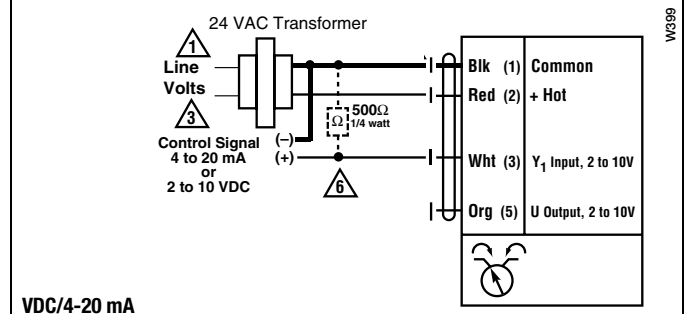
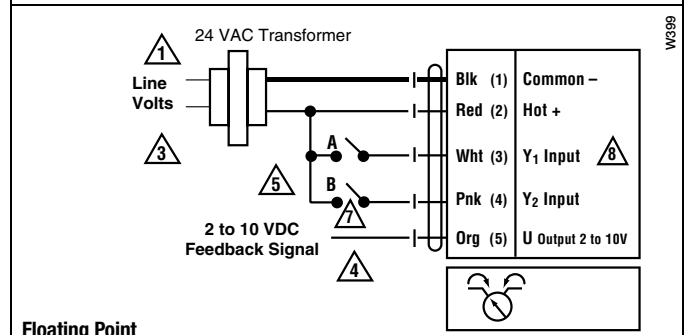
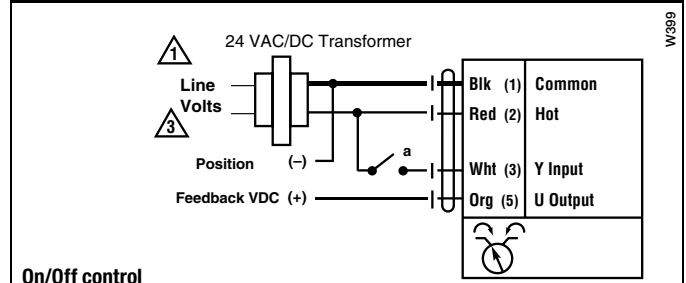


Meets cULus or UL and CSA requirements without the need of an electrical ground connection.



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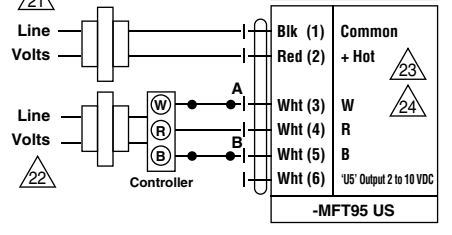
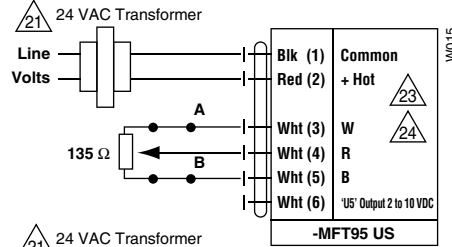
### INSTALLATION NOTES

- 21 Provide overload protection and disconnect as required.
- 22 Actuators and controller must have separate transformers.
- 23 Consult controller instruction data for more detailed information.
- 24 Resistor value depends on the type of controller and the number of actuators. Honeywell® resistor kits may also be used.
- 25 To reverse control rotation, use the reversing switch.

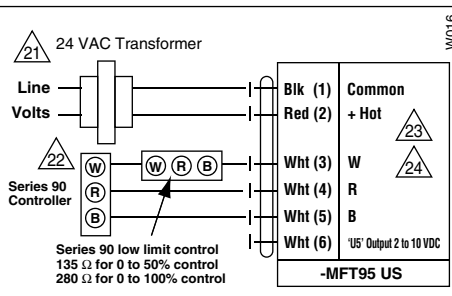
### Override

Switch A	Switch B	Damper Position
		Damper Open
		Damper Closed

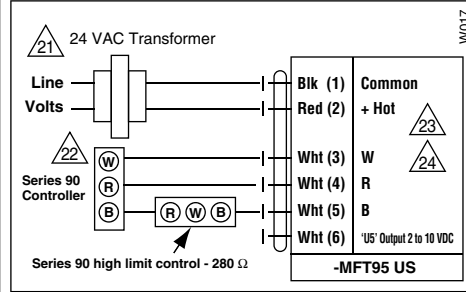
The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.



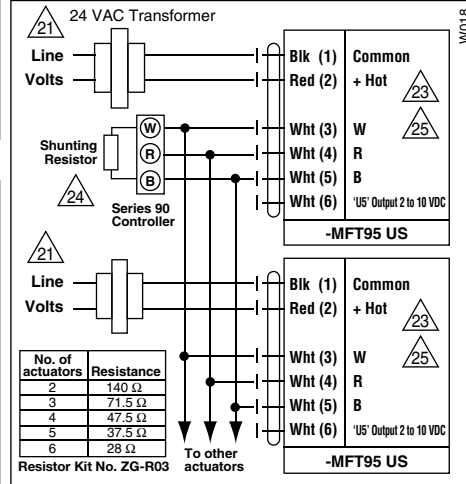
### Low Limit Control



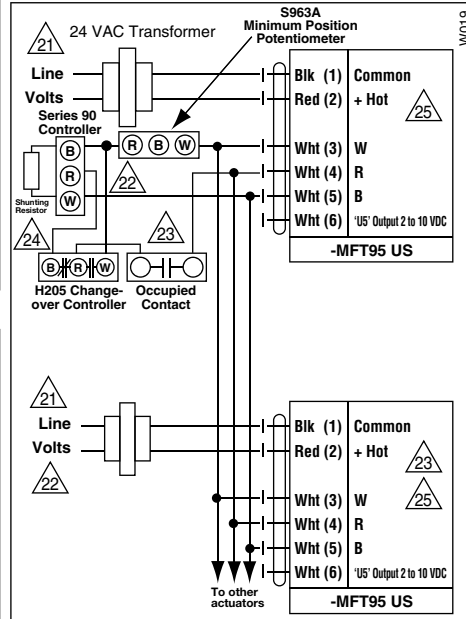
### High Limit Control



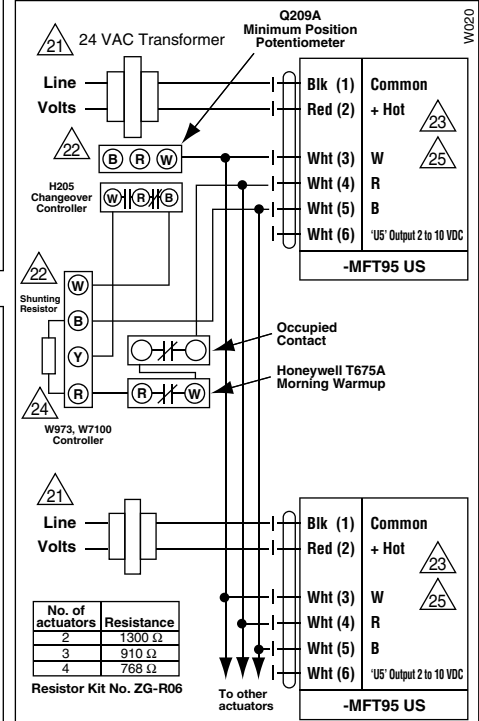
### Wiring Multiple Actuators to a Series 90 Controller



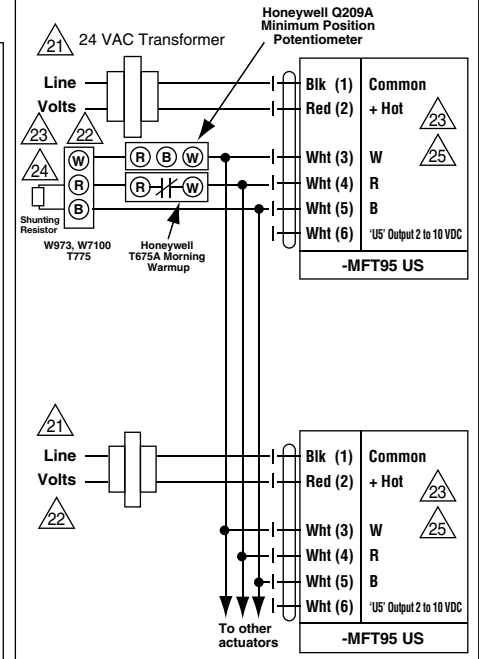
### Wiring Multiple Actuators to a Series 90 Controller using a Minimum Position Potentiometer



### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers



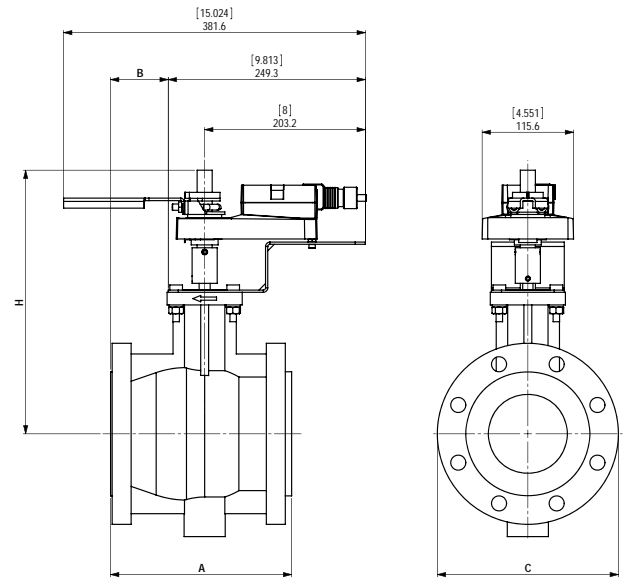
Used with the W973 and W7100 controllers





Technical Data		GMB24-3-X1
Control		on/off, floating point
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	4 W
	holding	2 W
Transformer sizing		6 VA (class 2 power source)
Electrical connection		3 ft [1m] 18 GA plenum rated cable ½" conduit connector
Overload protection		electronic throughout stroke
Angle of rotation		95°
Direction of rotation		reversible with  switch
Position indication		reflective visual indicator (snap-on)
Running time		150 seconds, constant independent of load
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Housing		NEMA 2/IP54 with cable entry down
Housing material		UL94-5V (flammability rating)
Agency listings		cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC
Noise level		<45 dB(A)
Quality standard		ISO 9001

### Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6400VB-350	150	4"	100	9.00	2.87	9.00	13.13

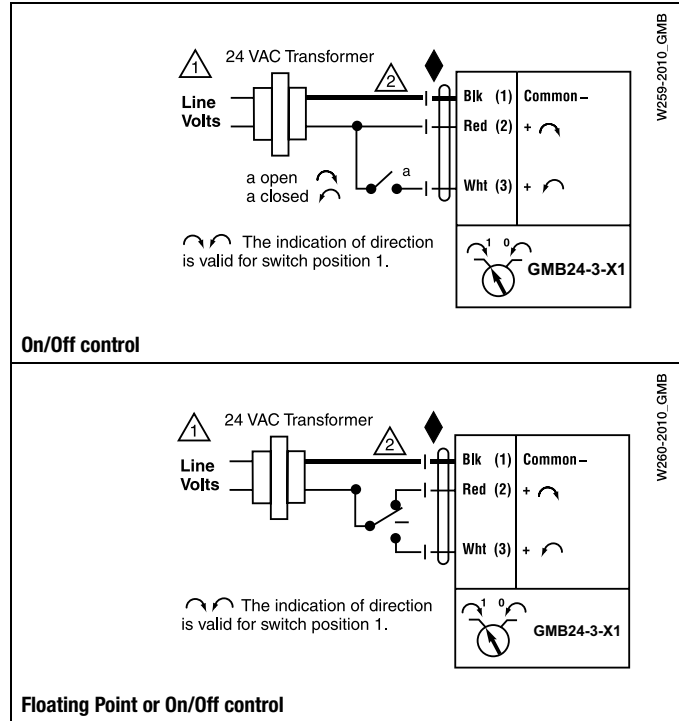
### Wiring Diagrams

- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible. Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 5 Contact closures A & B also can be triacs.
- 7 A & B should both be closed for triac source and open for triac sink.
- 8 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

### APPLICATION NOTES

- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

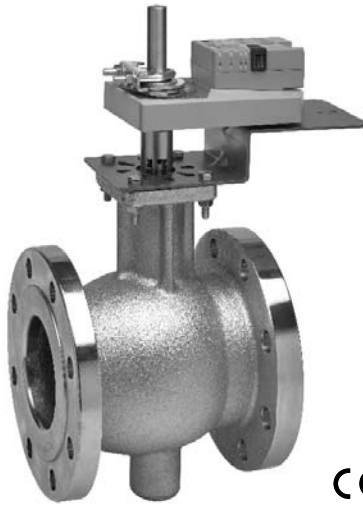
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### Piping

The valve should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. Allow 6" for cover removal and 12" for complete actuator removal. The assembly can be mounted with the actuator vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

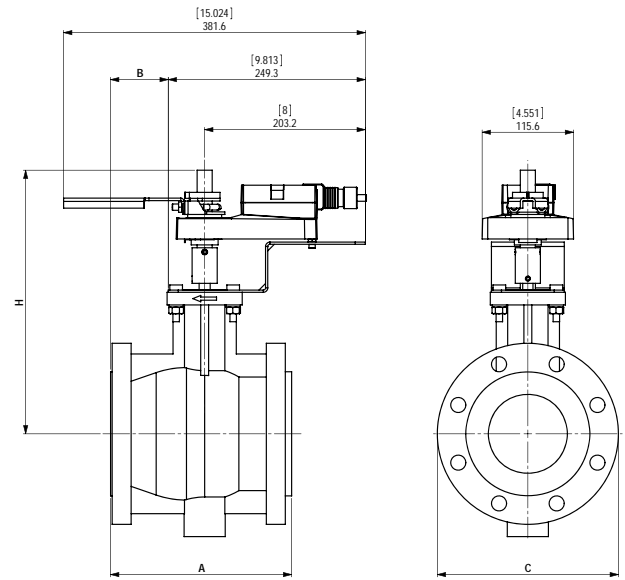
M40025 - 05/10 - Subject to change. © Belimo Aircontrols (USA), Inc.



Technical Data	GMB24-SR-X1
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	4.5 W (2W)
Transformer sizing	6.5 VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kW (0.1 mA), 500W
Feedback output U	2 to 10 VDC (max 0.5 mA)
Angle of rotation	max. 95°, adjustable with mechanical stop
Torque	360 in-lb [40 Nm]
Direction of rotation	reversible with  switch actuator will move: = CCW with decreasing control signal (10 to 2V) = CW with decreasing control signal (10 to 2V)
Position indication	reflective visual indicator (snap-on)
Running time	150 seconds, constant independent of load
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

†Rated Impulse Voltage 800V, Type of action 1, Control Pollution Degree 3.

### Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6400VB-350	150	4"	100	9.00	2.87	9.00	13.13

# GMB24-SR-X1

Proportional, 24V, 2..10 VDC or 4..20mA



## Wiring Diagrams

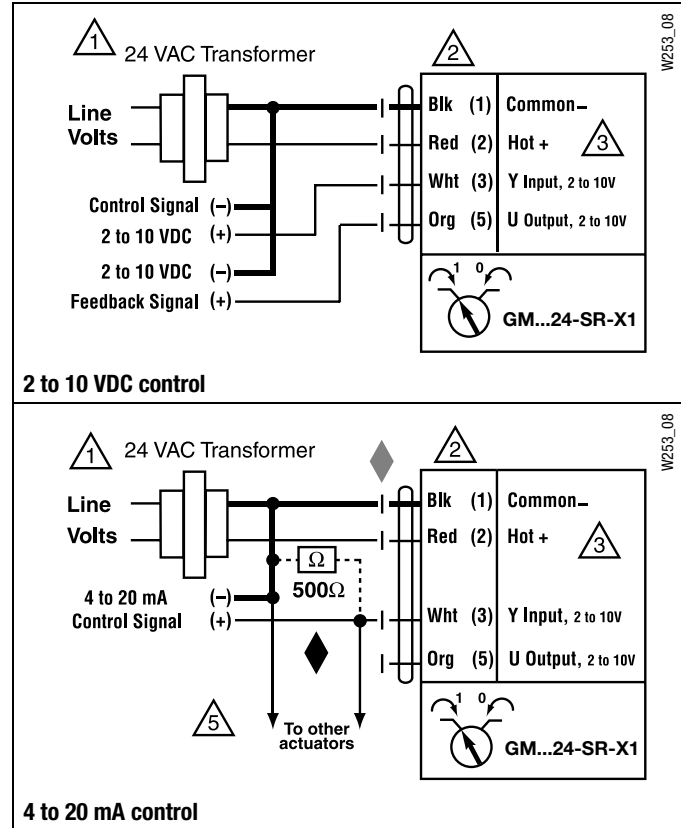
### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Only connect common to neg. (-) leg of control circuits.

### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



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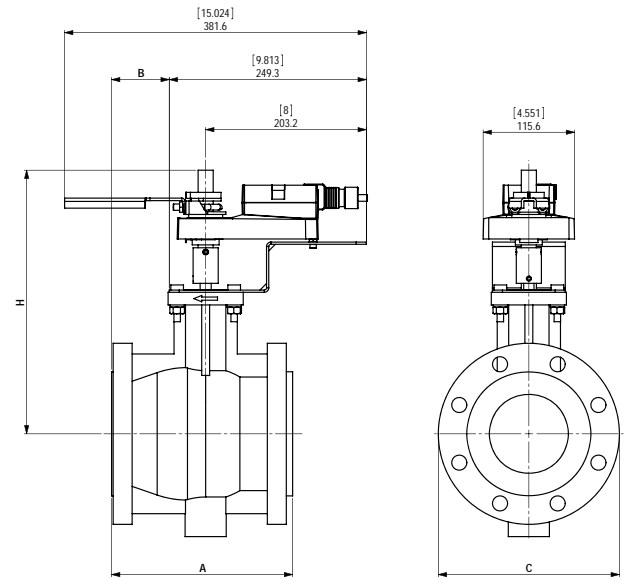
MFT

**2**  
YEAR  
WARRANTY



Technical Data		GMX24-MFTX1 GMX24-MFT95
Control		floating point, PWM, VDC range, on/off
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	4.5 W
	holding	3 W
Transformer sizing		7 VA (class 2 power source)
Electrical connection		3 ft [1m] 18 GA plenum rated cable ½" conduit connector
Overload protection		electronic throughout stroke
Input impedance		100k Ω for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 750 Ω for PWM 1500 Ω for on/off and floating point
Feedback		2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation		95°
Direction of rotation		reversible with ↻/↻ switch
Position indication		reflective visual indicator (snap-on)
Running time		150 seconds, constant independent of load
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Housing		NEMA 2/IP54 with cable entry down
Housing material		UL94-5V (flammability rating)
Agency listings		cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC
Noise level		<45 dB(A)
Quality standard		ISO 9001

### Dimensions with 2-Way Valve

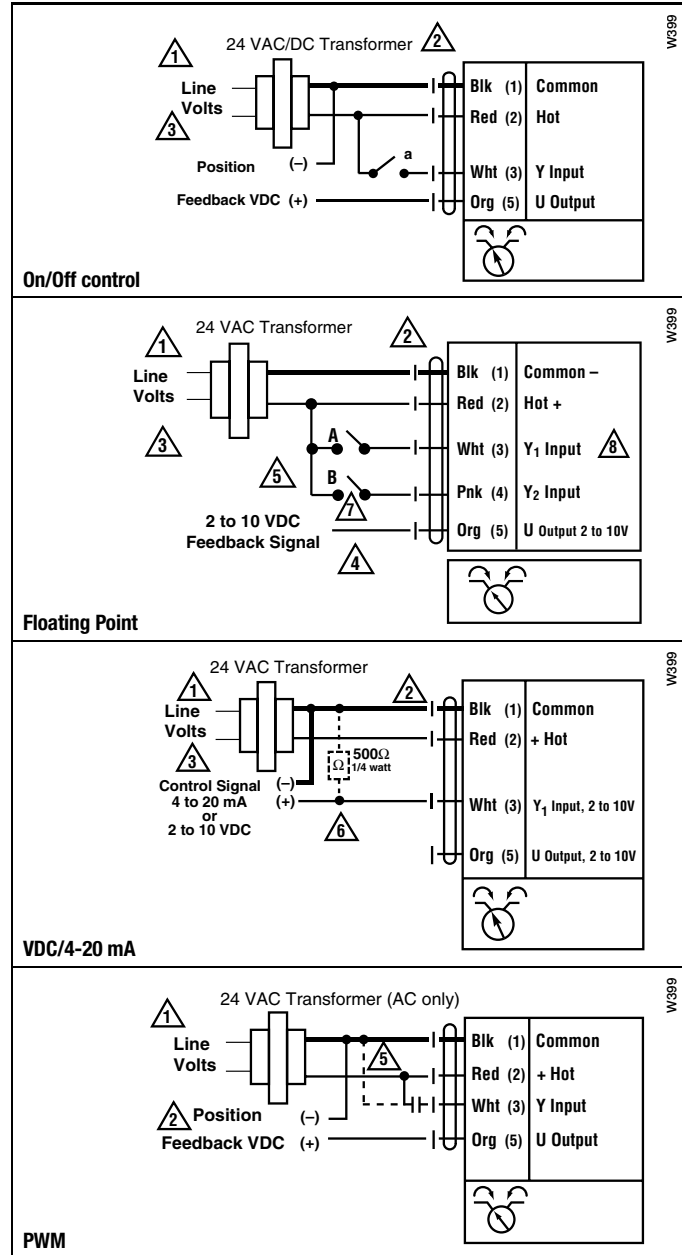


PAGE 7

Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6400VB-350	150	4"	100	9.00	2.87	9.00	13.13

### Wiring Diagrams

- 1 Provide overload protection and disconnect as required.
- 2 Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 6 ZG-R01 may be used.
- 7 Contact closures A & B also can be triacs.
- 8 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.





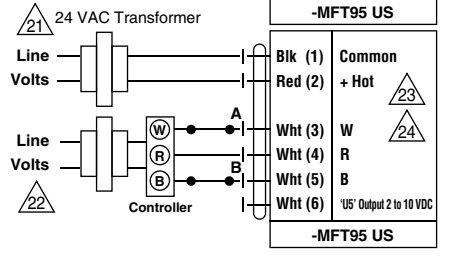
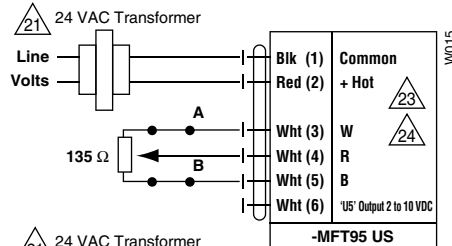
## INSTALLATION NOTES

- 21 Provide overload protection and disconnect as required.
- 22 Actuators and controller must have separate transformers.
- 23 Consult controller instruction data for more detailed information.
- 24 Resistor value depends on the type of controller and the number of actuators. Honeywell® resistor kits may also be used.
- 25 To reverse control rotation, use the reversing switch.

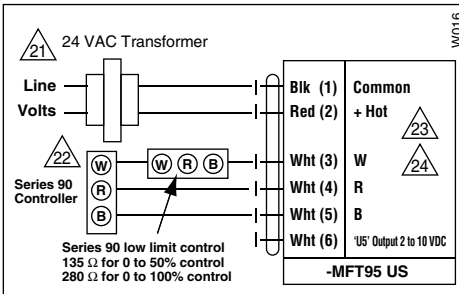
### Override

Switch A	Switch B	Damper Position
		Damper Open
		Damper Closed

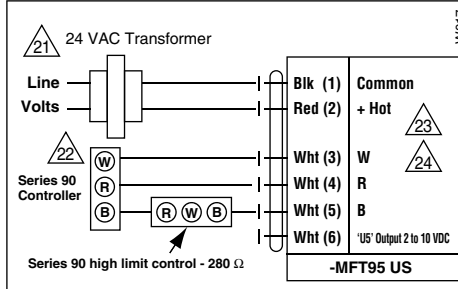
The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.



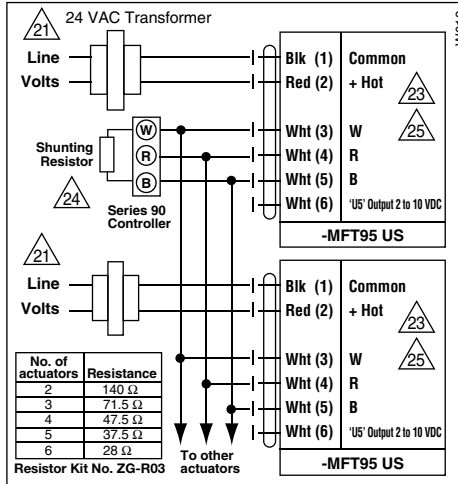
### Low Limit Control



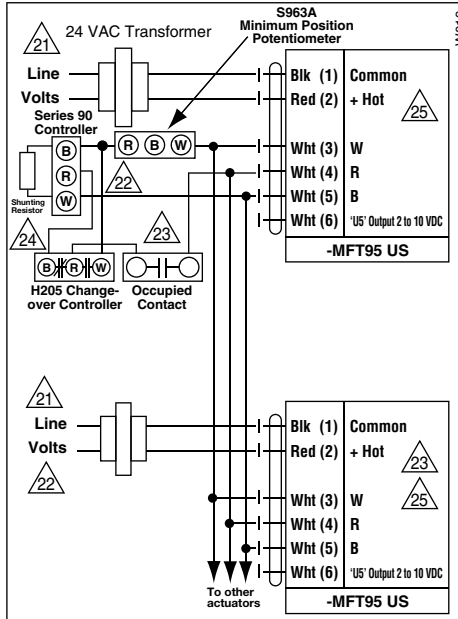
### High Limit Control



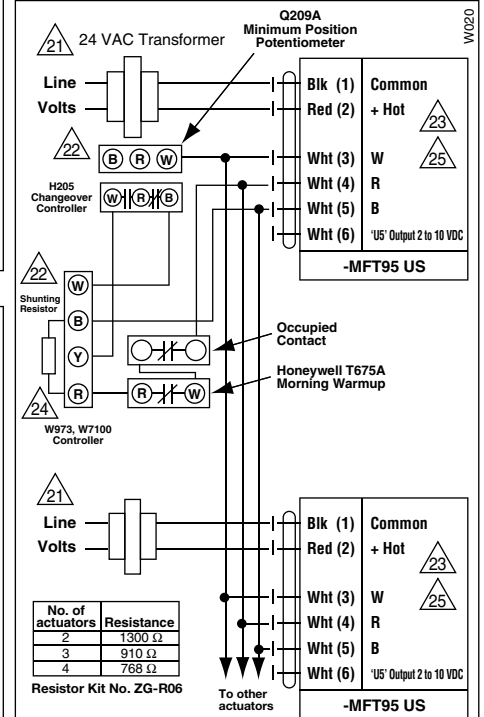
### Wiring Multiple Actuators to a Series 90 Controller



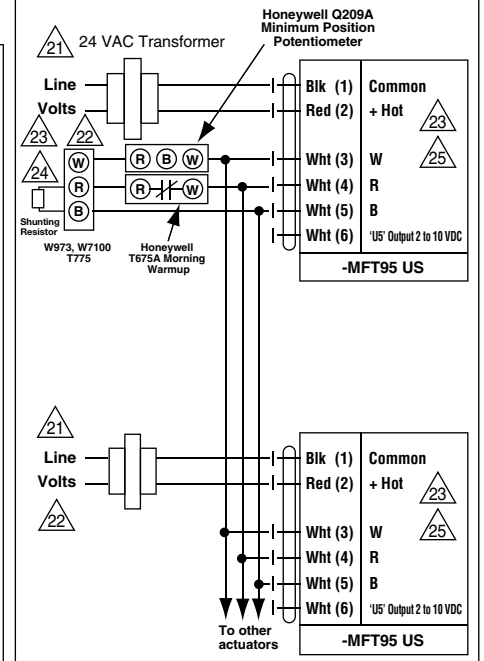
### Wiring Multiple Actuators to a Series 90 Controller using a Minimum Position Potentiometer



### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers



Used with the W973 and W7100 controllers



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### WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

# SY...24 NEMA 4X Industrial Style Actuators

24VAC



## Attention

SY Series actuators are fractional horsepower devices, and utilize **full-wave power supplies**. Observe wire sizing and transformer sizing requirements. Proportional models CANNOT be connected to Belimo direct coupled (AF, AM, GM...etc) actuator power supplies or any type of half-wave device. You **MUST** use a separate, dedicated transformer or power supply to power the SY actuator. Please do not connect other automation equipment to the dedicated SY supply source. You **MUST** use four wires (plus a ground) to control a proportional control SY actuator (**See SY Wiring Section**).

See page 26 for dimensions

Technical Data		SY1-24(P), SY2-24MFT
Power supply		24 VAC 50/60Hz, single phase
Electrical connection		½" conduit connector, screw terminals
Overload protection		thermally protected 135°C cut-out
Motor protection	SY1	H class insulation
	SY2	F class insulation
Geartrain		high alloy steel gear sets, self locking
Operating range	SY...-24	on/off
	SY...-24MFT	2-10 VDC, 4-20mA, 1-5 VDC
Sensitivity	SY...-24MFT	0.2mA / 100mV
Feedback	SY...-24MFT	2-10 VDC, 4-20mA
Angle of rotation		mechanically limited to 95°
Direction of rotation		reversible
Position indication		top mounted domed indicator
Internal humidity control		resistive heating element
Auxiliary switches		(2) SPDT, 10A 250 VAC factory set for 3° and 87° change of state
Ambient temperature		-22°F to 150°F [-30°C to 65°C]
Humidity range		up to 95%
Housing type		IP67, NEMA 4X
Housing material		die cast aluminum alloy
Agency listings		ISO, CE, cCSAus
<b>Power Consumption</b>		
	SY1-24(P)	1.8A
	SY2-24MFT	3.0A
<b>Torque</b>		
	SY1-24(P)	35 Nm / 310 in-lb
	SY2-24MFT	90 Nm / 801 in-lb
<b>Manual Override</b>		
	SY1-24(P)	8mm wrench
	SY2-24	hand wheel
<b>Running Time</b>		
	SY1-24(P)	15 seconds
	SY2-24MFT	15 seconds

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### Wiring Diagrams

#### ✂️ INSTALLATION NOTES



Transformer sizing = SY actuator draw X 1.25 (safety margin)  
 EXAMPLE: SY2-24 requires 3.0A x 1.25 = 3.75A, 3.75A X 24 VAC = 90VA Transformer.



There can be no connection (internal to automation controller, external wiring, or otherwise) between actuator supply neutral & control signal reference. These actuators are full wave devices. Any connection to half wave equipment will result in equipment damage.



Do not change sensitivity or dip switch settings with power applied.



Terminals 6 & 11 can be common when control and feedback signals are both set for 2-10VDC operation.

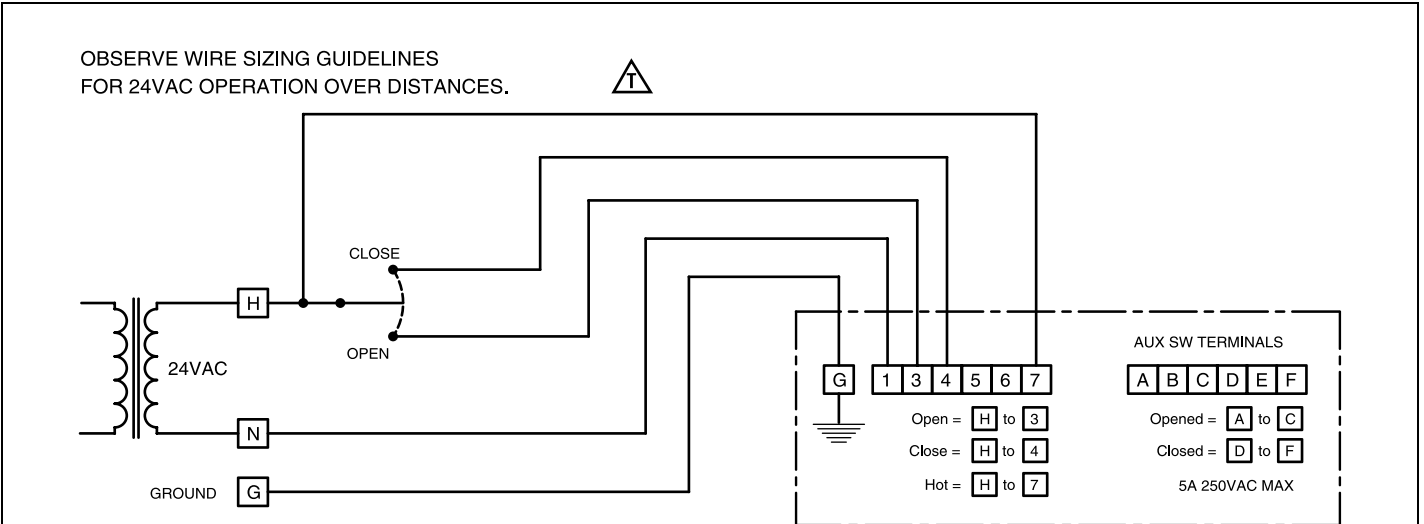


Use of feedback is optional.

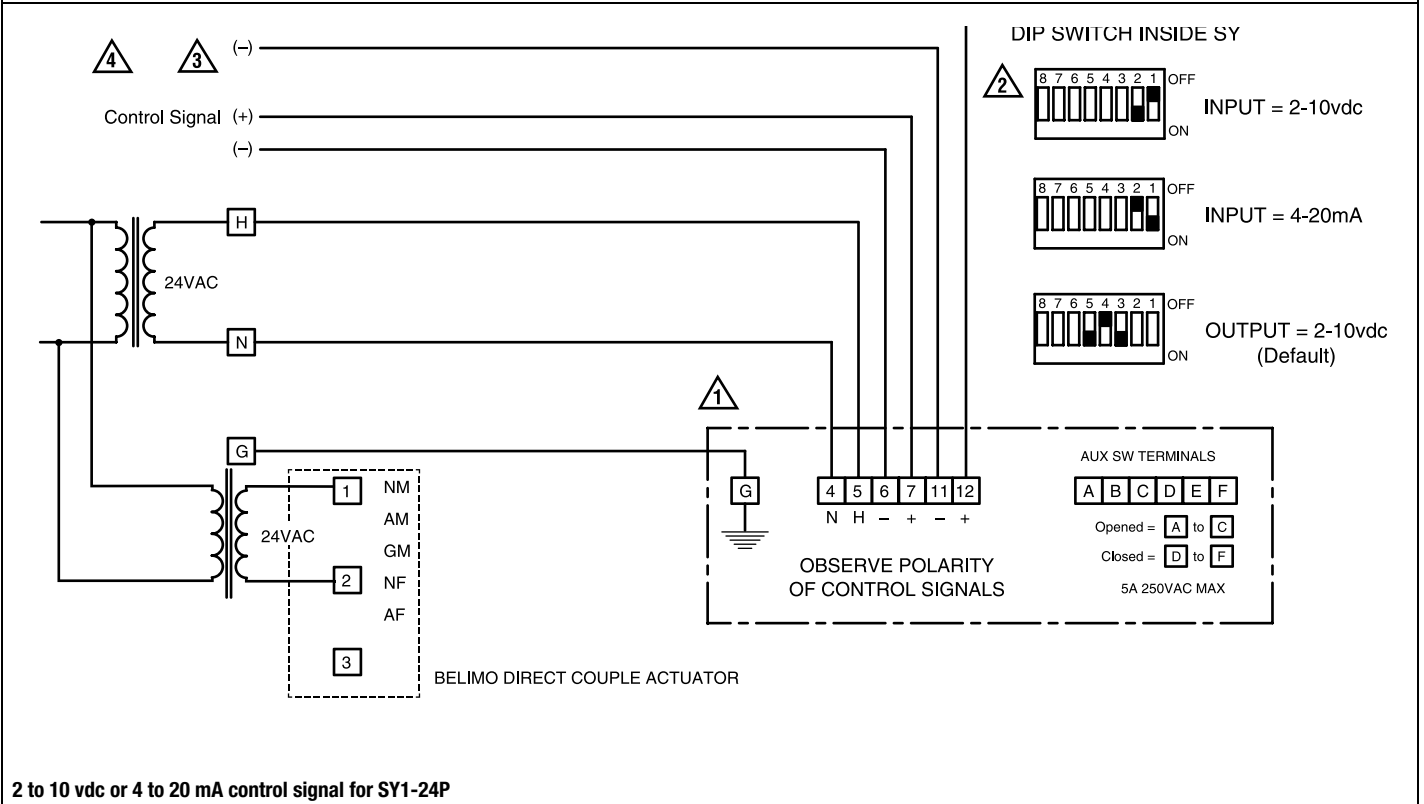


#### WARNING Live Electrical Components!

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#### On/Off control for SY(2-5)-24



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# SY...120 NEMA 4X Industrial Style Actuators

120VAC



## Application

The SY actuators are NEMA 4X rated and designed to meet the needs of HVAC and Commercial applications. Offered on the HSU and HS butterfly valve series, these actuators are available for on/off and modulating applications. Depending on the application, they are available in 24 VAC, 120 VAC and 230 VAC.

**See page 26 for dimensions**

Technical Data		SY1-110(P), SY2-120MFT	
Power supply		120 VAC 50/60Hz, single phase	
Electrical connection		½" conduit connector, screw terminals	
Overload protection		thermally protected 135°C cut-out	
Motor protection	SY1	H class insulation	
	SY2	F class insulation	
Geartrain		high alloy steel gear sets, self locking	
Operating range	SY...-110	on/off, floating point	
	SY...-120MFT	2-10 VDC 4-20mA, 1-5vdc	
Sensitivity	SY...-120MFT	0.2mA / 100mV	
Feedback	SY...120MFT	2-10 VDC, 4-20mA	
Angle of rotation		mechanically limited to 95°	
Direction of rotation		reversible	
Position indication		top mounted domed indicator	
Internal humidity control		resistive heating element	
Auxiliary switches		(2) SPDT, 5A 250VAC factory set for 5° and 85° change of state	
Ambient temperature		-22°F to 150°F [-30°C to 65°C]	
Humidity range		up to 95%	
Housing type		IP67, NEMA 4X	
Housing material		die cast aluminum alloy	
Agency listings		ISO, CE, cCSAus	
<b>Power Consumption</b>			
	SY1-110(P)	0.5A	
	SY2-120MFT	1.0A	
<b>Torque</b>			
	SY1-110(P)	35 Nm / 310 in-lb	
	SY2-120MFT	90 Nm / 801 in-lb	
<b>Manual Override</b>			
	SY1-110(P)	8mm wrench	
	SY2-120MFT – SY8-120MFT	hand wheel	
<b>Running Time</b>			
		<b>50hz</b>	<b>60hz</b>
	SY1-110(P)	13 seconds	12 seconds
	SY2-120MFT	17 seconds	15 seconds

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## Wiring Diagrams

### Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!  
Power consumption and input impedance must be observed.



### INSTALLATION NOTES

Observe class 1 and class 2 wiring restrictions.



### APPLICATION NOTES



Recommended twisted shielded pair for control wiring. Ground shielded wire at control panel chassis. Tape back ground at actuator.



Use of feedback is optional.



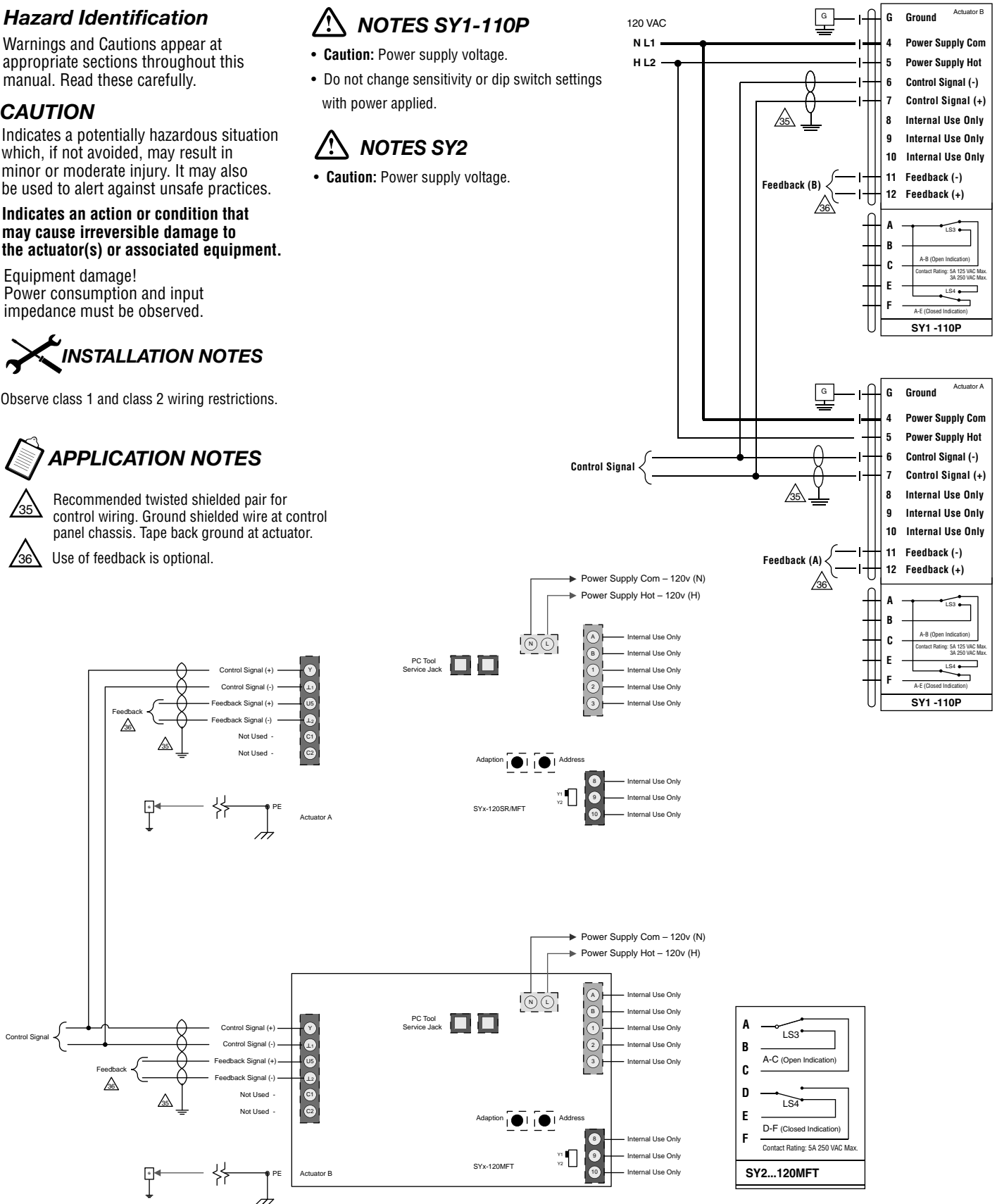
### NOTES SY1-110P

- **Caution:** Power supply voltage.
- Do not change sensitivity or dip switch settings with power applied.



### NOTES SY2

- **Caution:** Power supply voltage.



# SY...230 NEMA 4X Industrial Style Actuators

230VAC



## Attention

SY Series actuators are fractional horsepower devices, and utilize **full-wave power supplies**. Observe wire sizing and transformer sizing requirements. Proportional models CANNOT be connected to Belimo direct coupled (AF, AM, GM...etc) actuator power supplies or any type of half-wave device. You **MUST** use a separate, dedicated transformer or power supply to power the SY actuator. Please do not connect other automation equipment to the dedicated SY supply source. You **MUST** use four wires (plus a ground) to control a proportional control SY actuator (**See SY Wiring Section**).

**See page 26 for dimensions**

Technical Data		SY1-220(P), SY2-230MFT	
Power supply		230 VAC 50/60Hz, single phase	
Electrical connection		1/2" conduit connector, screw terminals	
Overload protection		thermally protected 135°C cut-out	
Motor protection	SY1	H class insulation	
	SY2	F class insulation	
Geartrain		high alloy steel gear sets, self locking	
Operating range	SY...-220	on/off, floating point	
	SY...-230MFT	2-10 VDC, 4-20mA, 1-5vdc	
Sensitivity	SY...-230MFT	0.2mA / 200mV	
Feedback	SY...-230MFT	2-10 VDC, 4-20mA	
Angle of rotation		mechanically limited to 95°	
Direction of rotation		reversible	
Position indication		top mounted domed indicator	
Internal humidity control		resistive heating element	
Auxiliary switches		(2) SPDT, 5A 250VAC factory set for 5° and 85° change of state	
Ambient temperature		-22°F to 150°F [-30°C to 65°C]	
Humidity range		up to 95%	
Housing type		IP67, NEMA 4X	
Housing material		die cast aluminum alloy	
Agency listings		ISO, CE, cCSAus	
<b>Power consumption</b>			
	SY1-220(P)	0.3A	
	SY2-230MFT	0.5A	
<b>Torque</b>			
	SY1-220(P)	35 Nm / 310 in-lb	
	SY2-230MFT	90 Nm / 801 in-lb	
<b>Manual Override</b>			
	SY1-220(P)	8mm wrench	
	SY2-230MFT	hand wheel	
<b>Running Time</b>			
		<b>50hz</b>	<b>60hz</b>
	SY1-220(P)	13 seconds	12 seconds
	SY2-230MFT	17 seconds	15 seconds

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**Wiring Diagrams**

**Hazard Identification**

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

**CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!  
Power consumption and input impedance must be observed.



**INSTALLATION NOTES**

Observe class 1 and class 2 wiring restrictions.



**APPLICATION NOTES**



Recommended twisted shielded pair for control wiring. Ground shielded wire at control panel chassis. Tape back ground at actuator.



Use of feedback is optional.



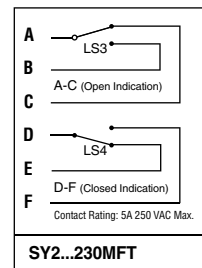
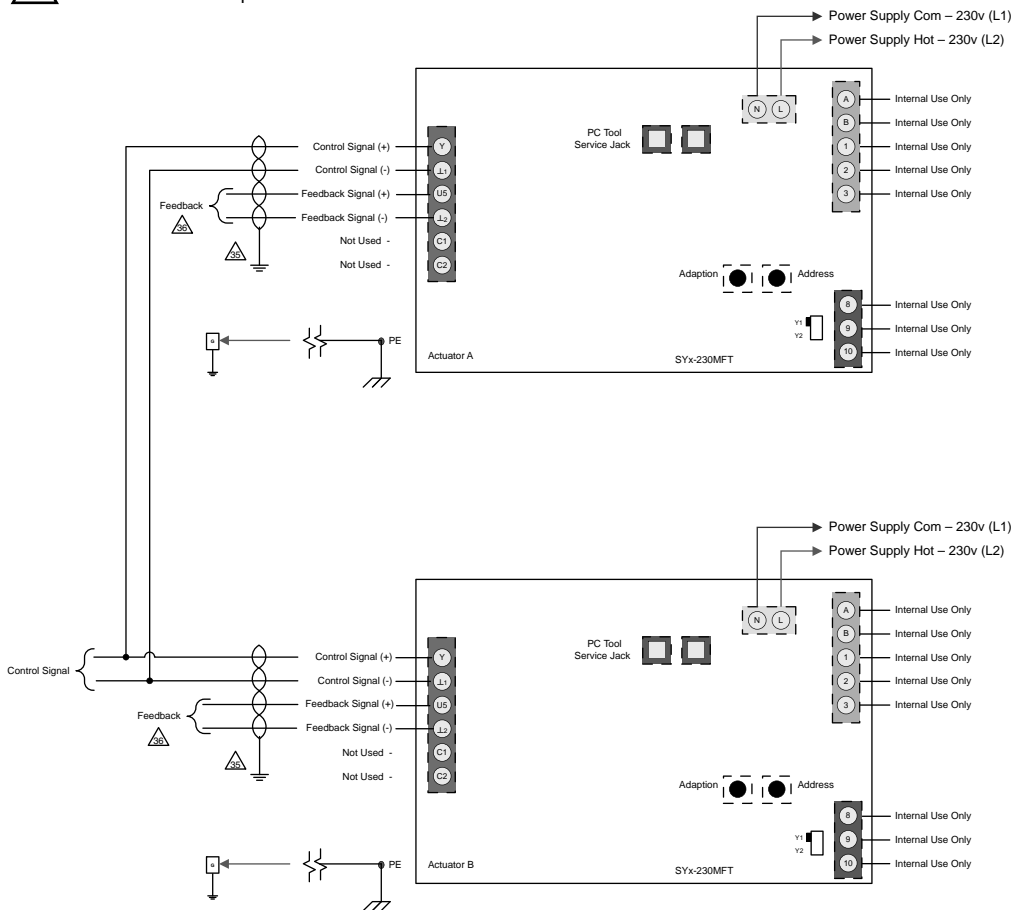
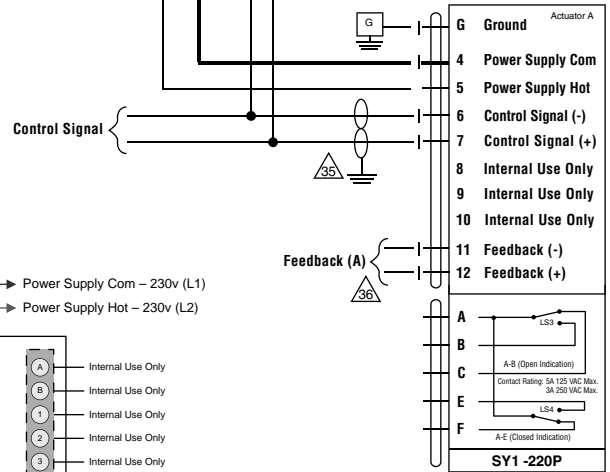
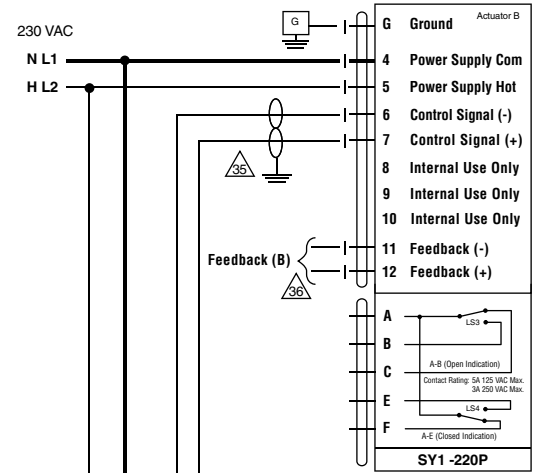
**NOTES SY1-220P**

- **Caution:** Power supply voltage.
- Do not change sensitivity or dip switch settings with power applied.



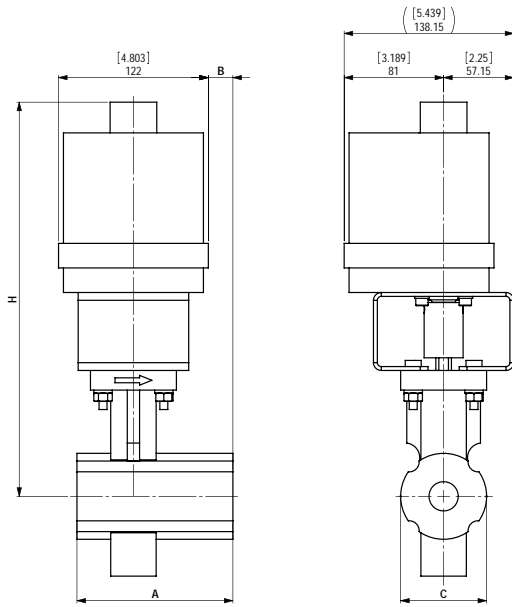
**NOTES SY2**

- **Caution:** Power supply voltage.



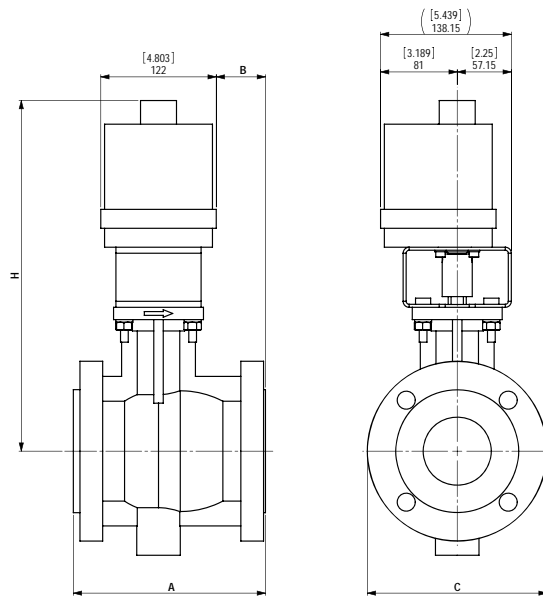
# Ball Valve Dimensions with SY... Series Actuators

## Dimensions with 2-Way Valves



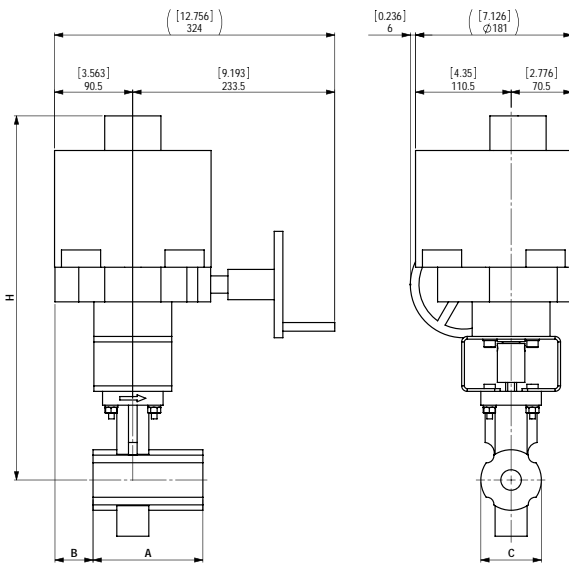
SY1 Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	0.78	2.75	12.64
B2150VB-055	150	1½"	40	7.00	1.92	3.42	13.03
B2200VB-077	150	2"	50	7.00	1.92	3.93	13.74

## Dimensions with Flanged Valves



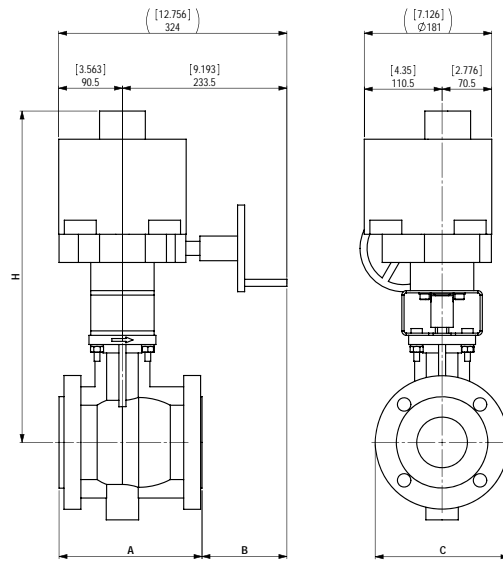
SY1 Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6300VB-207	150	3"	80	8.00	2.05	7.48	14.59

## Dimensions with 2-Way Valves



SY2 Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	1.73	2.75	16.57
B2150VB-055	150	1½"	40	7.00	0.86	3.42	16.97
B2200VB-077	150	2"	50	7.00	0.86	3.93	17.68

## Dimensions with Flanged Valves



SY2 Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6300VB-207	150	3"	80	8.00	4.74	7.48	18.54
B6300VB-350	150	4"	100	9.00	4.50	9.01	19.61
B6300VB-507	150	6"	150	10.49	3.76	10.98	20.51

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### Models

NFB24-X1  
 NFBUP(-S)-X1 w/built-in Aux. Switch  
 NFBUP-X1

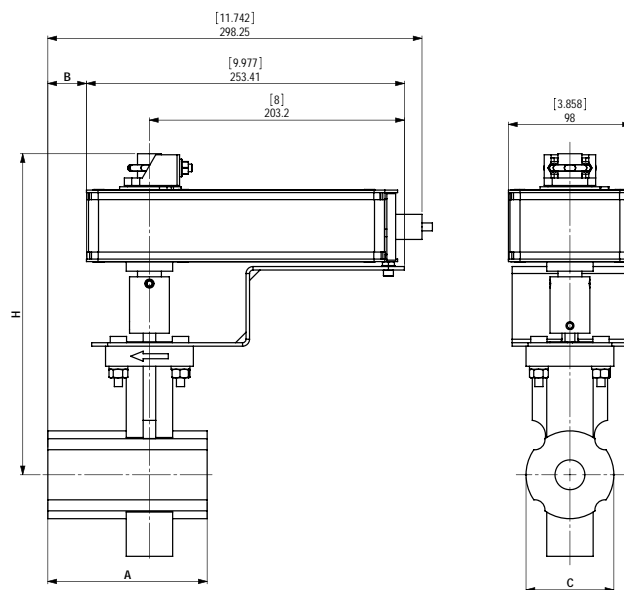
### Technical Data

Control	on/off	
Power consumption		
NFB24-X1	running	6 W
	holding	2.5 W
NFBUP(-S)-X1	running	6 W
	holding	2.5 W
Transformer sizing		
NFB24-X1		8.5 VA
NFBUP(-S)-X1		9.5 VA
Electrical connection (-S model has 2 cables)		½" conduit connector 3 ft [1m], 18 GA appliance cables
Electrical protection		120 V actuators double insulated
Overload protection		electronic throughout 0° to 95° rotation
Angle of rotation		95°
Position indication		visual indicator
Running time	control	<75 seconds
	spring	<20 seconds
Ambient temperature		-22° F to 122° F [-30° C to 50° C]
Housing		NEMA 2 / IP54
Agency listings		UL 873, CSA C22.2 No. 24 certified, CE
Noise level		max. 45 dB(A)

### NFBUP-S-X1

Auxiliary switch	2 x SPDT, 3A (0.5A inductive) @ 250V
------------------	--------------------------------------

### Dimensions with 2-Way Valve



### Valve Nominal Size Dimensions (Inches)

Valve Body	COP	Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	1.21	2.75	10.07
B2150VB-055	150	1½"	40	7.00	2.35	3.42	10.47

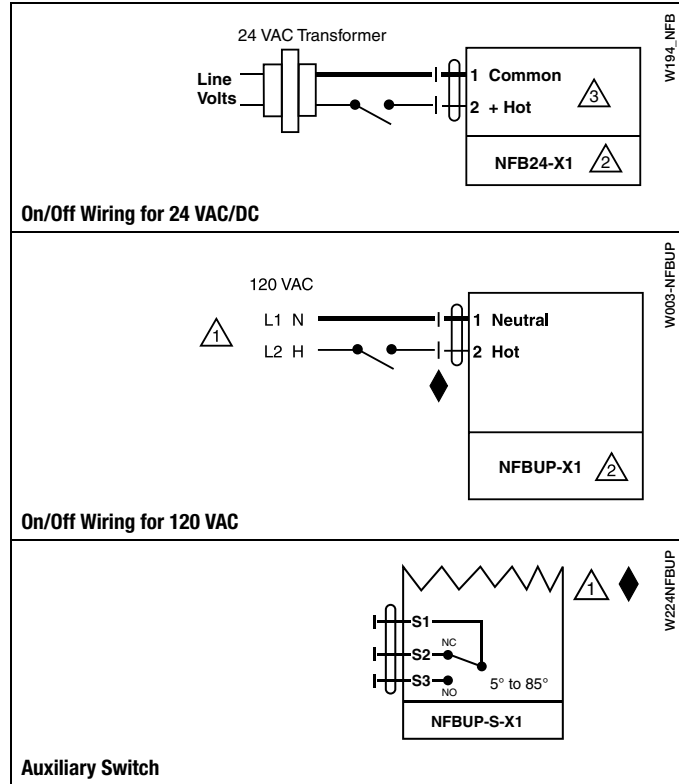
### Wiring Diagrams

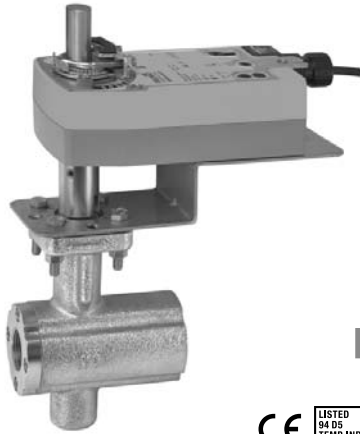
#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel.  
Power consumption must be observed.
- 3 24V actuators can be powered by 24 VAC/DC.
- 4 For end position indication, interlock control, fan startup, etc.,  
(-S) Models: 2 SPDT, 3A (0.5 inductive) @250V, one switch fixed at 10°,  
one adjustable 10° to 90°.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**  
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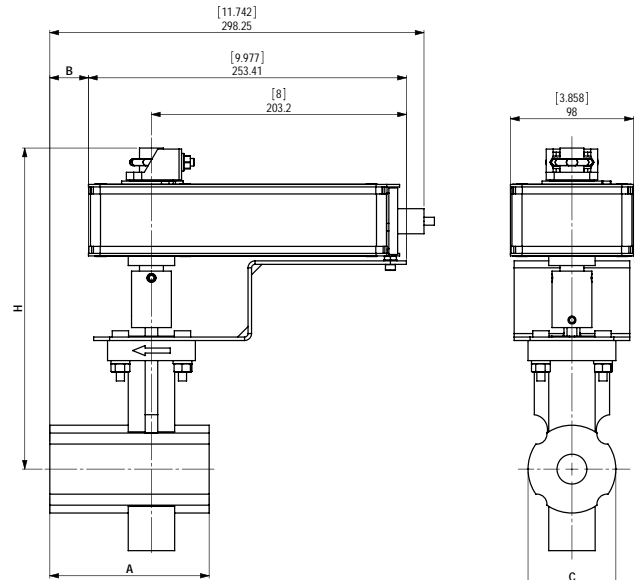


**Models**

NFX24-MFT-X1

Technical Data		
Control		MFT
Control signal		2 to 10 VDC, (4 to 20 mA with 500 Ω resistor)
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	6.5 W
	holding	3 W
Transformer sizing		9 VA, class 2 power
Electrical connection		½" conduit connector 3 ft [1m], 18 GA appliance cable
Overload protection		electronic throughout rotation
Feedback output		variable DC
Angle of rotation		95°, adjustable 35° to 95° (mechanically with limit stops), MFT (electronically variable 0-100%)
Direction of rotation		external switch (proportional models) electronically selectable with MFT
Spring return reversible		CW/CCW mounting
Position indication		visual indicator, 0° to 95°
Running time	control	150 seconds default
	spring	<60 seconds at -22° F [-30°C] 20 seconds at -4°F to 122°F [-20°C to 50°C]
Operating temperature		-22° F to 122° F [-30° C to 50° C]
Housing		NEMA 2 / IP54, Enclosure Type2
Agency listings		cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC
Noise level		less than 45 dB(A)

**Dimensions with 2-Way Valve**



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2100VB-024	150	1"	25	5.00	1.21	2.75	10.07
B2150VB-055	150	1½"	40	7.00	2.35	3.42	10.47

**Wiring Diagrams**

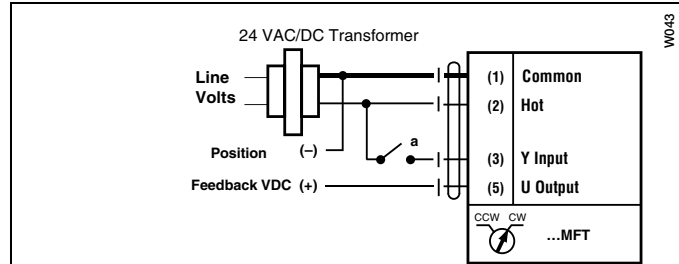
**INSTALLATION NOTES**

- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 5 Triac A and B can also be contact closures.
- 6 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
- 7 Position feedback cannot be used with Triac sink controller. The actuators internal common reference is not compatible.

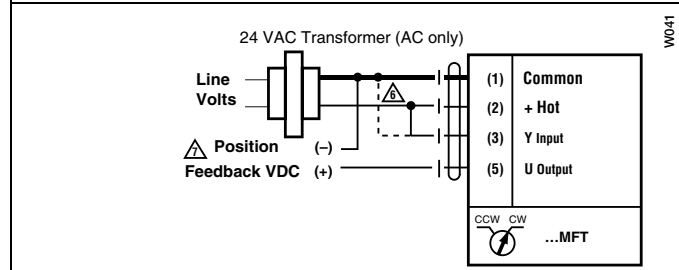
**APPLICATION NOTES**

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.
- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

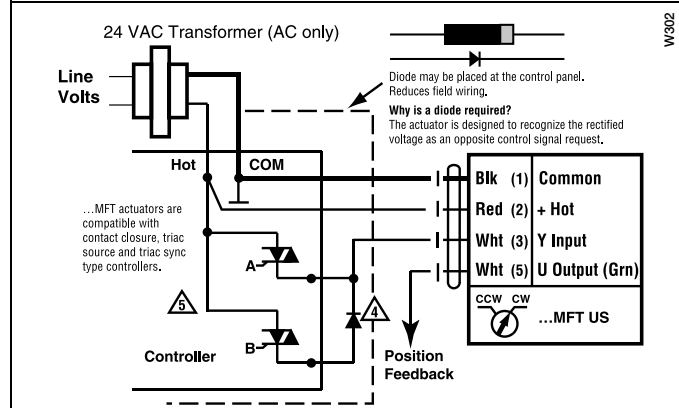
**WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



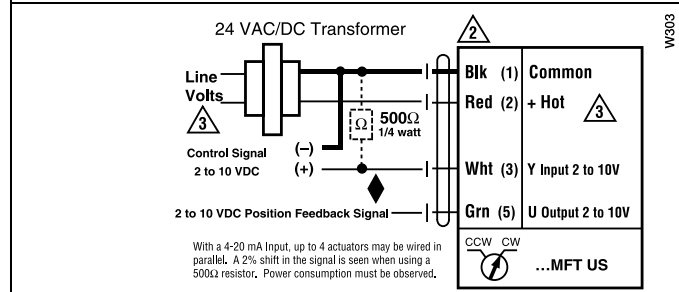
**On/Off control**



**PWM, triac source and sink**

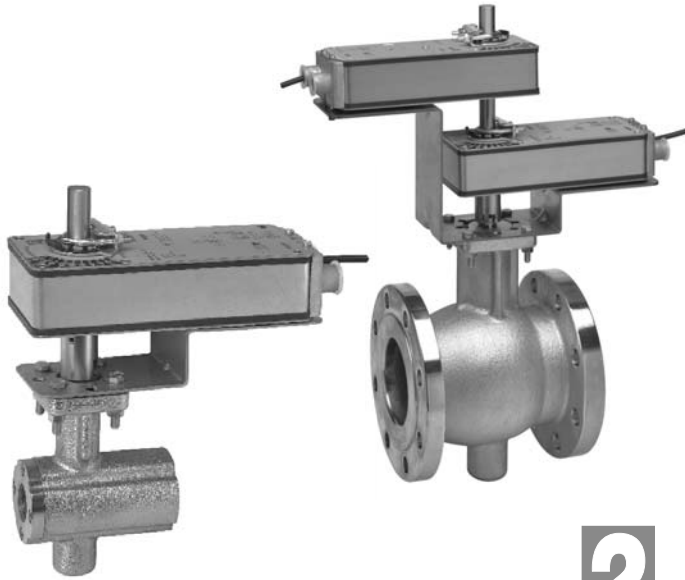


**Floating Point control**



**Proportional 2 to 10 or 4 to 20 mA control signal**

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### Models

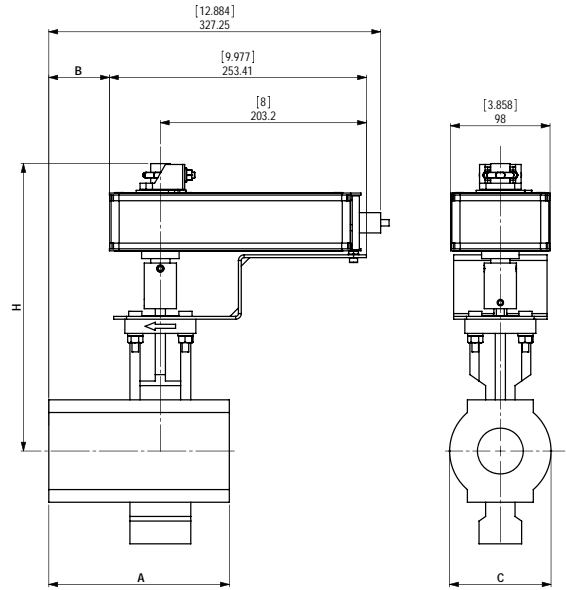
- AF24 US
- AF24-S US w/built-in Aux. Switches
- AF120 US
- AF120-S US w/built-in Aux. Switches



Technical Data	
Control	on/off
Power consumption	
AF24(-S) US	running 5 W
	holding 1.5 W
AF120(-S) US	running 6 W
	holding 2.3 W
Transformer sizing	10 VA, class 2 power
Electrical connection	½" conduit connector
(-S model has 2 cables)	3 ft [1m], 18 GA appliance cables
Electrical protection	120 V actuators double insulated
Overload protection	electronic throughout 0° to 95° rotation
Angle of rotation	95°
Position indication	visual indicator
Manual override	hex crank
Running time	control 150 seconds independent of load
	spring <20 seconds
Ambient temperature	-22° F to 122° F [-30° C to 50° C]
Housing	NEMA 2 / IP54
Agency listings	UL 873, CSA C22.2 No. 24 certified, CE
Noise level	max. 45 dB(A)

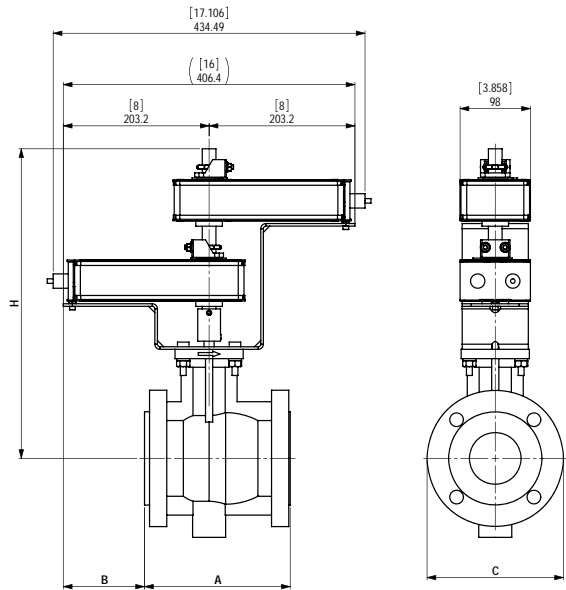
AF...-S US	
Auxiliary switches	2 x SPDT, 7A (2.5A) @ 250 VAC, UL listed, one switch is fixed at +5°, one is adjustable 25° to 85° (double insulated)

### Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2200VB-077	150	2"	50	7.00	2.35	3.94	11.16

### Dual AF Actuators



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6300VB-207	150	3"	80	8.00	4.46	7.48	431.4

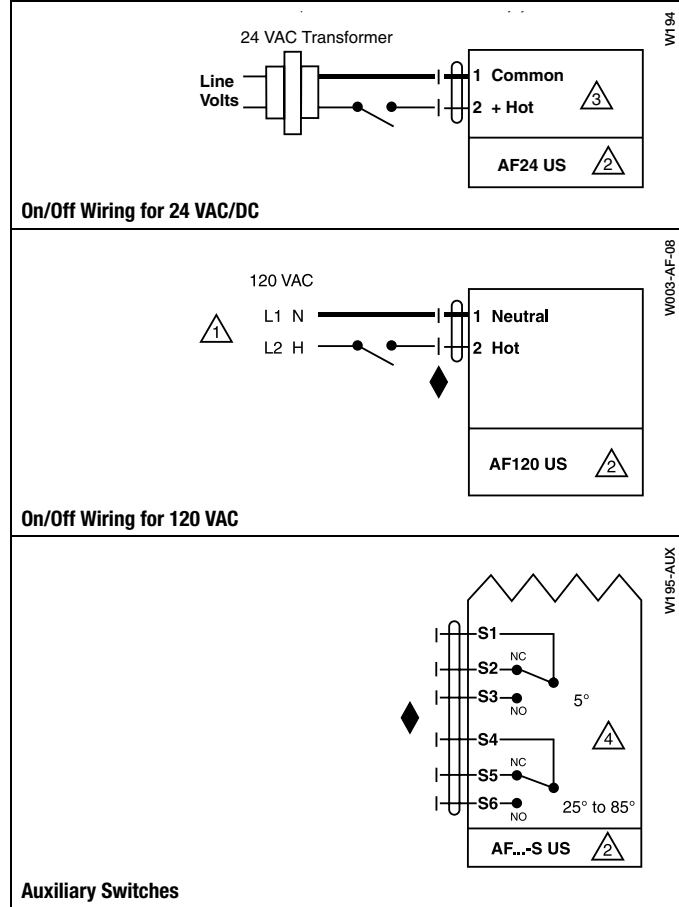
### Wiring Diagrams

#### ✂️ INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel.  
Power consumption must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AF24-S US incorporates two built-in auxiliary switches: 2 x SPDT, 7A (2.5A) @ 250 VAC, UL listed, one switch is fixed at +5°, one is adjustable 25° to 85°.

#### 📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**  
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

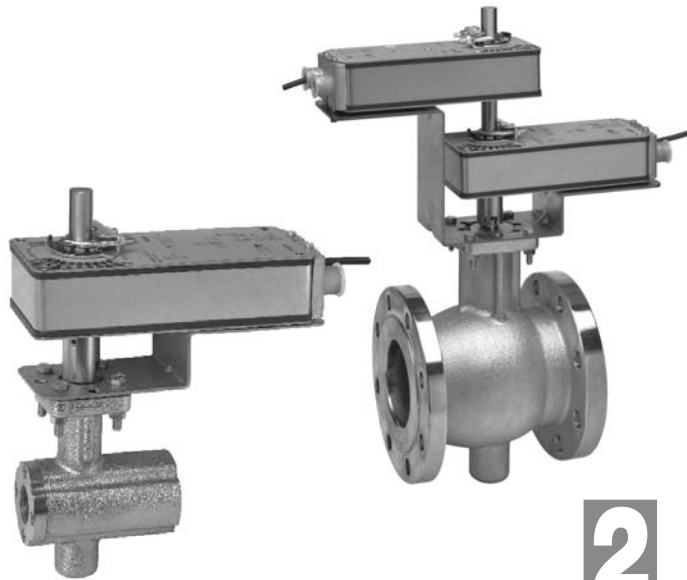


W194

W003-AF-08

W195-AUX





**MFT**



**Models**

AF24-MFT US  
 AF24-MFT-S US  
 AF24-MFT95 US

w/built-in Aux. Switches

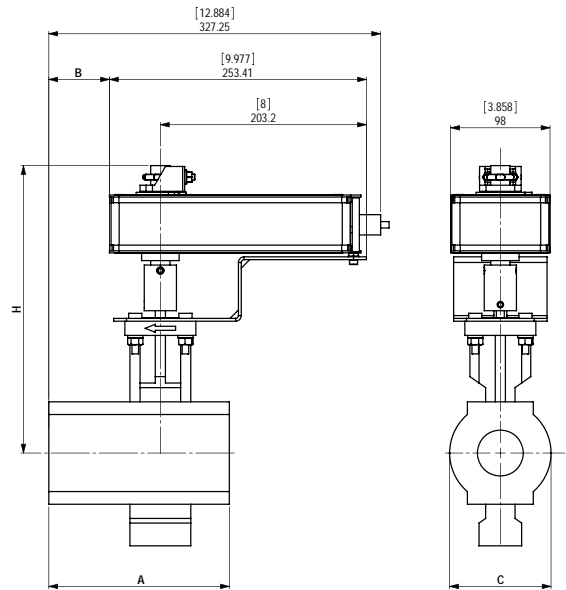


Technical Data		
Control		MFT
Control signal		2 to 10 VDC, (4 to 20 mA with 500 Ω resistor) 0-135 Ω (MFT95)
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		10 VA, class 2 power
Electrical connection		½" conduit connector
(-S model has 2 cables)		3 ft [1m], 18 GA appliance cable
Overload protection		electronic throughout rotation
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 750 Ω for PWM 1500 Ω for on/off and floating point
Feedback output		2 to 10 VDC, 0.5 mA max
Angle of rotation		95°
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in ↻ switch
Position indication		visual indicator
Manual override		hex crank
Running time	control	150 seconds independent of load
	spring	<20 seconds
Ambient temperature		-22° F to 122° F [-30° C to 50° C]
Housing		NEMA 2 / IP54
Agency listings		UL 873, CSA C22.2 No. 24 certified, CE
Noise level		max. 45 dB(A)

AF24-MFT-S US		
Auxiliary switches		2 x SPDT, 7A (2.5A) @ 250 VAC, UL listed, one switch is fixed at +5°, one is adjustable 25° to 85° (double insulated)

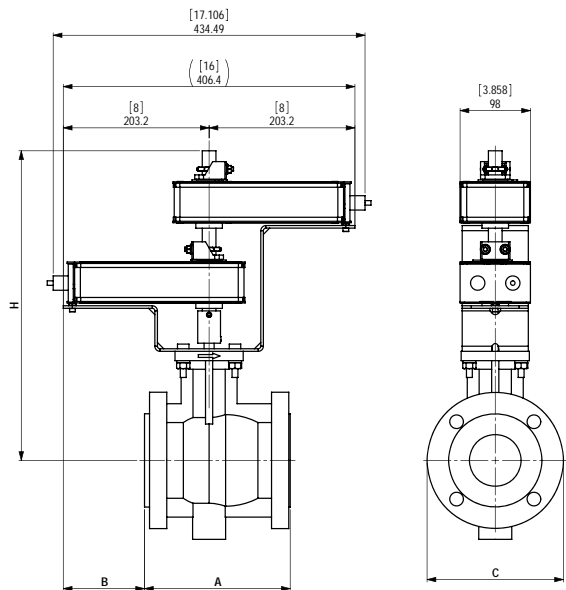
\* Dual Mounted Actuators

**Dimensions with 2-Way Valve**



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B2200VB-077	150	2"	50	7.00	2.35	3.94	11.16

**Dual AF Actuators**



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6300VB-207	150	3"	80	8.00	4.46	7.48	431.4

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## Wiring Diagrams

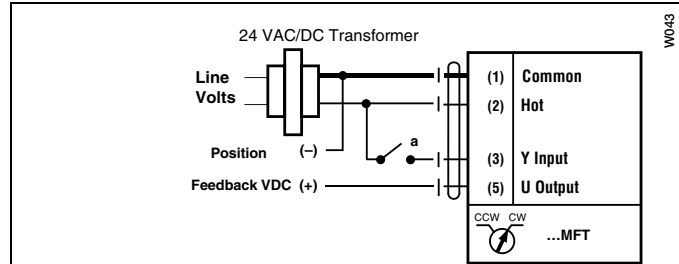
### INSTALLATION NOTES

- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 IN4004 or IN4007 diode (IN4007 supplied, Belimo part number 40155).
- 5 Triac A and B can also be contact closures.
- 6 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
- 7 Position feedback cannot be used with Triac sink controller. The actuators internal common reference is not compatible.

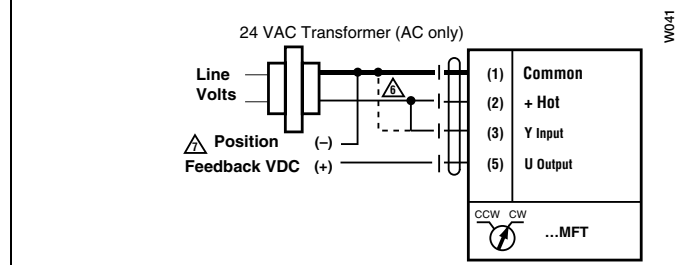
### APPLICATION NOTES

- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.
- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

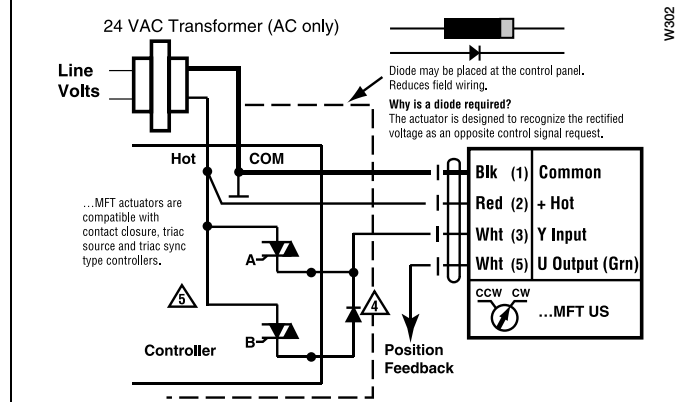
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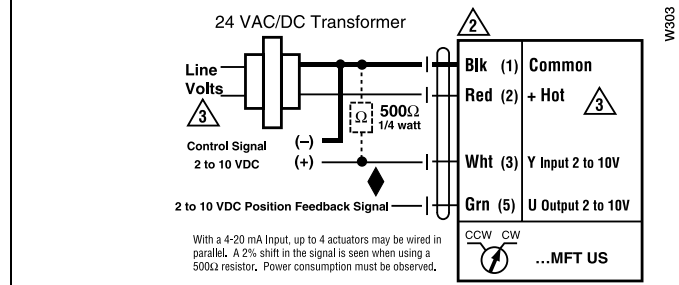
On/Off control



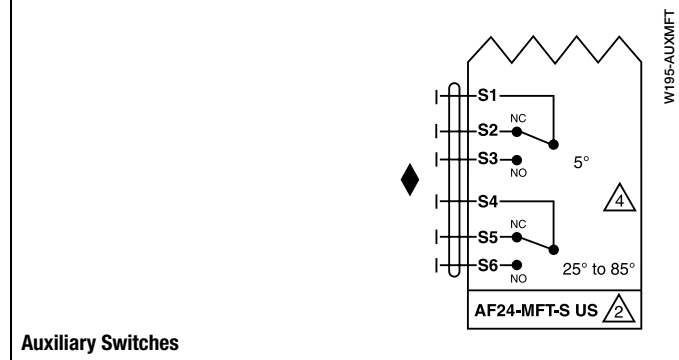
PWM, triac source and sink



Floating Point control



Proportional 2 to 10 or 4 to 20 mA control signal



Auxiliary Switches



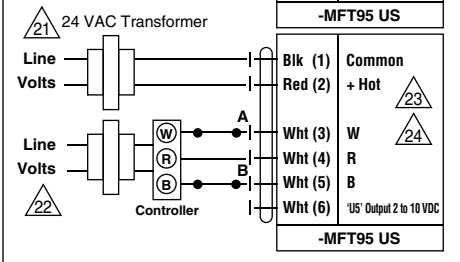
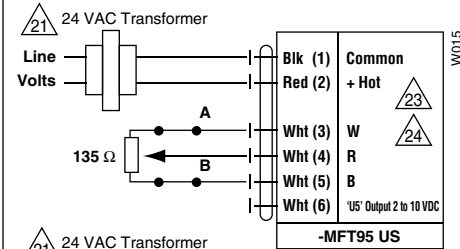
## INSTALLATION NOTES

- 21 Provide overload protection and disconnect as required.
- 22 Actuators and controller must have separate transformers.
- 23 Consult controller instruction data for more detailed information.
- 24 Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell® resistor kits may also be used.
- 25 To reverse control rotation, use the reversing switch.

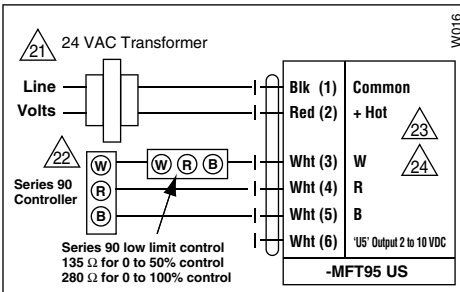
### Override

Switch A	Switch B	Damper Position
		Damper Open
		Damper Closed

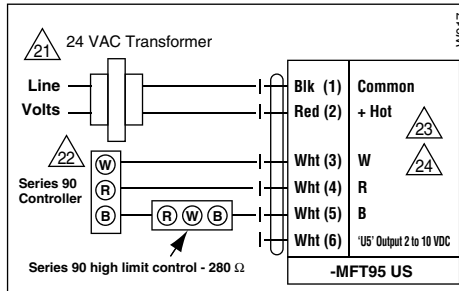
The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.



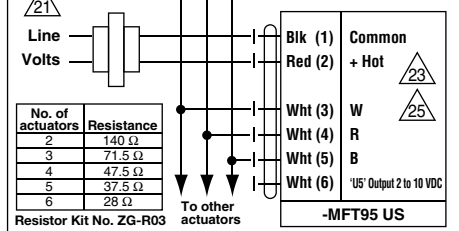
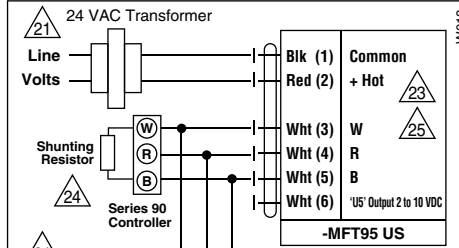
### Low Limit Control



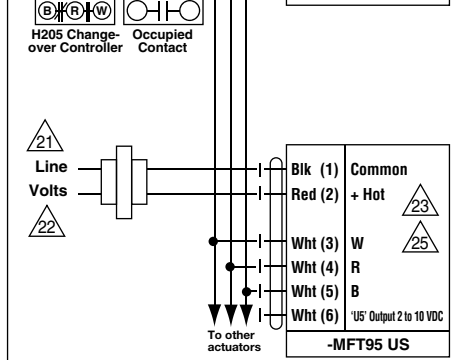
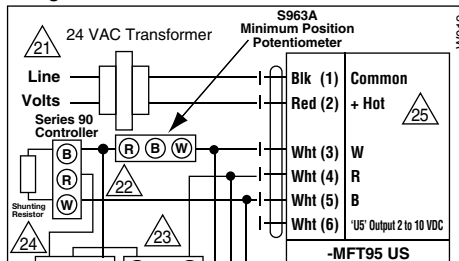
### High Limit Control



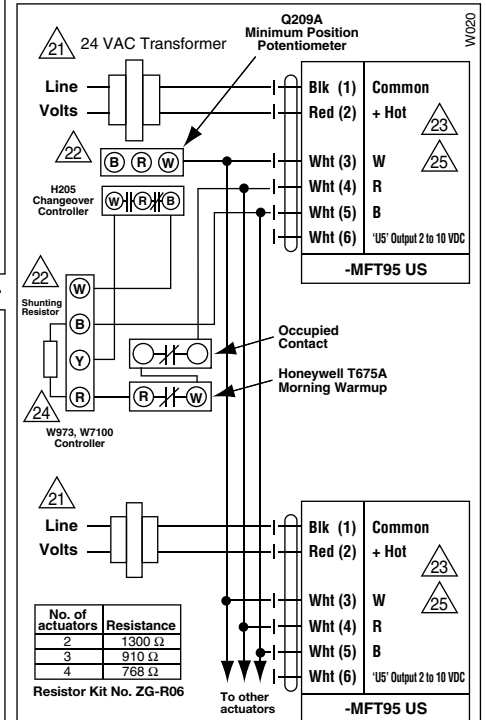
### Wiring Multiple Actuators to a Series 90 Controller



### Wiring Multiple Actuators to a Series 90 Controller using a Minimum Position Potentiometer



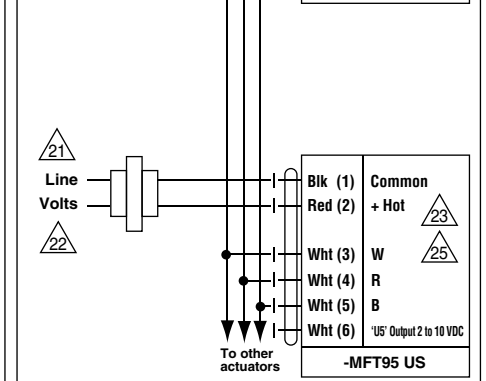
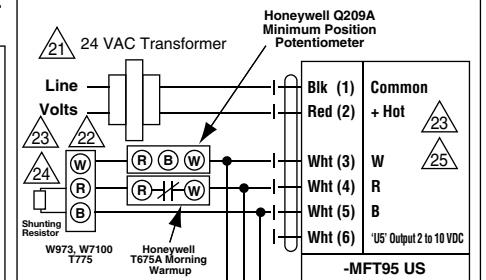
### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers



No. of actuators	Resistance
2	1300 Ω
3	910 Ω
4	768 Ω

Resistor Kit No. ZG-R06

Used with the W973 and W7100 controllers



# GKB24-3-X1 Actuators

On/Off, Floating Point

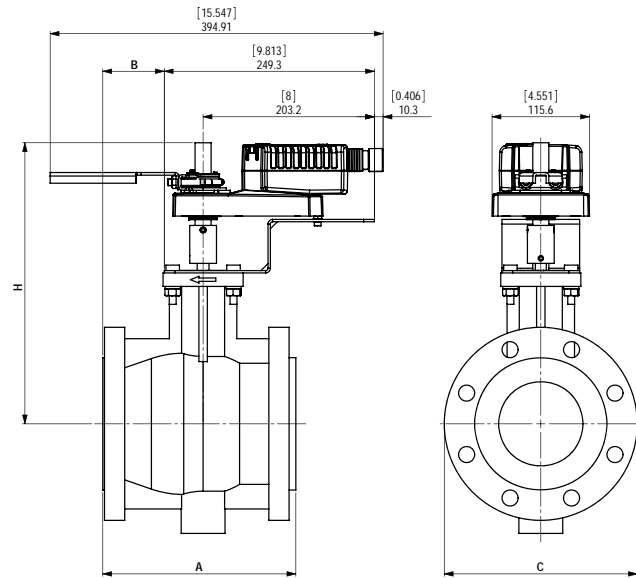


**Models**  
GKB24-3-X1



Technical Data	
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	15W (1.5W)
Transformer sizing	20VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Operation range Y	on/off, floating point
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max VDC variable
Angle of rotation	max. 95°, adjust. with mechanical stop electronically variable
Torque	360 in-lb [40Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with knob or tool 0 to 100%
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	
normal operation	95 seconds (default) variable 90 to 150 seconds
fail safe	35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	< 45dB(A) at 90 seconds
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.85 lbs [1.75 kg]

## Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6400VB-350	150	4"	100	9.02	2.87	9.02	13.13

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#### Wiring Diagrams

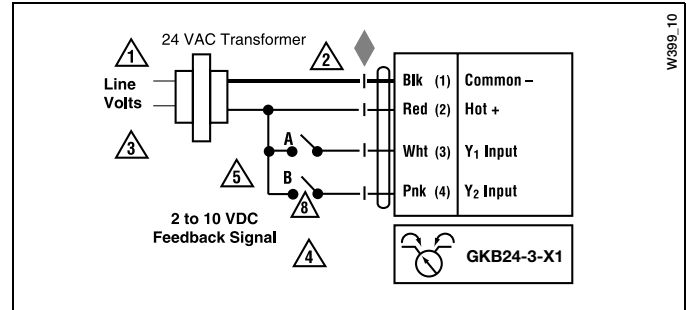
#### ✂️ **INSTALLATION NOTES**

- 1 Provide overload protection and disconnect as required.
- 2 *CAUTION Equipment Damage!*  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.

#### 📄 **APPLICATION NOTES**

- ◆ Meets UL requirements without the need of an electrical ground connection.

- ⚠️ *WARNING Live Electrical Components!*  
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# GKX24-MFT-X1 Actuators

Multi-Function Technology



**MFT**

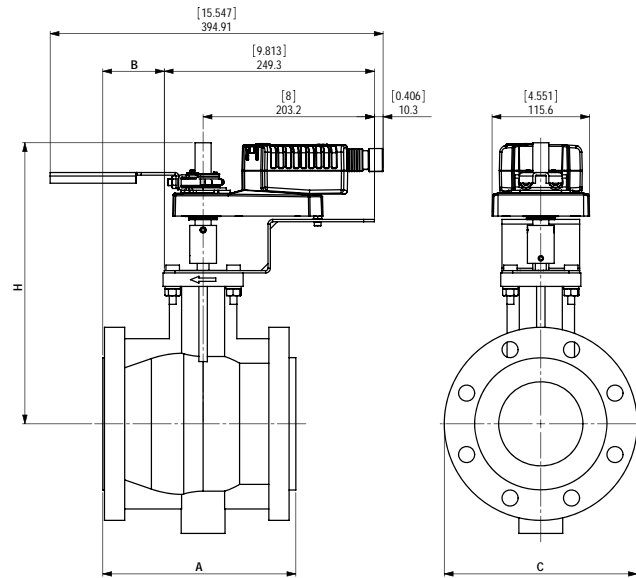


**Models**  
GKX24-MFT-X1



Technical Data	
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	15W (1.5W)
Transformer sizing	20VA (class 2 power source)
Electrical connection	18 GA plenum rated Cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default) variable (VDC,PWM, floating point, on-off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Torque	360 in-lb [40Nm]
Direction of rotation	reversible with  switch
Fail-safe position	adjustable with knob or tool 0 to 100%
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	normal operation 95 seconds (default), variable 90 to 150 seconds fail-safe 35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	< 45dB(A) at 90 seconds
Servicing	maintenance free
Quality standard	ISO 9001
Weight	3.85 lbs [1.75 kg]

## Dimensions with 2-Way Valve



Valve Body	COP	Valve Nominal Size		Dimensions (Inches)			
		Inches	DN [mm]	A	B	C	H
B6400VB-350	150	4"	100	9.02	2.87	9.02	13.13

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### Wiring Diagrams

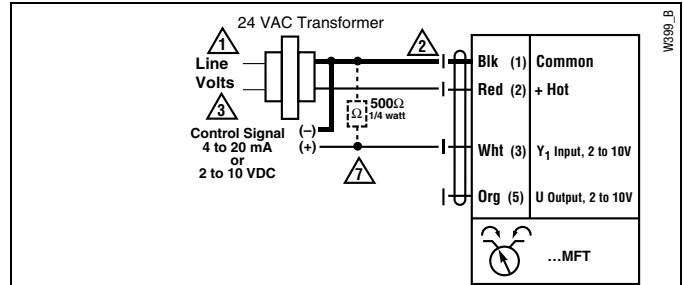
#### INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**  
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
- 5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
- 8 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.

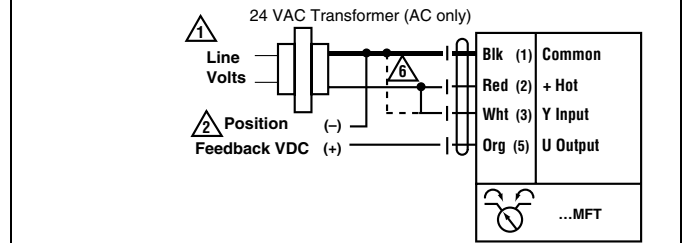
#### APPLICATION NOTES

- ◆ Meets UL requirements without the need of an electrical ground connection.

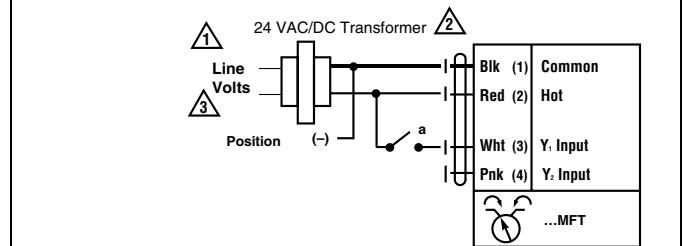
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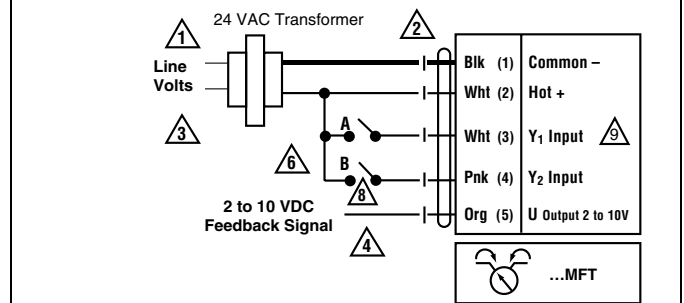
VDC/4-20 mA



PWM



On/Off

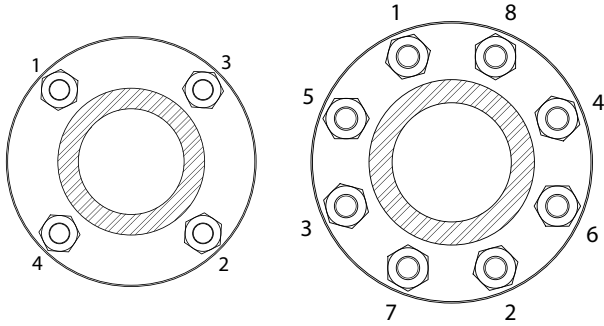


Floating Point

## Valve Installation Procedure

### 3", 4" & 6" Valves - Flanged Installation

1. Valve must be in the closed position for installation.
2. **Figure 1 illustrates a flanged valve installation.**
3. Use hex bolts & nuts to secure valve to flange.
4. Ensure proper gaskets are used between the valve flange and pipe flange.
5. Tighten bolts & nuts in alternating opposite sides until completely tightened. Please see torque requirements below. Torque wrench is required.



3" Bolt Tightening Sequence

4" & 6" Bolt Tightening Sequence



**WARNING:** Exceeding the Maximum Torque Can Damage the Valve and Void the Warranty!

- 3" ANSI 150 Flange - 65 ft/lbs
- 4" ANSI 150 Flange - 70 ft/lbs
- 6" ANSI 150 Flange - 100 ft/lbs

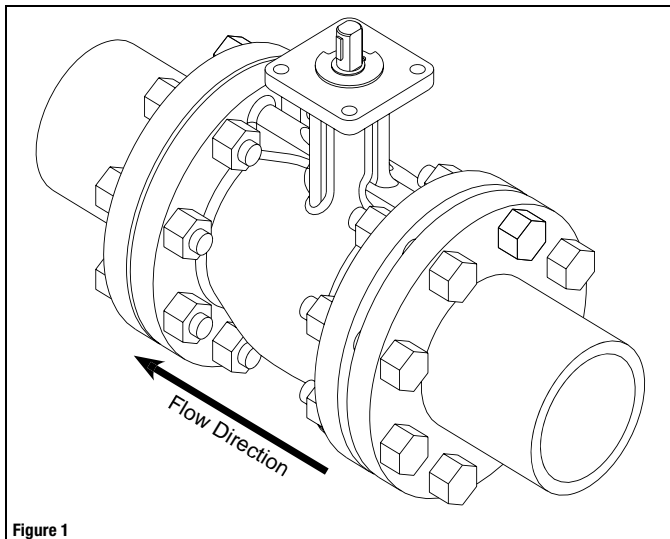


Figure 1

## Seat Replacement Procedure

### 3", 4" & 6" Valves

1. Remove valve from pipe
2. Remove 2 cap retaining washers (1)
3. Using 2 wrenches/flat-head screwdrivers, pry cap assembly (2) out of valve
4. Rotate valve to fully open position
5. Using hands, pull seat (3) out of the valve
6. Replace seat and reverse procedure to reassemble
7. Reinstall valve per installation instructions

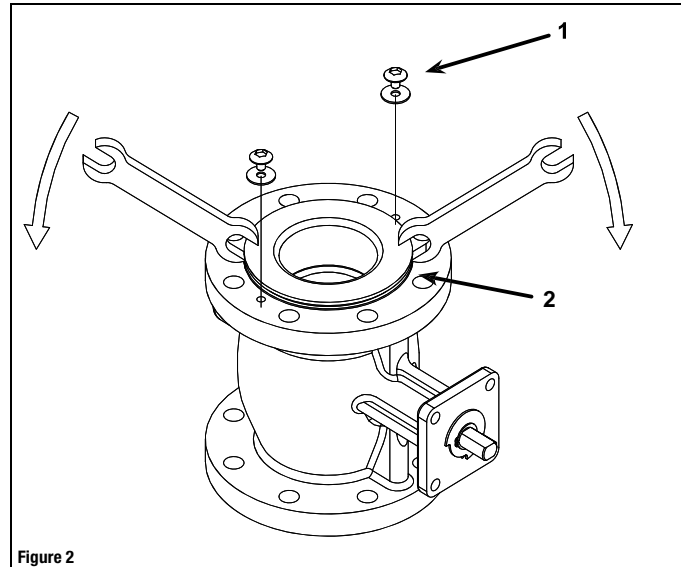


Figure 2

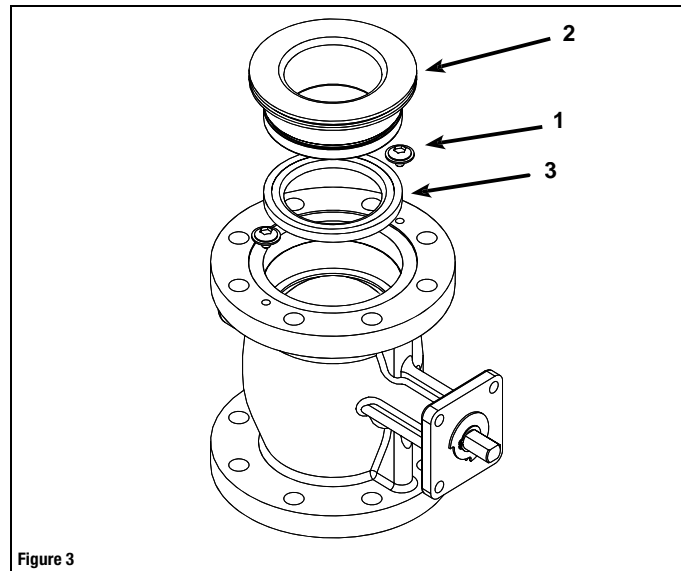


Figure 3



	Configuration (Substitute 'V' for 'P' for NV[F] actuators)	Code	Control		Motion			List Price
			Input Range	Position Feedback	Running Time†	Torque %	Adaptation	
Voltage	P-10001	A01	2.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10002	A02	0.0 to 10.0 VDC	0.0 to 10.0 VDC	150	100	Manual	●
	P-10003	A03	2.0 to 10.0 VDC	0.0 to 5.0 VDC	150	100	Manual	●
	P-10004	A04	4.0 to 7.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10005	A05	6.0 to 9.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10006	A06	10.5 to 13.5 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10007	A07	0.0 to 5.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10009	A09	5.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10010	A10	5.0 to 10.0 VDC	0.0 to 10.0 VDC	150	100	Manual	●
	P-10013	A13	0.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10015	A15	2.0 to 5.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10016	A16	2.0 to 6.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10017	A17	6.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10018	A18	14.0 to 17.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10020	A20	9.0 to 12.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10028	A28	0.0 to 10.0 VDC	0.0 to 10.0 VDC	100	100	Manual	●
	P-10031	A31	0.0 to 4.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10063	A63	0.5 to 4.5 VDC	0.5 to 4.5 VDC	150	100	Manual	●
P-10064	A64	5.5 to 10.0 VDC	5.5 to 10.0 VDC	150	100	Manual	●	
PWM	P-20001	W01	0.59 to 2.93 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20002	W02	0.02 to 5.00 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20003	W03	0.10 to 25.50 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20004	W04	0.10 to 25.60 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20005	W05	0.10 to 5.20 sec.	0.0 to 5.0 VDC	150	100	Manual	●
Floating Point	P-30001	F01	Floating point	2.0 to 10.0 VDC	150	100	Manual	●
	P-30002	F02	Floating point	0.0 to 10.0 VDC	150	100	Manual	●
	P-30003	F03	Floating point	2.0 to 10.0 VDC	100	100	Manual	●
	P-30004	F04	Floating point	0.0 to 5.0 VDC	100	100	Manual	●
	P-30005	F05	Floating point	0.0 to 10.0 VDC	100	100	Manual	●
	P-30006	F06	Floating point	0.0 to 5.0 VDC	150	100	Manual	●
On/Off	P-40001	J01	On/Off	2.0 to 10.0 VDC	75	100	Manual	●
	P-40002	J02	On/Off	2.0 to 10.0 VDC	150	100	Manual	●
	P-40003	J03	On/Off	2.0 to 10.0 VDC	75	100	Manual	●
	P-40004	J04	On/Off	0.0 to 5.0 VDC	100	100	Manual	●
	P-40005	J05	On/Off	0.0 to 10.0 VDC	100	100	Manual	●

\*P-10001 is the default configuration.

Example: AF24-MFT US is the basic model. Add the P... pre-set MFT configuration number and list price to the actuator when ordering, as needed.

Note: V-codes used for NV...Series actuator. All other MFT actuators use P-codes.

Note: Most popular configurations available at no additional cost.

Note: If the configuration needed is not listed, please fill in pg. 52 or call Customer Service.

Note: For Non-Spring Return Actuators the 3-digit code can be used in place of the P... pre-set MFT configuration number.

SY MULTI-FUNCTION TECHNOLOGY						
Description	Code	Control Input	Built-in Feedback	Loss of Signal	Running Time	
MFT	ACE	2-10 VDC	2-10 VDC	stop	actuator(s) constant	
MFT	ACF	0.5-10 VDC	0.5-10 VDC	stop	actuator(s) constant	
MFT	ACH	4-20 mA	2-10 VDC	stop	actuator(s) constant	
MFT	ACJ	2-10 VDC	2-10 VDC	open	actuator(s) constant	
MFT	ACK	0.5-10 VDC	0.5-10 VDC	open	actuator(s) constant	
MFT	ACM	4-20 mA	2-10 VDC	open	actuator(s) constant	
MFT	ACN	2-10 VDC	2-10 VDC	close	actuator(s) constant	
MFT	ACP	0.5-10 VDC	0.5-10 VDC	close	actuator(s) constant	
MFT	ACS	4-20 mA	2-10 VDC	close	actuator(s) constant	

# MFT Programming Codes, Flexible Products



## PRODUCTS

Model	Base Actuator Codes	Torque	Control Input	Feedback	Running Time	Angle of Rotation/Stroke	Power Supply	VA Rating	Weight (lb)	List Price (add to valve assembly)
AMX24-3X1	AX000	180 in-lb [20 Nm]	On/Off, Floating Point	—	95 (Default)	95 deg	24 VAC/DC	5.5	2.20	●
AMX24-MFTX1	AX100	180 in-lb [20 Nm]	2-10 VDC (Default)	2-10 VDC	150 (Default)	95 deg	24 VAC/DC	6	2.60	●
GMX24-3X1	GX000	360 in-lb [40 Nm]	On/Off, Floating Point	—	95 (Default)	95 deg	24 VAC/DC	6	3.40	●
GMX24-MFTX1	GX100	360 in-lb [40 Nm]	2-10 VDC (Default)	2-10 VDC	150 (Default)	95 deg	24 VAC/DC	7	3.40	●

	Configuration (Substitute 'V' for 'P' for NV[F] actuators)	Code	Control		Motion			List Price
			Input Range	Position Feedback	Running Time†	Torque %	Adaptation	
Voltage	P-10001	A01	2.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●*
	P-10002	A02	0.0 to 10.0 VDC	0.0 to 10.0 VDC	150	100	Manual	●
	P-10003	A03	2.0 to 10.0 VDC	0.0 to 5.0 VDC	150	100	Manual	●
	P-10004	A04	4.0 to 7.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10005	A05	6.0 to 9.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10006	A06	10.5 to 13.5 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10007	A07	0.0 to 5.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10009	A09	5.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10010	A10	5.0 to 10.0 VDC	0.0 to 10.0 VDC	150	100	Manual	●
	P-10013	A13	0.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10015	A15	2.0 to 5.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10016	A16	2.0 to 6.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10017	A17	6.0 to 10.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10018	A18	14.0 to 17.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10020	A20	9.0 to 12.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●
	P-10028	A28	0.0 to 10.0 VDC	0.0 to 10.0 VDC	100	100	Manual	●
P-10031	A31	0.0 to 4.0 VDC	2.0 to 10.0 VDC	150	100	Manual	●	
P-10063	A63	0.5 to 4.5 VDC	0.5 to 4.5 VDC	150	100	Manual	●	
P-10064	A64	5.5 to 10.0 VDC	5.5 to 10.0 VDC	150	100	Manual	●	
PWM	P-20001	W01	0.59 to 2.93 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20002	W02	0.02 to 5.00 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20003	W03	0.10 to 25.50 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20004	W04	0.10 to 25.60 sec.	2.0 to 10.0 VDC	150	100	Manual	●
	P-20005	W05	0.10 to 5.20 sec.	0.0 to 5.0 VDC	150	100	Manual	●
Floating Point	P-30001	F01	Floating point	2.0 to 10.0 VDC	150	100	Manual	●
	P-30002	F02	Floating point	0.0 to 10.0 VDC	150	100	Manual	●
	P-30003	F03	Floating point	2.0 to 10.0 VDC	100	100	Manual	●
	P-30004	F04	Floating point	0.0 to 5.0 VDC	100	100	Manual	●
	P-30005	F05	Floating point	0.0 to 10.0 VDC	100	100	Manual	●
	P-30006	F06	Floating point	0.0 to 5.0 VDC	150	100	Manual	●
On/Off	P-40001	J01	On/Off	None	75	100	Manual	●
	P-40002	J02	On/Off	2.0 to 10.0 VDC	150	100	Manual	●
	P-40003	J03	On/Off	None	75	100	Manual	●
	P-40004	J04	On/Off	0.0 to 5.0 VDC	100	100	Manual	●
	P-40005	J05	On/Off	0.0 to 10.0 VDC	100	100	Manual	●

\*P-10001 is the default configuration.

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