


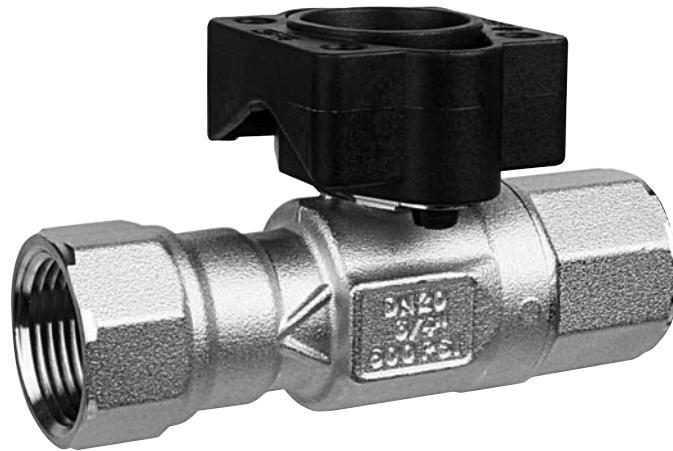
Technical Documentation High Temperature Characterized Control Valves (HTCCV)

Effective February 2010

Belimo Project: Aetna Headquarters, Hartford, Connecticut



High Temperature Characterized Control Valves (HTCCV)



BENEFIT OF THE BELIMO CHARACTERIZING DISC

- Equal percentage flow characteristic.
- Excellent control stability assured with the characterizing disc.
- C_v values equal to C_v values for globe valves of the same size.
- The need for multiple pipe reduction is usually eliminated.
- Better control prevents “hunting” of the control loop, increasing life span of actuator and valve.

FEATURES

- Thermal isolating adapter between flange and actuator.
- Easy direct coupling of actuator with a single screw.
- Perpendicular mounting flange and square drive head eliminate lateral forces on the stem.
- Blow-out proof stem with thrust-bearing Teflon® disc and double O-ring design for long service life.*
- Stainless steel ball and stem.
- Vent holes reduce condensation build-up.
- Forged dezincified brass valve body — no pin-hole leaks.
- Characterizing disc — made of Tefzel® known for excellent strength and chemical resistance.
- Teflon® seats with O-rings provide constant seating force against the ball and reduce torque requirement.
- Actuator can be mounted in four different positions.

* Designed for service life of over 100,000 full cycles.
 Teflon® and Tefzel® are both registered trademarks of Dupont.

EQUAL PERCENTAGE VALVE CHARACTERISTIC

In order to ensure good stability of control, it is essential for a control valve to have an equal percentage characteristic. This type of characteristic produces a linear variation in thermal output according to the amount of opening of the valve (also known as the system characteristic). Under normal testing conditions a conventional ball valve exhibits an S-shaped characteristic. When it is installed in a real system, however, this characteristic is seriously deformed because, compared with its nominal size, a ball valve possesses an extremely high flow coefficient. Whether used with or without pipe reducers or a reduced bore, they do not normally allow stable regulation of the thermal capacity.

Belimo’s unique High Temperature Characterized Control Valve (HTCCV) is very different. A special characterizing disc inside the valve gives it an equal percentage characteristic which makes it out perform a globe valve of the same nominal size. The flow (the C_v value) is reduced to the required value by a combination of the hole in the ball and the shaped aperture in the disc. The increase in flow as the valve is opened is very slow and controlled, and it also reduces turbulence.

This produces better part-load behavior and improved stability of control while also optimizing energy consumption.

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Feature / Benefits

High Temperature Characterized Control Valves™ (HTCCV)



COORDINATED MOTORIZED OPERATION

The optimum functionality of the Belimo HTCCV is assured by properly coordinating its actuation with MFT. Specially developed rotary actuators provide the necessary precision for modulating, floating-point, and on/off methods of control.

All HTCCVs are supplied with the appropriate rotary actuator to provide the close-off and operation desired.

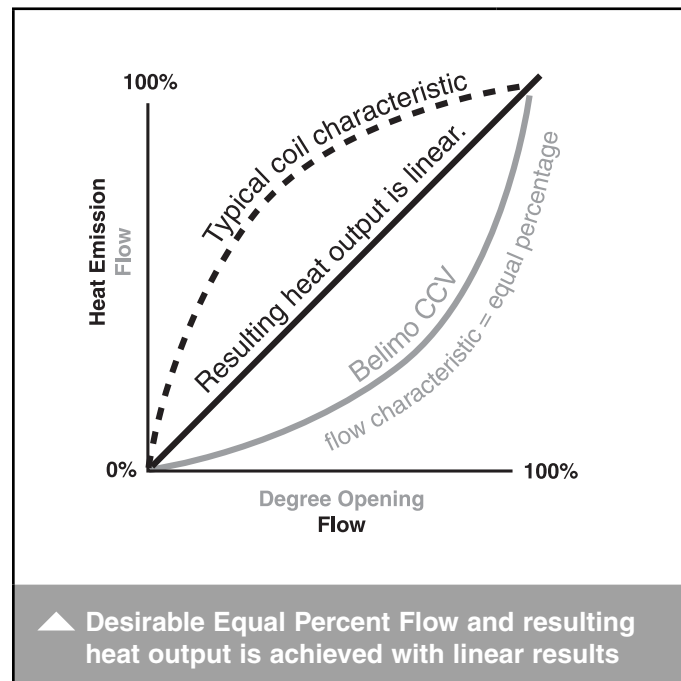
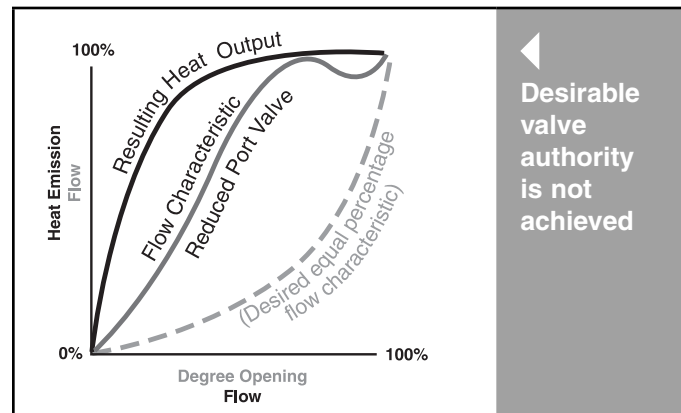
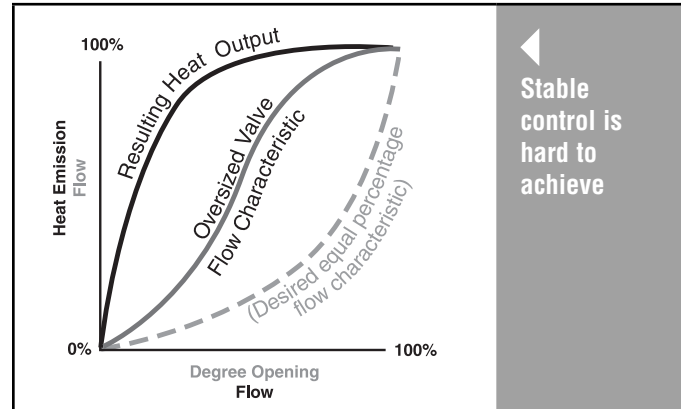
OPTIMIZED FOR CONTROL

The Belimo HTCCV marries known technology with an innovative development – the unique fluid dynamical designed characterizing disc.

The marriage of HTCCV and MFT technologies has produced a range of valuable features which surpass the capabilities of globe valves at a very attractive price level:

- An equal-percentage valve characteristic
- Unlike a globe valve, no sudden change in inlet flow upon opening
- Excellent stability of control
- C_v values comparable with those of globe valves of the same size
- Higher close-off ratings than standard globe valves
- 100% tight shut-off on two-way valves means NO leak-by unlike globe valves that have ANSI IV shutoff (leakage rate of 0.01% of the C_v rating)

Flow Characteristics of Conventional Ball Valves versus BELIMO CHARACTERIZED CONTROL VALVES



B2 Series	Two-way
1/2" to 1"	
Service:	Water/low pressure steam 60% glycol
C_v Range	0.29-28
Material:	Stainless trim
Control:	On/Off, Floating, 2-10 VDC Multi-Function Technology® Spring Return or Non-Spring Return

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

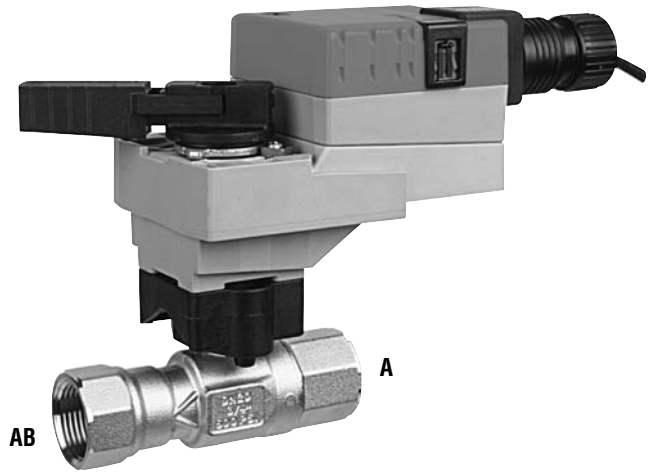
SET-UP

		TWO-WAY VALVE (Specify upon ordering)	
NON-SPRING RETURN Stays in Last Position	TR24-3 US	Power to pin 2 will drive valve CCW. Power to pin 3 will drive valve CW.	
	TR24-SR US	NC: Closed A to AB, will open as voltage increases.	NO: Open A to AB, will close as voltage increases (Can be chosen with switch inside terminal block of actuator).
	LRB24-3, LRB24-SR, LRX24-MFT	Power to pin 2 will drive valve CW. Power to pin 3 will drive valve CCW. The above will function when the directional switch is in the "1" position, to reverse select the "0" position.	NO: Open A to AB, will close as voltage increases or power applied. (Can be chosen with CW/CCW switch).
SPRING RETURN Note Fail Position	TFX24 US LF24 US	NO/FO Valve: Open A to AB will drive closed. Spring Action: Will spring open A to AB upon power loss.	NC/FC Valve: Closed A to AB will drive open. Spring Action: Will spring closed A to AB upon power loss.
	TF (-3), MFT, SR LF (-3), MFT, SR Floating or Proportional type actuators	NC/FO Valve: Closed A to AB will drive open. Spring Action: Will spring open A to AB upon power loss.	NC/FC or NO/FC Valve: Closed A to AB or Open A to AB (Can be chosen with CW/CCW switch). Spring Action: Will spring closed A to AB upon power loss. NO/FO Valve: Open A to AB Spring Action: Will spring open A to AB upon power loss. (NO action can be chosen with CW/CCW switch).

Technical Data, Flow, Assembly and Installation High Temperature Characterized Control Valves™ (HTCCV)

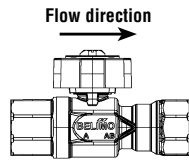
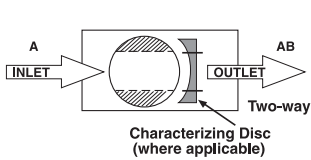


Service	potable hot water, 60% glycol, steam
Flow characteristic	A-port equal percentage
Media temp range	60°F to 266°F [15.6°C to 130°C] Water max 250°F (120°C) Steam
Maximum differential pressure (ΔP)	60 psi typical application 116 psi full open only (Model # B215HT455) steam: 15 psi
Maximum inlet	steam: 15 psi
Leakage	0% for A to AB



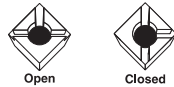
FLOW PATTERN

2-way High Temperature Characterized Control Valves™



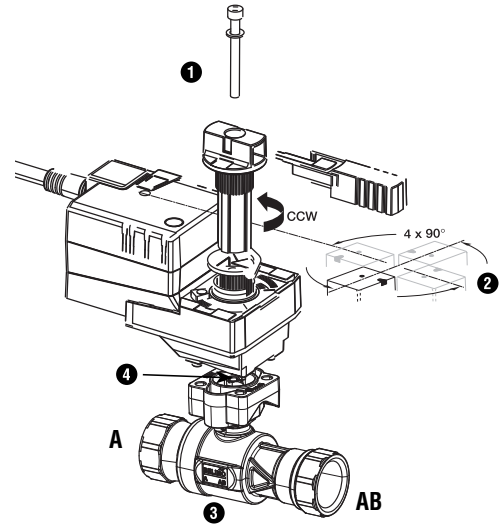
Upstream A
Downstream AB

Valve should be installed with the disc downstream unlike the CCV.



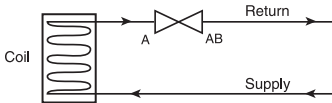
ASSEMBLY

- 1 One screw attaches to valve
- 2 Four actuator mounting positions
- 3 2-way flow pattern
- 4 Top of valve stem indicates direction of flow (Flow A to AB shown)

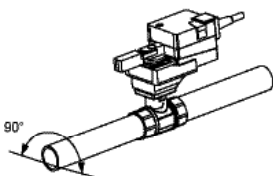


OPERATION/INSTALLATION

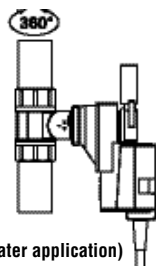
2-way Valve Piping Diagram
(1 Input, 1 Output)



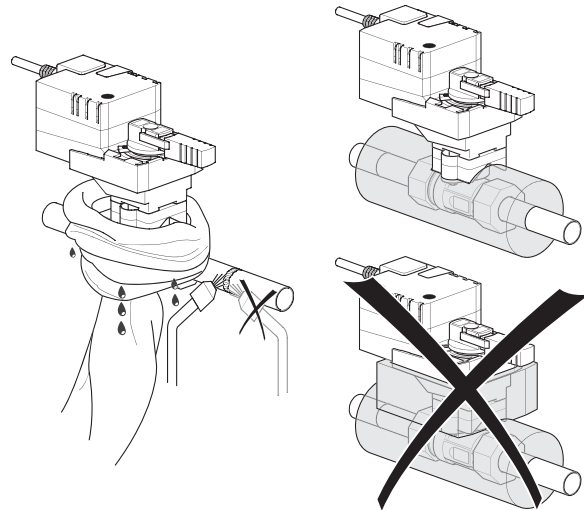
Assembly can be mounted horizontally or vertically for water applications. For steam applications the valve can be mounted vertically but if mounted horizontally the valve must be 90° off center of the pipe. Do not install with actuator below pipe.



(Water application only)



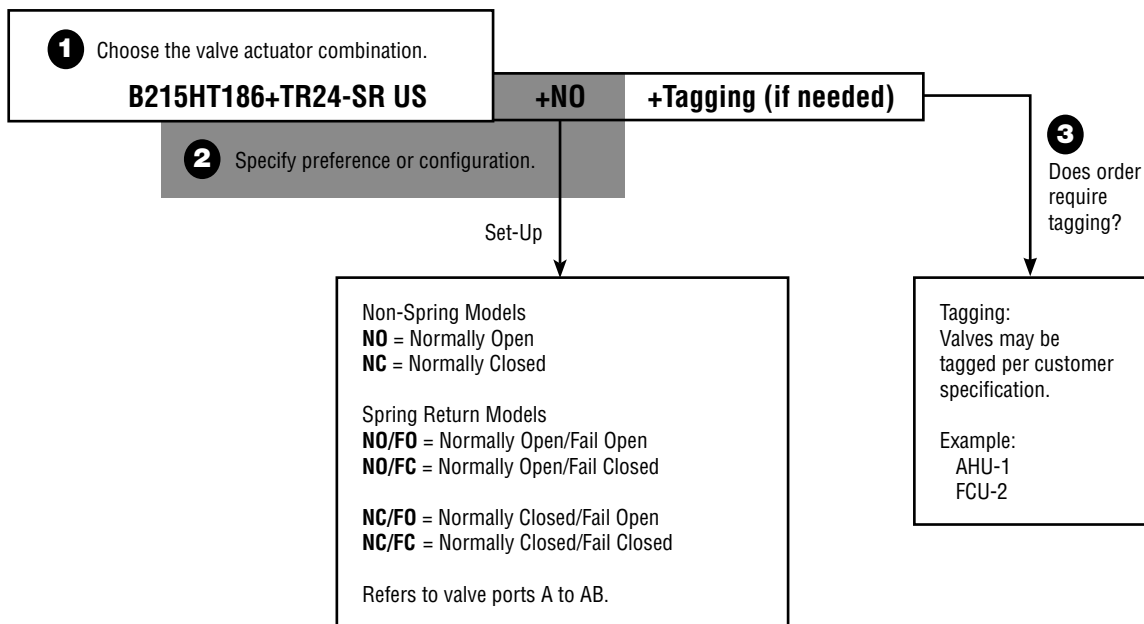
(Steam or water application)



IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

B2	15	HT	186	TR	24	-SR	
Valve B2 = 2-way	Valve Size 15-25 = 1/2" -1"	High Temperature	Cv Rating 1.86 Refer to Table	Actuator Type Non-Spring Return TR... LR... Spring Return TF... LF...	Power Supply 24 = 24 VAC/DC 120 = 120 VAC*	Control Blank = On/Off -3 = Floating Point -SR = 2-10 VDC -MFT = Multi-Function Technology	-S = Built-in Auxiliary Switch

ORDERING EXAMPLE

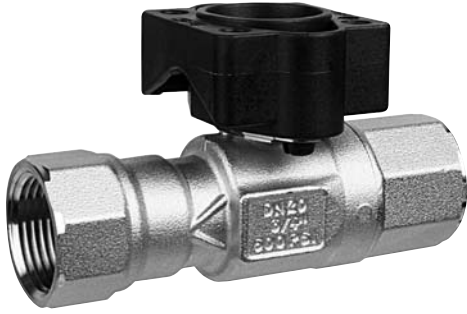


4 Complete Ordering Example: **B215HT186+TR24-SR US+NO**

*TF Series has 100 to 240 VAC nominal power supply.

B2...HT... Two-way High Temperature Characterized Control Valve

Stainless Steel Ball and Stem



Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

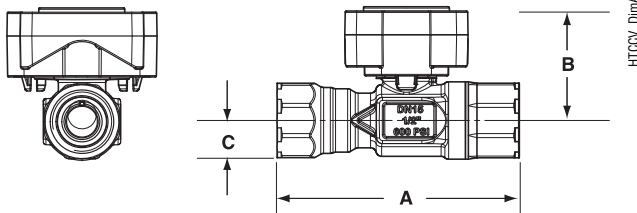
This valve is designed to fit in compact areas where on/off or floating point control is required using 24 VAC.

Technical Data	
Service	potable water/low pressure steam, 60% glycol
Flow characteristic	A-port equal percentage
Sizes	½", ¾", 1"
Type of end fitting	female, NPT
Materials:	
Body	brass (DZR) P-CuZn35Pb2
Ball	stainless steel
Stem	stainless steel
Seats	PTFE Teflon
Characterizing disc	PTFE Teflon
Packing	2 EPDM O-rings
Pressure rating	600 psi
Media temperature range	
Steam	250°F (15 psig)
Hot water	37°F - 266°F
Close off pressure	200 psi
Maximum differential pressure (ΔP)	116 psi full open ball 60 psi partially open ball
Leakage	bubble tight 0%

C _v	Valve Nominal Size		Type	Suitable Actuators	
	Inches	DN [mm]	2-way NPT	Spring	Non-Spring
0.29	½	15	B215HT029	TF Series	TR Series
0.46	½	15	B215HT046		
0.73	½	15	B215HT073		
1.16	½	15	B215HT116		
1.86	½	15	B215HT186		
2.90	½	15	B215HT290		
4.55	½	15	B215HT455*	LF Series	LR Series
1.86	¾	20	B220HT186		
2.90	¾	20	B220HT290		
4.64	¾	20	B220HT464		
7.31	¾	20	B220HT731		
9.28	¾	20	B220HT928		
13.20	¾	20	B220HT1320		
4.64	1	25	B225HT464		
7.31	1	25	B225HT731		
11.6	1	25	B225HT1160		
18.56	1	25	B225HT1856		
28.00	1	25	B225HT2800		

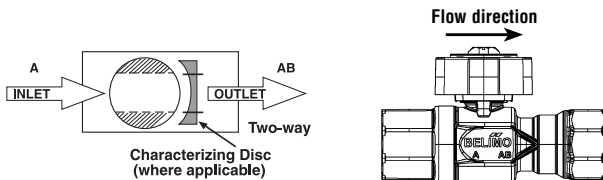
* modified equal percentage

Dimensions



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	½"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]
B220HT	¾"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

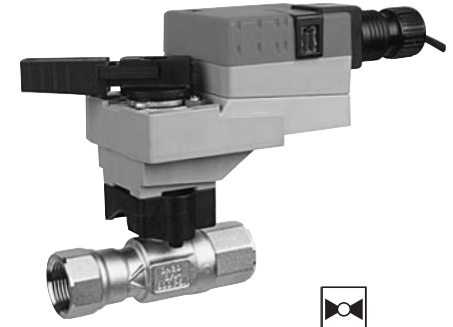
Flow Patterns



IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

C _v	Valve Nominal Size		Type	Suitable Actuators	
	Inches	DN [mm]		Spring Return	Non-Spring Return
0.29	½	15	B215HT029	TF Series	TR Series
0.46	½	15	B215HT046		
0.73	½	15	B215HT073		
1.16	½	15	B215HT116		
1.86	½	15	B215HT186		
2.90	½	15	B215HT290		
4.55	½	15	B215HT455*	LF Series	LR Series
1.86	¾	20	B220HT186		
2.90	¾	20	B220HT290		
4.64	¾	20	B220HT464		
7.31	¾	20	B220HT731		
9.28	¾	20	B220HT928		
13.20	¾	20	B220HT1320		
4.64	1	25	B225HT464		
7.31	1	25	B225HT731		
11.6	1	25	B225HT1160		
18.56	1	25	B225HT1856		
28.00	1	25	B225HT2800		

* modified equal percentage



Applications

- Water/low pressure steam control of air handling apparatus in ventilation and air-conditioning systems
- District heating
- Humidifier

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 to the valve to the position dictated by the control signal and change the flow.

Product Features

Equal-percentage characteristic of the flow; models with * have modified equal percentage characteristic.

Actuator Specifications

Control type	On/Off, Floating Point, 2-10 VDC Multi-Function Technology (MFT)
Manual override	(only LR, TR Series)
Electrical connection	3 ft [1m] cable with ½" conduit fitting (except TR)

Valve Specifications

Service	potable hot water, 60% glycol, steam
Flow characteristic	A-port equal percentage
Controllable flow range	75°
Sizes	½" - 1"
Type of end fitting	NPT female ends
Materials	
Body	brass (DZR) P-CuZn35Pb2
Ball	stainless steel
Stem	stainless steel
Seats	Tefzel®
Characterizing disc	Tefzel®
Packing	EPDM O-rings
Pressure rating	600 psi
Media temp range	
Steam	250°F
Water	60°F to 266°F
Close off pressure	200 psi
Maximum differential pressure (DP)	60 psi partially open ball 116 psi full open only (Model #B215HT455)
Steam	15 psi
Maximum inlet pressure	
Steam	15 psi
Leakage	bubble tight 0%
C _v rating	see above product chart for values

TR24-3 Actuators, On-Off, Floating Point



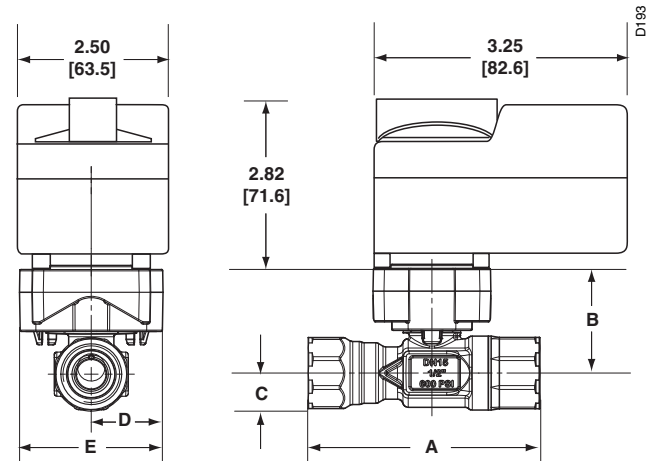
Models

TR24-3 US

Technical Data	
Control	On/Off, Floating Point
Input impedance	.36 kΩ
Nominal voltage	24 VAC 50/60 Hz
Nominal voltage range	19.2...28.8 VAC
Power consumption	1 W
Transformer sizing	1VA (class 2 power source)
Electrical connection	screw terminals accessible after removal of small cover (3 ft, 10 ft, 16 ft cables optional)
Angle of rotation	90°
Position indication	integrated into handle
Manual override	push down handle
Running time	90 seconds @ 60 hz, 108 seconds @ 50 hz
Humidity	5 to 95% non-condensing
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 1/IP40
Housing rating	UL94-5V(B)
Agency listing†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	Max. 35 db (A)
Quality standard	ISO 9001

† Rated impulse voltage 330V, Control pollution degree 2, Type of action 1

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	1/2"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

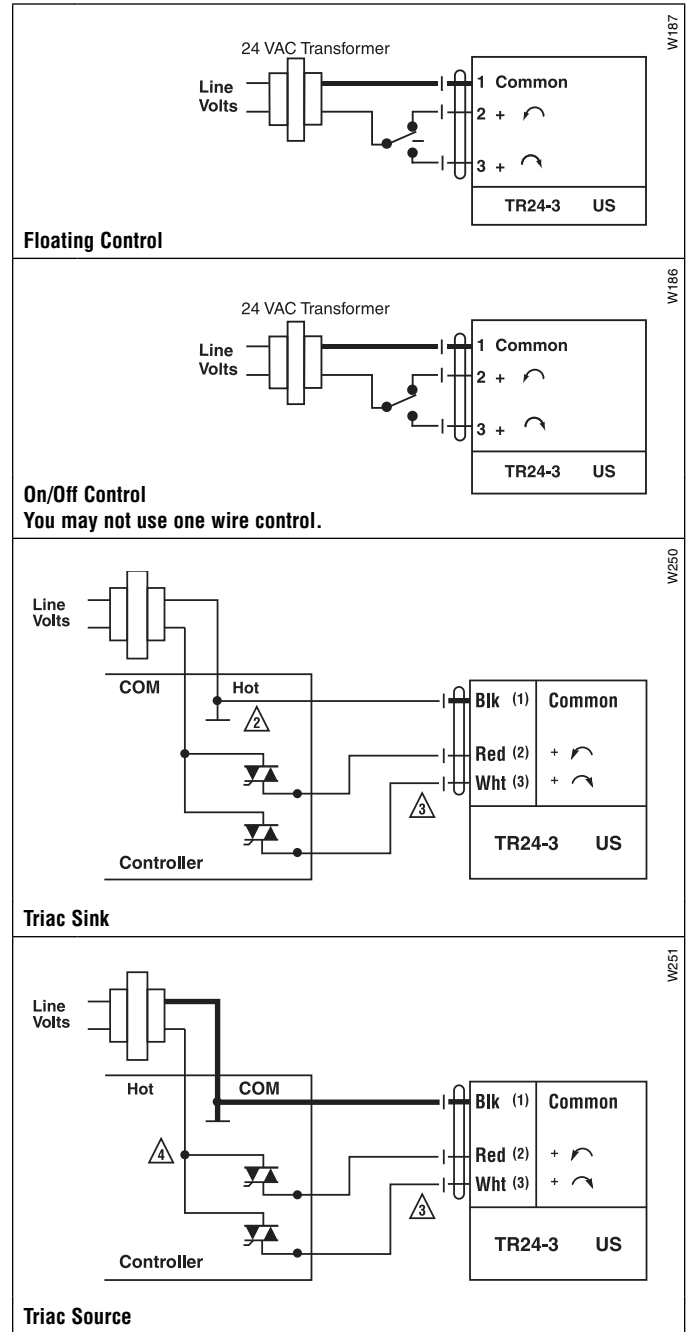
Wiring Diagrams

✂ INSTALLATION NOTES

- 2 The common connection from the actuator must be connected to the Hot connection of the controller.
- 3 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 4 The actuator Hot must be connected to the control board Hot.

⚠ 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.

NOTE: TR24-3 US cannot be wired in parallel with themselves or any other actuator.



M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

TR24-SR Actuators, Proportional



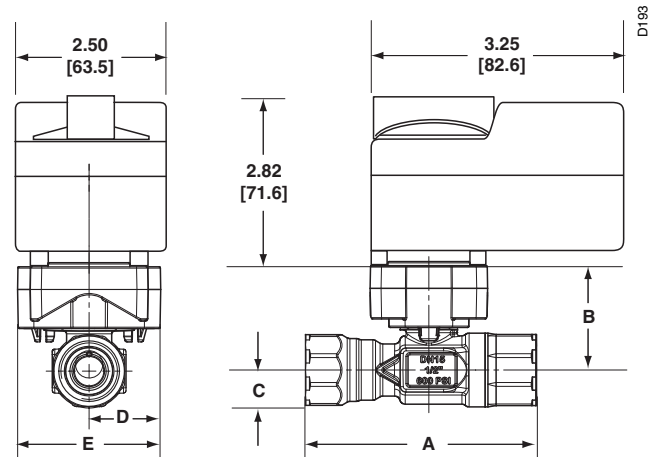
Models

TR24-SR US

Technical Data	
Control	Proportional reversing switch under cover
Input impedance	100 kΩ
Nominal voltage	24 VAC 50/60 Hz, 24 VDC
Nominal voltage range	19.2...28.8 VAC, 21.6...28.8 VDC
Power consumption	0.5 W
Transformer sizing	1VA (class 2 power source)
Electrical connection	screw terminals accessible after removal of small cover (3 ft, 10 ft, 16 ft cables optional)
Angle of rotation	90°
Position indication	integrated into handle
Manual override	push down handle
Running time	90 seconds
Humidity	5 to 95% non-condensing
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 1/IP40
Housing rating	UL94-5V(B)
Agency listing†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	max. 35 db (A)
Quality standard	ISO 9001

† Rated impulse voltage 500V, Control pollution degree 2, Type of action 1

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	½"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

✂ INSTALLATION NOTES

△² Actuators with color coded wires are optional.
Wire numbers are provided for reference.

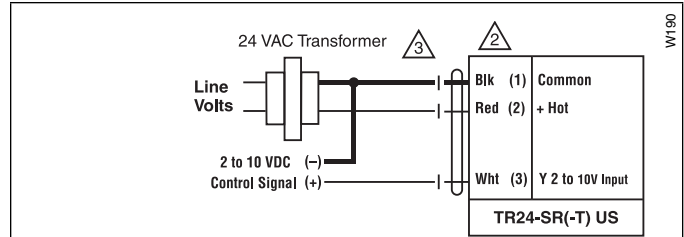
CAUTION Equipment damage!

Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

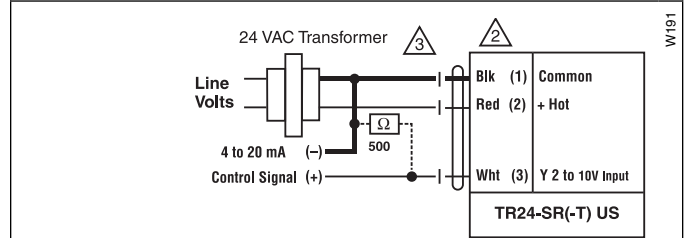
△³ Actuators may also be powered by 24 VDC.

⚠ 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.



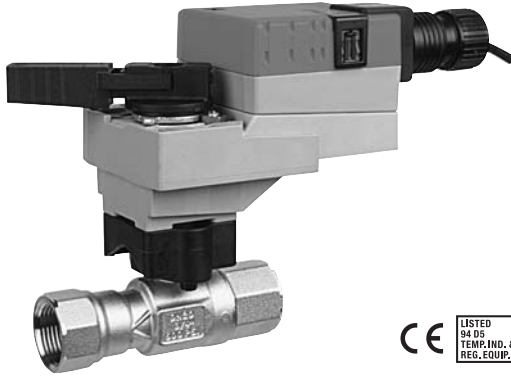
2 to 10 VDC Control



4 to 20 mA Control

Direct/Reverse acting switch is under wiring cover.
R = CW with decrease in signal
L = CCW with decrease in signal
No feedback

LRB24-3 Actuators, On/Off, Floating Point



Models

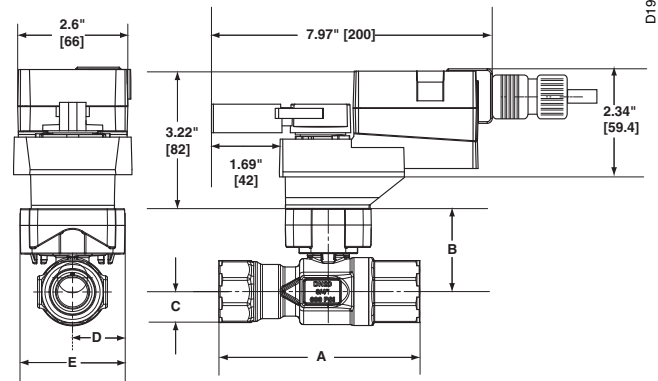
LRB24-3
LRB24-3-S w/built-in Aux. Switch

Technical Data	
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running 1.5 W holding 0.2 W
Transformer sizing	3 VA (class 2 power source)
Electrical connection	3 ft, 18 GA, Plenum rated cable ½" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Control	On/Off, Floating Point
Input impedance	600 Ω
Angle of rotation	90°, adjustable with mechanical stop
Direction of rotation	reversible with protected switch
Position indication	handle
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 type	NEMA 2/IP54
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	less than 35 dB(A)
Quality standard	ISO 9001

LRB24-3-S	
Auxiliary switch	1 SPDT, 3A (0.5A) @ 250 VAC, UL Listed, adjustable 0° to 100°

† Rated impulse voltage 800V, Control pollution degree 3, Type of action 1 (1.B for -S models)

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	½"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]
B220HT	¾"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

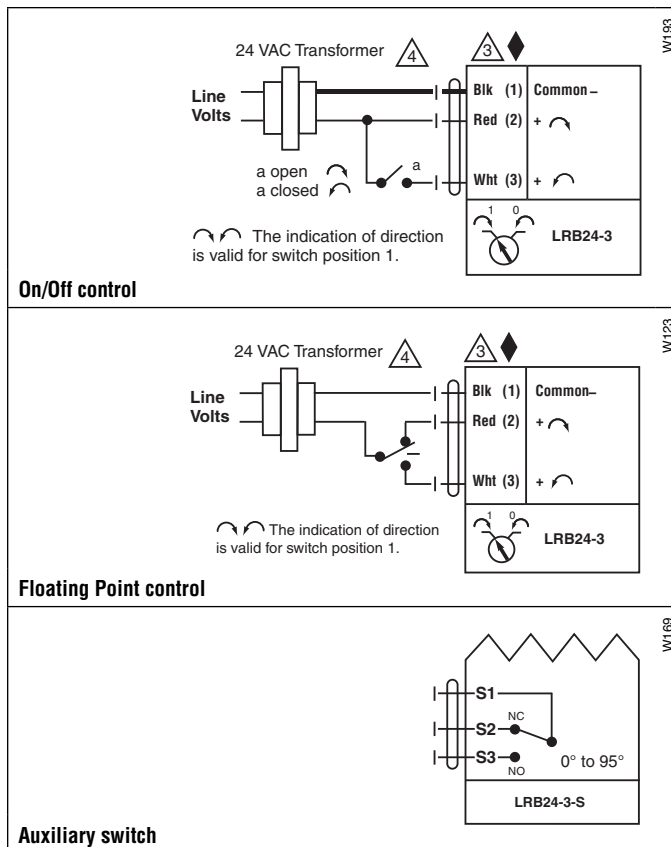
Wiring Diagrams

✂️ INSTALLATION NOTES

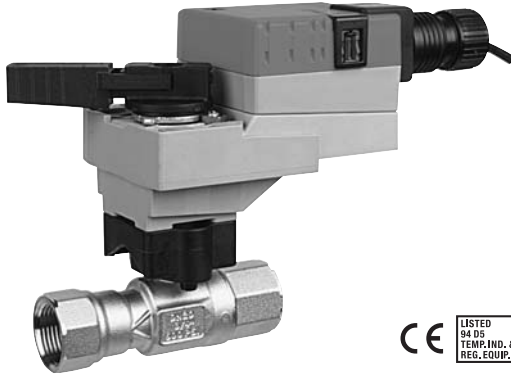
- ⚠️ **CAUTION Equipment damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- ⚠️ Actuators are provided with color coded wires.
- ⚠️ Wire numbers are provided for reference.
- ⚠️ Actuators may also be powered by 24 VDC.

📄 APPLICATION NOTES

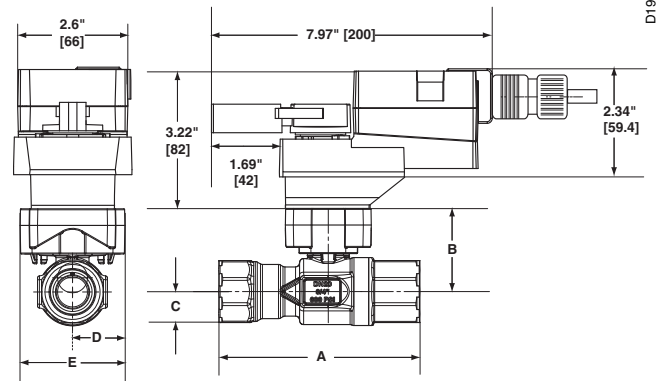
- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.
- ⚠️ **WARNING Live Electrical Components!**
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed 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.



LRB24-SR Actuators, Proportional



Dimensions with 2-Way Valve



D196

Model

LRB24-SR

Technical Data	
Power supply	24 VAC ±20% 50/60 Hz 24 VDC ±10%
Power consumption	running 1.5 W holding 0.4 W
Transformer sizing	3 VA (class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable ½" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100 kΩ (0.1 mA), 500 Ω
Angle of rotation	90°, adjustable with mechanical stop
Direction of rotation	reversible with protected switch
Position indication	handle
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 2/IP54
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<35 dB(A)
Quality standard	ISO 9001

† Rated impulse voltage 800V, Control pollution degree 3, Type of action 1
(1.B for -S models)

Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	½"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]
B220HT	¾"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

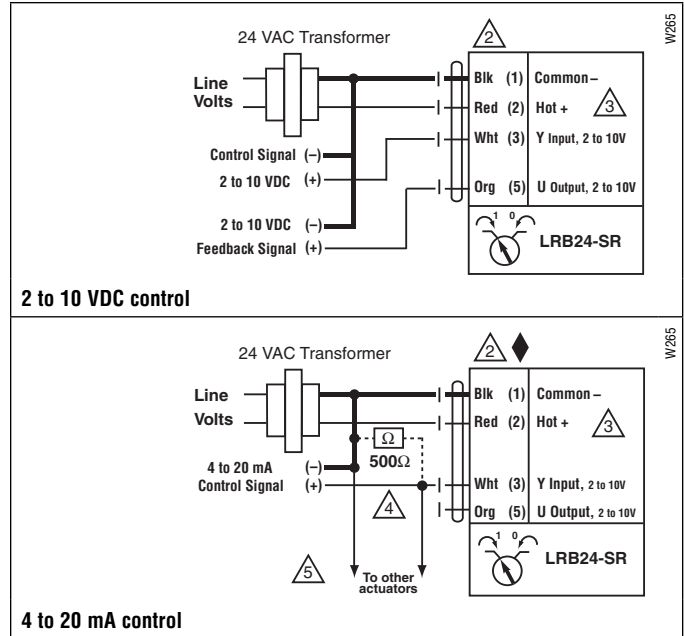
✂ INSTALLATION NOTES

- ⚠ **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.

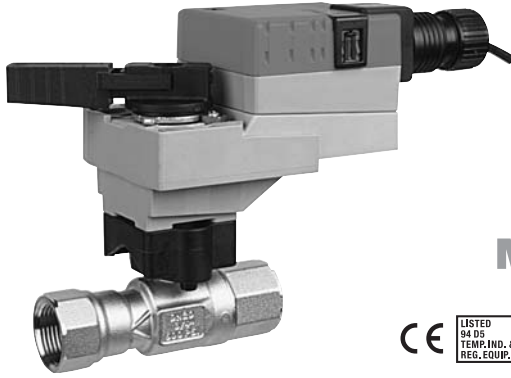
📄 APPLICATION NOTES

- ◆ 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.



LRX24-MFT Actuators, Multi-Function Technology



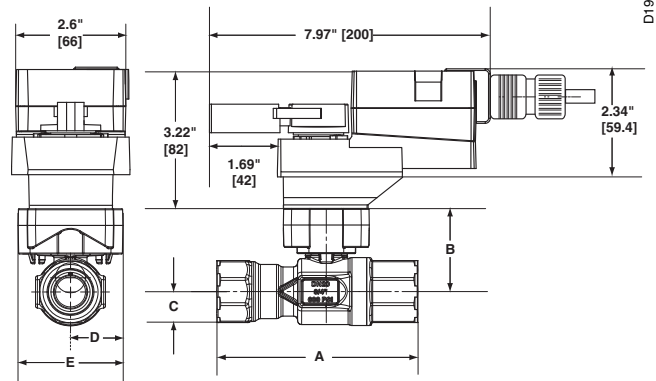
Model

LRX24-MFT

Technical Data	
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running 2 W holding 1.2 W
Transformer sizing	3.5 VA (class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector □ 3 ft [1m] □ 10 ft [3m] □ 16 ft [5m]
Overload protection	electronic throughout 0° to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (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 10 VDC, 0.5mA max VDC Variable
Angle of rotation	max. 95°, adjust. with mechanical stop electronically variable
Torque	45 in-lb [5 Nm]
Direction of rotation	reversible with protected switch
Position indication	handle
Manual override	external push button
Running time	150 seconds (default) Variable (35 to 150 secs)
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 2/IP54
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	<35 dB(A)
Quality standard	ISO 9001
Weight	1.5 lbs [0.7 kg]

† Rated impulse voltage 800V, Control pollution degree 3,
Type of action 1 (1.B for -S models)

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	1/2"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]
B220HT	3/4"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

INSTALLATION NOTES

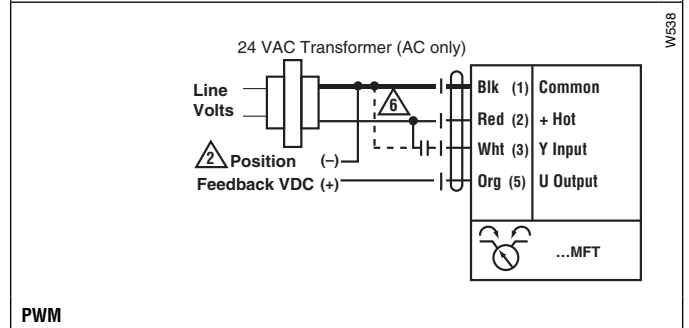
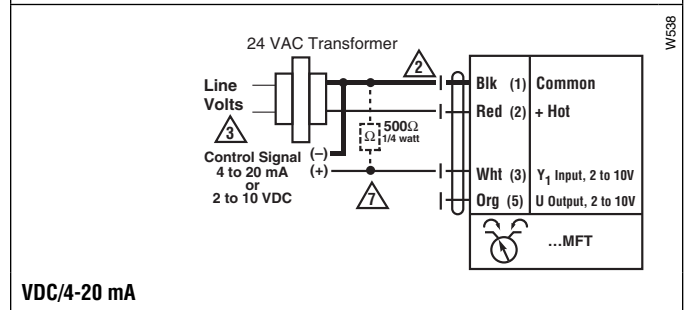
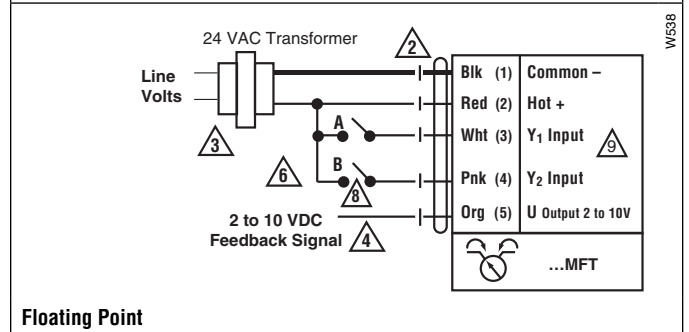
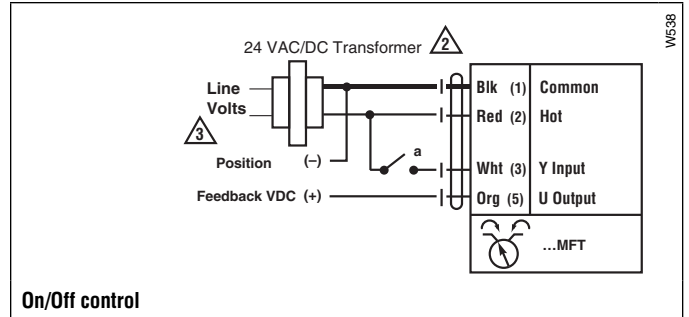
- 2** **CAUTION Equipment damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- 3** Actuators may also be powered by 24 VDC.
- 4** Position feedback cannot be used with Triac sink controller.
The actuator internal common reference is not compatible.
- 6** 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.
- 9** For triac sink the common connection from the actuator must be connected to the hot connection.

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.

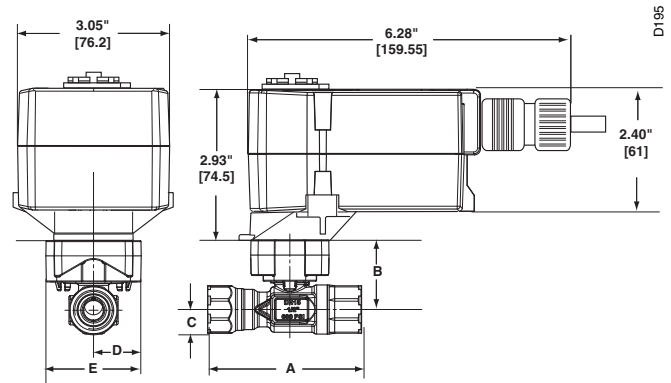
! WARNING Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components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

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.





Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	1/2"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]

Models

- TFX24 US
- TFX24-S US w/built-in Aux. Switch
- TFX120 US
- TFX120-S US w/built-in Aux. Switch

Technical Data

Control	On/Off
Power supply	24VAC ± 20%, 50/60Hz
TFX24(-S) US	24VDC ± 10%
TFX120(-S) US	(nominal) 100 to 240 VAC, 50/60 Hz (tolerance) 85 to 265 VAC, 50/60 Hz
Power consumption	running 2.5 W
	holding 1.3 W
Transformer sizing	4 VA (class 2 power source)
TFX24(-S) US	5 VA (class 2 power source)
TFX120(-S) US	
Electrical connection	3 ft, 18 GA appliance cable (-S models have 2 cables) (6 ft, 10 ft cables optional) 1/2" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Angle of rotation	95°
Torque	min. 18 in-lb [2 Nm]
Direction of rotation	reversible with protected mounting
Position indication	visual indicator, 0° to 95°
Running time	motor < 75 sec (0 to 18 in-lb)
	spring < 75 sec @ -22°F to +122°F [-20°C to +50°C]
Humidity	5 to 95% RH non-condensing
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/IP42
Housing material	UL94 - 5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC (and 2006/95/EC for line voltage and/or -S versions)
Noise level (max)	running < 40 db (A)
	spring return < 40 db (A)
Quality standard	ISO 9001

TFX...-S

Auxiliary switch	1 x SPDT, 3A (0.5A) @ 250 VAC, UL Listed adjustable 0° to 95°
------------------	---

† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3, Type of action 1.AA (1.AA.B for -S models)

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

✂️ INSTALLATION NOTES



CAUTION Equipment damage!

Actuators may be connected in parallel.
Power consumption and input impedance must be observed.



Actuators may also be powered by 24 VDC.



APPLICATION NOTES

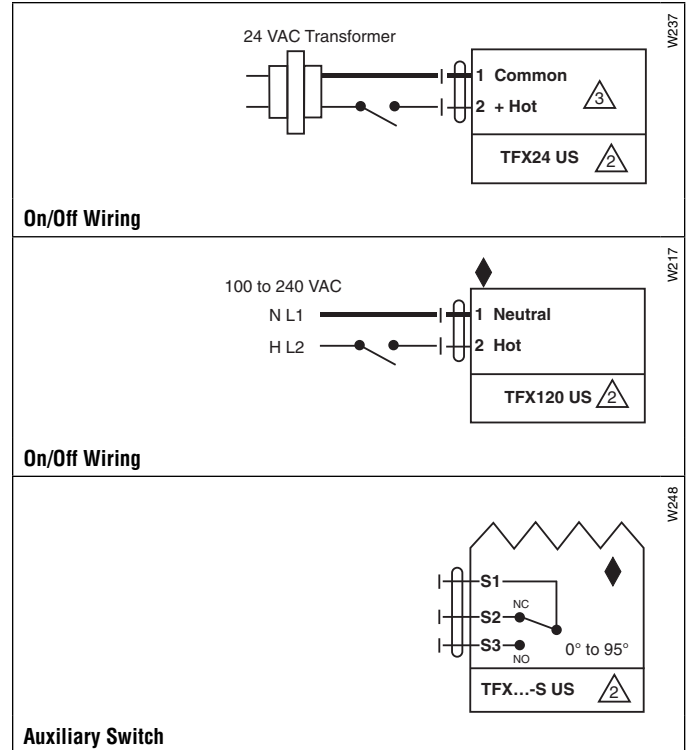


Meets cULus or UL and CSA requirements without the need of an electrical ground connection.



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.



Wiring Diagrams

INSTALLATION NOTES



CAUTION Equipment damage!

Actuators may be connected in parallel.
Power consumption and input impedance must be observed.



The common connection from the actuator must be connected to the Hot connection of the controller.



The actuator Hot must be connected to the control board common.



For end position indication, interlock control, fan startup, etc., TF24-3-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL listed, adjustable 0° to 95°.



Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers.



APPLICATION NOTES

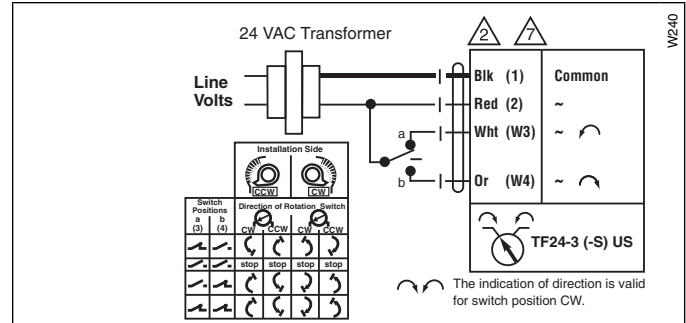


Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

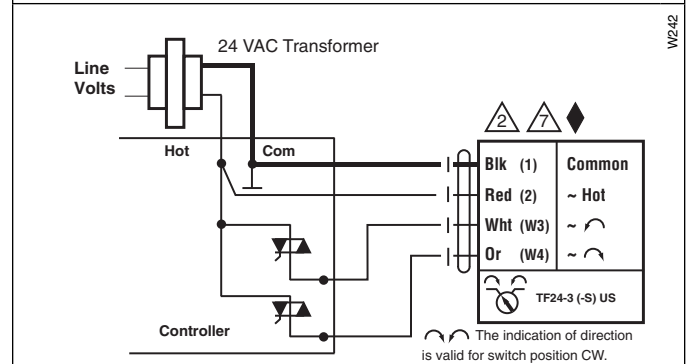


WARNING Live Electrical Components!

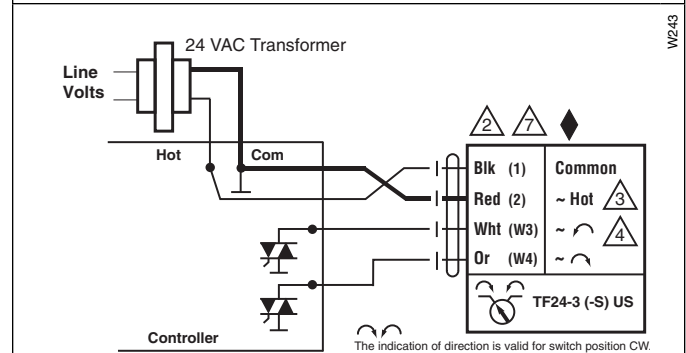
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow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



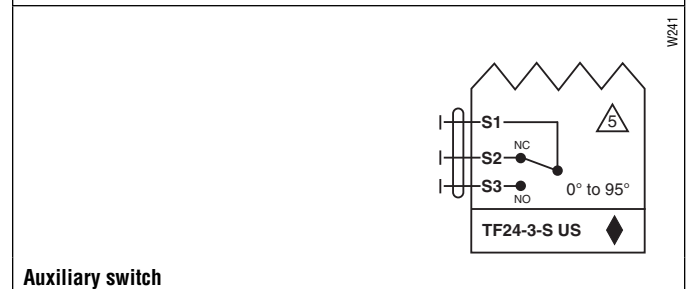
Floating point control



Triac source

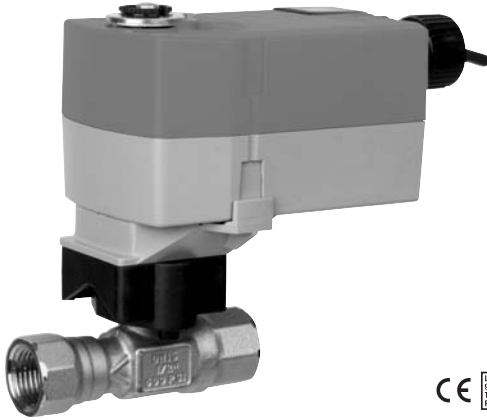


Triac sink with separate transformers

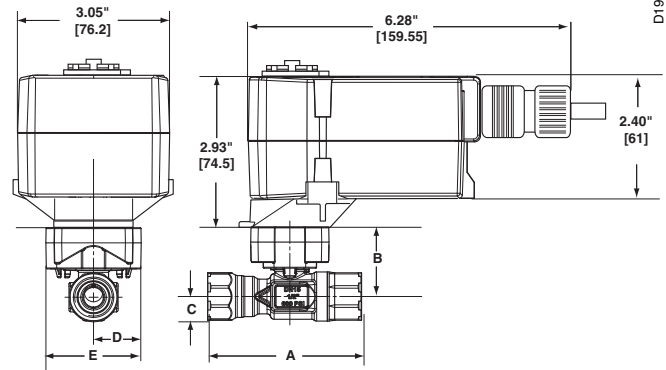


Auxiliary switch

TF24-SR US Actuators, Proportional



Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	1/2"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]

Models

TF24-SR US
TF24-SR-S US w/built-in Aux. Switch

Technical Data		
Control		Proportional
Power supply		24 VAC ± 20%, 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1.0 W
Transformer sizing		4 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable (-S model has 2 cables) (6 ft, 10 ft cables optional) 1/2" conduit connector
Electrical protection		actuators are double insulated
Overload protection		electronic throughout 0° to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20 mA
Input impedance		100k Ω (0.1mA), 500 Ω
Angle of rotation		95°
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in switch
Position indication		visual indicator, 0° to 95°
Running time	motor	95 sec constant, independent of load
	spring	< 25 sec @ -4°F to +122°F [-20°C to +50°C] < 60 sec @ -22°F [-30°C]
Humidity		5 to 95% RH non-condensing
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/IP42
Housing material		UL94 - 5VA
Agency listings†		cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC (and 2006/95/EC for line voltage and/or -S versions)
Noise level (max)	running	< 35 db (A)
	spring return	< 62 db (A)
Quality standard		ISO 9001

TF24-SR-S US	
Auxiliary switch	1 x SPDT, 3A (0.5A) @ 250 VAC, UL Listed, adjustable 0° to 95°

† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3, Type of action 1.AA (1.AA.B for -S models)

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

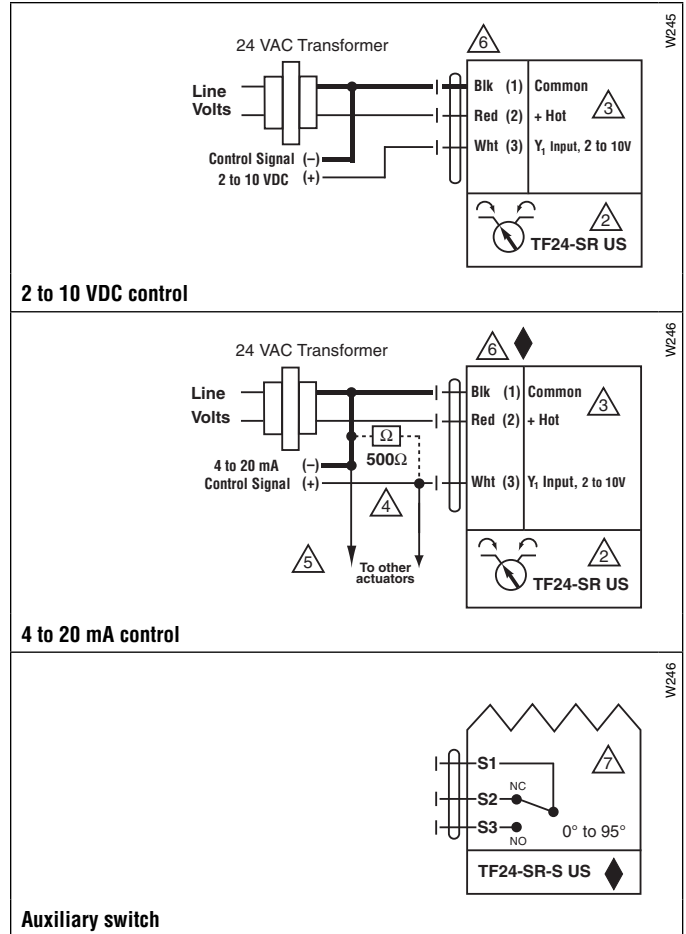
✂️ INSTALLATION NOTES

- ⚠️ 2 CAUTION Equipment damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- ⚠️ 4**
Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required.
Power consumption must be observed.
- ⚠️ 3**
Actuators may also be powered by 24 VDC.
- ⚠️ 5**
Only connect common to neg. (—) leg of control circuits.
- ⚠️ 6**
Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- ⚠️ 7**
For end position indication, interlock control, fan startup, etc., TF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL listed, adjustable 0° to 95°.

📄 APPLICATION NOTES

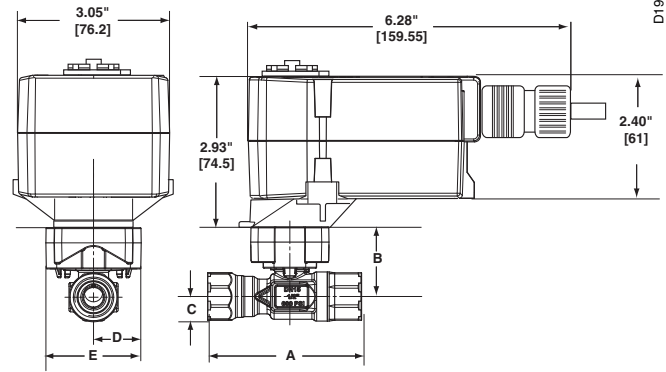
- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

- ⚠️ 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.





Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B215HT	1/2"	15	3.33" [84.6]	2.09" [53.2]	0.53" [13.5]

Models

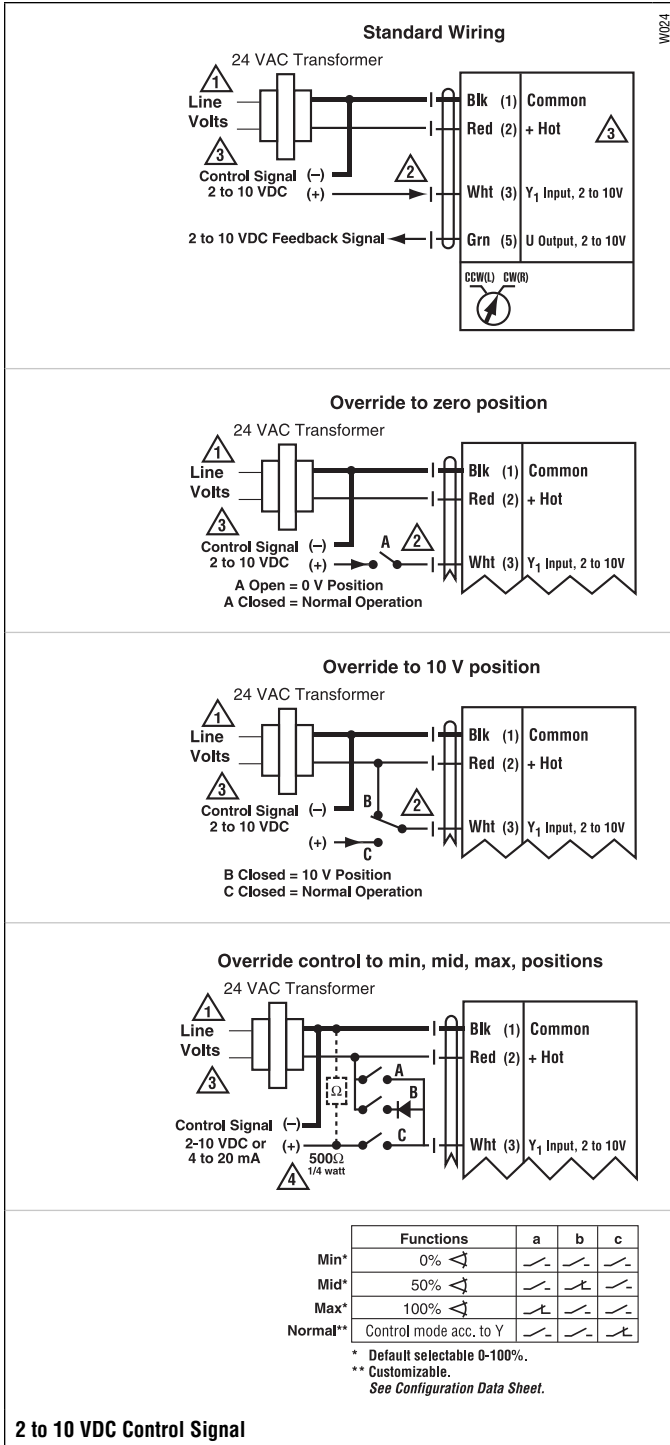
TF24-MFT US

Technical Data		
Control		MFT
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.5 W
	holding	1.0 W
Transformer sizing		4 VA (class 2 power source)
Electrical connection		3 ft, 18 GA plenum rated cable 1/2" conduit connector
Overload protection		electronic throughout 0° to 95° rotation
Operating range Y*		2 to 10 VDC 4 to 20 mA (w/500 Ω, 1/4 W resistor) ZG-R01
Input impedance		100k Ω for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, Floating point and On-Off control
Feedback output U*		2 to 10 VDC, 0.5 mA max
Direction of rotation	spring	reversible with CW/CCW mounting
	motor	reversible with built-in ↻/↻ switch
Mechanical angle of rotation*		95°
Running time	motor*	95 sec constant independent of load
	spring	<25 sec @ -4°F to 122°F [-20°C to 50°C] <60 sec @ -22°F [-30°C]
Angle of Rotation Adaptation*		Off (Default)
Override control*		Min. (Min Position) = 0% - ZS (Mid. Position) = 50% - Max. (Max. Position) = 100%
Position indication		visual indicator, 0° to 95°
Humidity		5 to 95% RH, non-condensing
Ambient temperature		-22 to 122° F (-30 to 50° C)
Storage temperature		-40 to 176° F (-40 to 80° C)
Housing		NEMA 2/IP42
Housing material		UL 94-5VA
Noise level (max)	running	<35 dB (A)
	spring return	<65 dB (A)
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No.24-93, CE acc to 89/336/EEC
Quality standard		ISO 9001

* Variable when configured with MFT options

† Rated impulse voltage 0.8 kV, Control pollution degree 3, Type of action 1.AA.

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

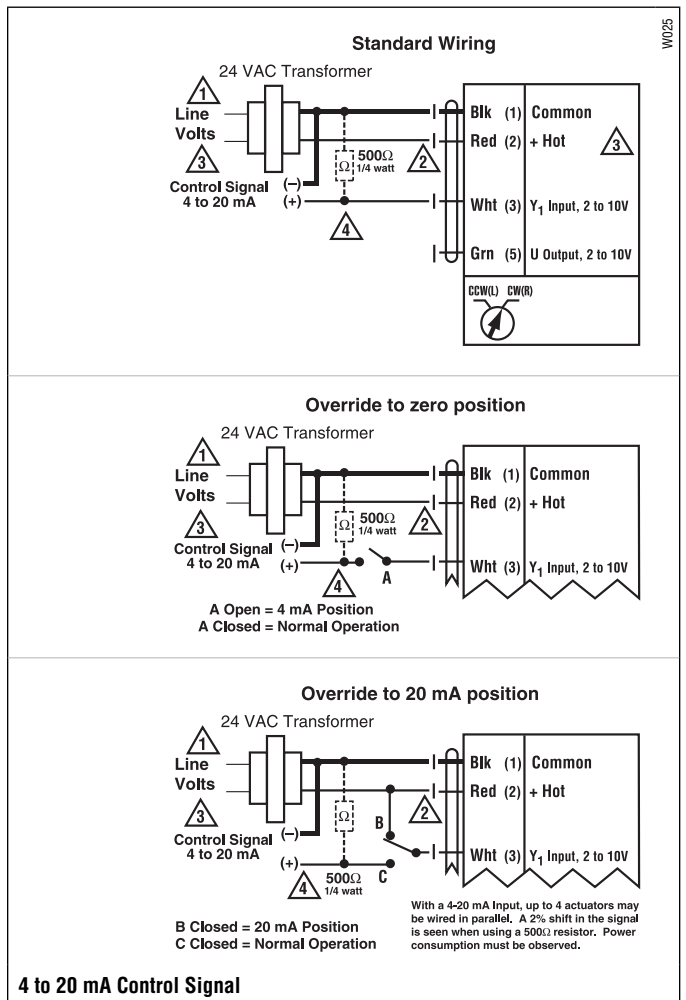


Wiring Diagrams

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.
- 4 ZG-R01 may be used.

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.

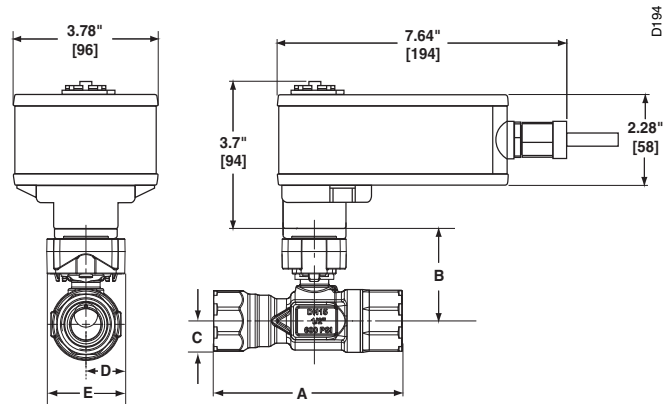


M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

LF Actuators, On/Off



Dimensions with 2-Way Valve



Models

- LF24 US
- LF24-S US w/built-in Aux. Switch
- LF120 US
- LF120-S US w/built-in Aux. Switch

Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B220HT	3/4"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

Technical Data	
Control	On/Off, Floating
Power supply	24 VAC ± 20% 50/60 Hz
LF24(-S) US	24 VDC ± 10%
LF120(-S) US	120 VAC ± 10% 50/60 Hz
Power consumption	
LF24(-S) US	running 5 W
	holding 2.5 W
LF120(-S) US	running 5.5 W
	holding 3.5 W
Transformer sizing	
LF24(-S) US	7 VA, class 2 power source
LF120(-S) US	7.5 VA, class 2 power source
Electrical connection	3 ft, 18 GA appliance cable (-S models have 2 cables) 1/2" conduit connector
Electrical protection	120V actuators double insulated
Overload protection	electronic throughout rotation
Angle of rotation	95°
Spring return direction	reversible with CW/CCW mounting
Position indication	visual indicator 0° to 90°
Running time	<40 to 75 sec. (on-off)
	spring <25 sec. @-4°F to 122°F [-20°C to 50°C]
	<60 sec. @-22°F [-30°C]
Ambient temperature	-22° F to 122° F [-30° C to 50° C]
Housing	NEMA 2
Agency listings†	UL 873, CSA C22.2 No. 24 certified, CE
Quality standard	ISO 9001
Noise level	max. 62 dB(A)

LF...-S US	
Auxiliary switch	1 x SPDT, 6A (1.5A) @ 250 VAC, UL Listed, adjustable 0° to 95° (double insulated)

† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3, Type of action 1.AA (1.AA.B for -S models)

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

✂️ INSTALLATION NOTES



CAUTION Equipment damage!

Actuators may be connected in parallel.
Power consumption must be observed.



Actuator may also be powered by 24 VDC.



For end position indication, interlock control, fan startup, etc., LF24-S US and LF120-S US incorporates a built-in auxiliary switch: 1 x SPDT, 6A (1.5A) @ 250 VAC, UL listed, adjustable 0° to 95°.



APPLICATION NOTES

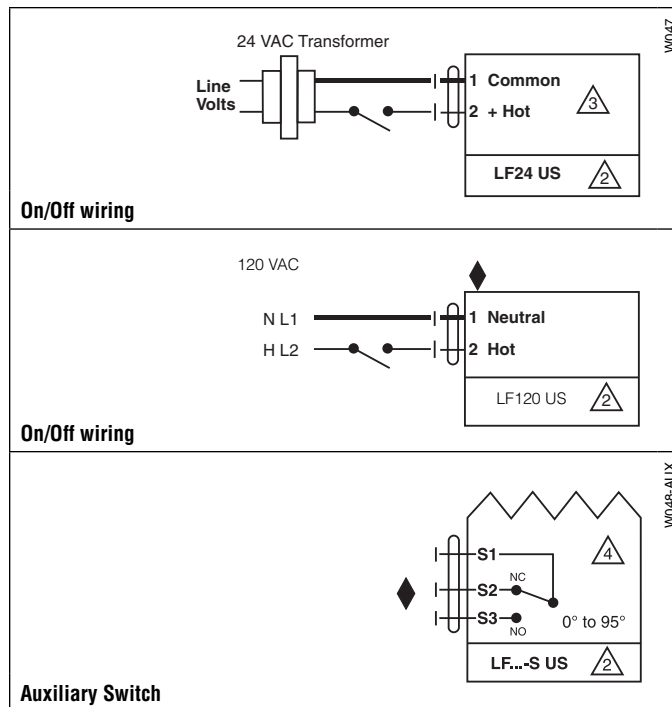


Meets cULus or UL and CSA requirements without the need of an electrical ground connection.



WARNING Live Electrical Components!

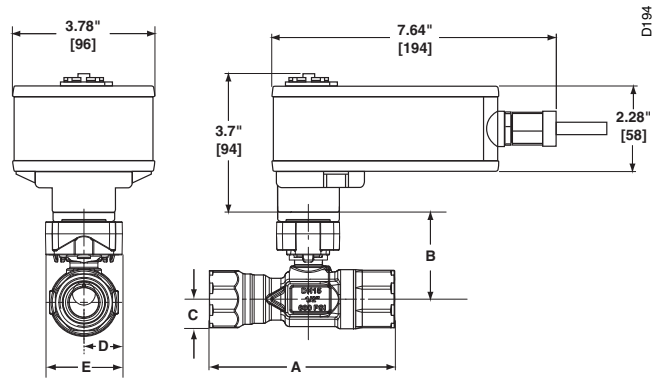
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow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



LF24-3 Actuators, Floating Point



Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B220HT	3/4"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

Models

- LF24-3 US
- LF24-3-S US w/built-in Aux. Switch

Technical Data	
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running 2.5 W holding 1W
Transformer sizing	5 VA (class 2 power source)
Electrical connection	3 ft, 18 GA appliance cables (-S model has 2 cables) 1/2" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Input Impedance	1000 Ω (0.6w) control inputs
Angle of rotation	95°
Torque	35 in-lb [Nm]
Direction of rotation	spring motor reversible with CW/CCW mounting reversible with built-in switch
Position indication	visual indicator 0° to 90°
Running time	motor 150 sec. constant independent of load spring <25 sec. @-4°F to +122°F [-20°C to +50°C] <60 sec. @-22°F [-30°C]
Humidity	5 to 95% RH non-condensing
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	zinc coated metal
Agency listings	UL 873 listed, CSA C22.2 No. 24 certified, CE
Noise level (max)	running < 30 db(A) spring return 62 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001

LF24-3-S US	
Auxiliary switch	1 x SPDT, 6A (1.5A) @ 250 VAC, UL Listed, adjustable 0° to 95° (double insulated)

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

✂ INSTALLATION NOTES

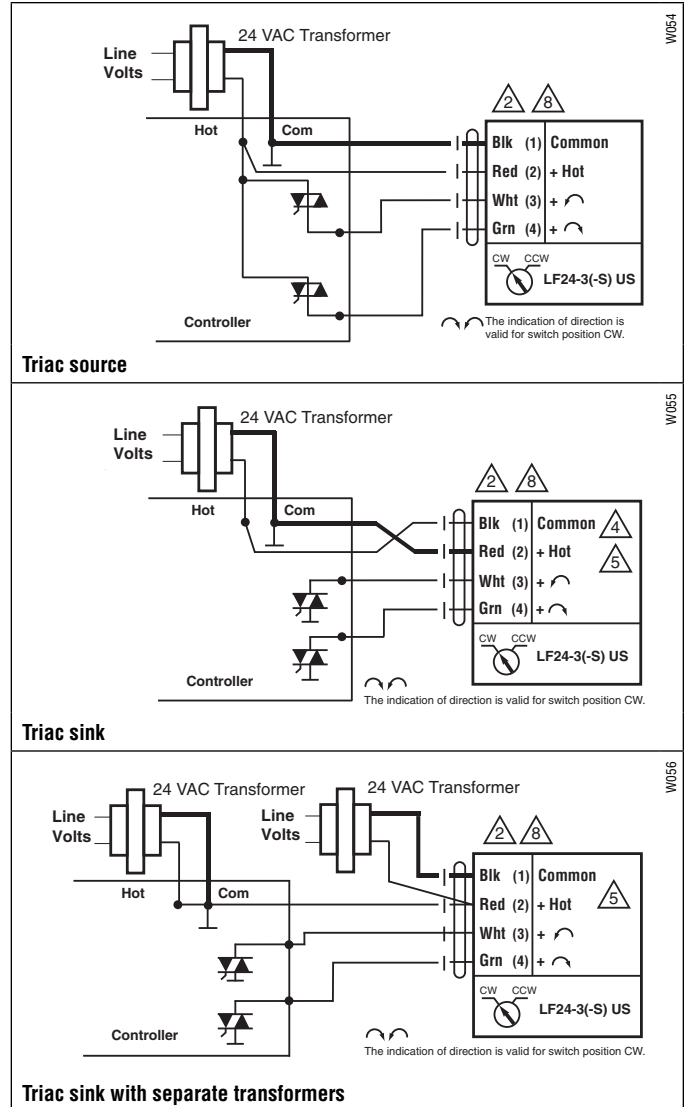
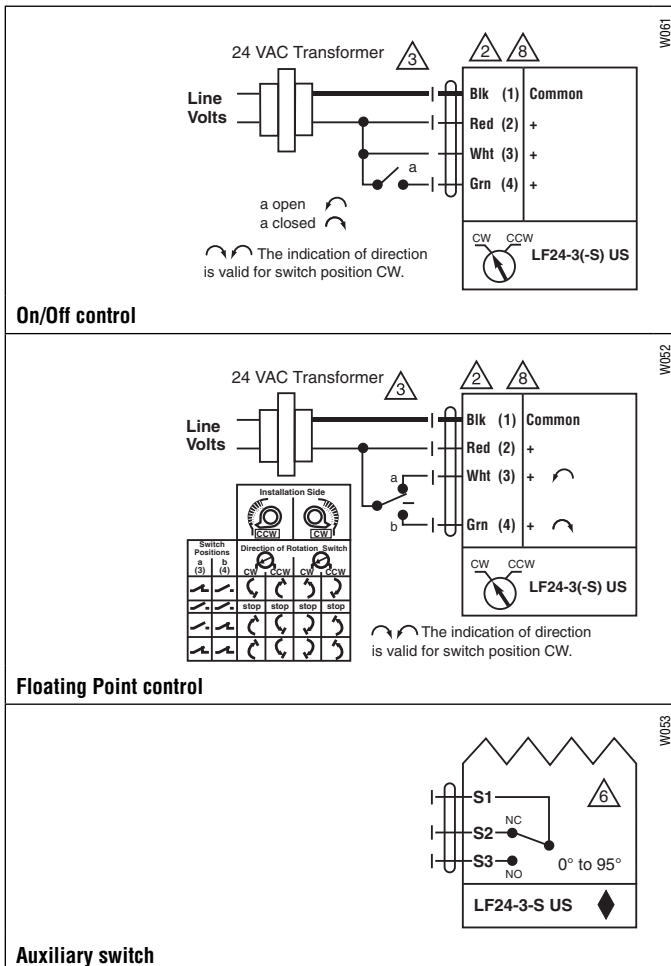
- CAUTION Equipment damage!**
- 2 Actuators may be connected in parallel. Power consumption must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 The common connection from the actuator must be connected to the Hot connection of the controller.
- 5 The actuator Hot must be connected to the control board common.
- 6 For end position indication, interlock control, fan startup, etc., LF24-3-S US incorporates one built-in auxiliary switch: 1 x SPDT, 6A (1.5A) @ 250 VAC, UL listed, adjustable 0° to 95°.
- 8 Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers.

📄 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.

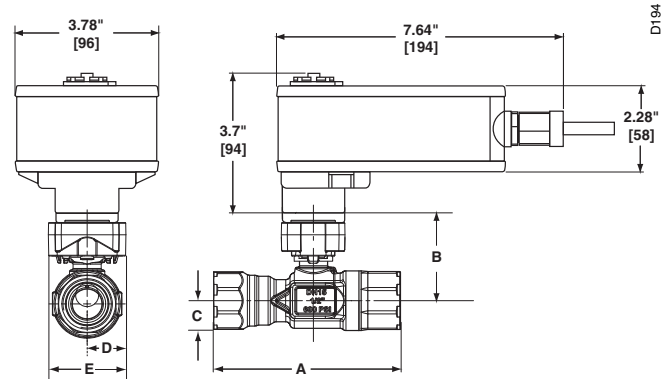
MA40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.



LF24-SR Actuators, Proportional



Dimensions with 2-Way Valve



Models

- LF24-SR US
- LF24-SR-S US w/built-in Aux. Switch

Technical Data	
Control	Proportional
Control signal	2 to 10 VDC 4 to 20 mA (with 500 Ω resistor)
Power consumption	running 2.5 W holding 1 W
Transformer sizing	5 VA, class 2 power
Electrical connection	3 ft, 18 GA appliance cables (-S model has 2 cables) ½" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Input impedance	100k Ω
Feedback output	2 to 10 VDC
Angle of rotation	95°
Direction of rotation	spring reversible with CW/CCW mounting motor reversible with built-in ↻/↺ switch
Position indication	visual indicator
Running time	motor <40 to 75 sec. (on-off) 150 sec. independent of load (proportional) spring <25 sec. @-4°F to +122°F [-20°C to +50°C] <60 sec. @-22°F [-30°C]
Ambient temperature	-22° F to 122° F [-30° C to 50° C]
Housing	NEMA 2
Agency listings	UL 873, CSA C22.2 No. 24 certified, CE
Quality standard	ISO 9001
Noise level	max. 62 dB(A)

LF24-SR-S US	
Auxiliary switch	1 x SPDT, 6A (1.5A) @ 250 VAC, UL Listed, adjustable 0° to 95° (double insulated)

Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B220HT	¾"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

Wiring Diagrams

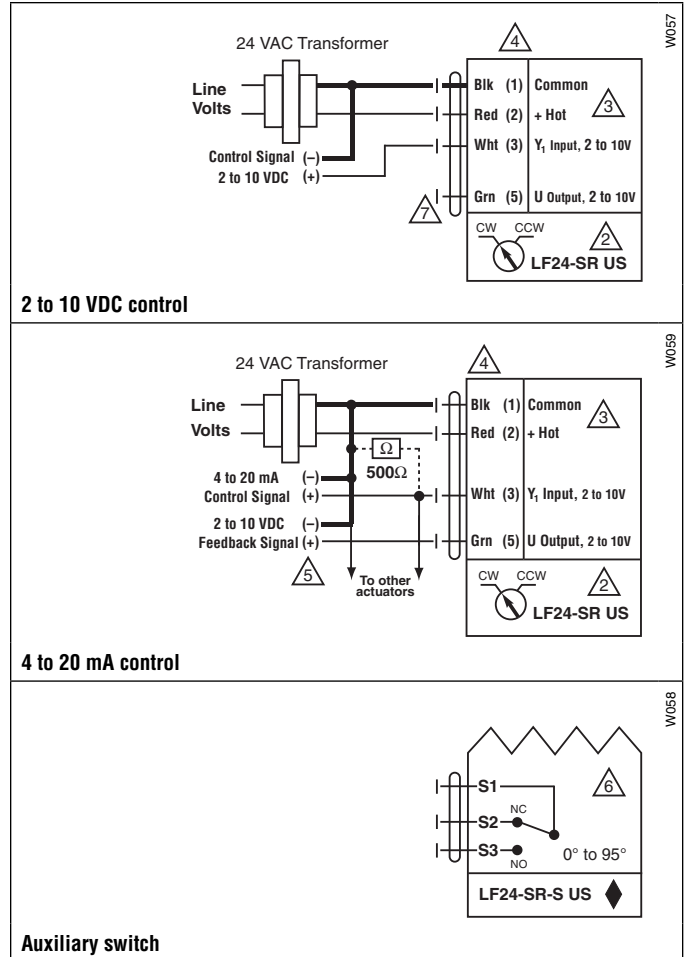
✂️ INSTALLATION NOTES

- ⚠️ **CAUTION Equipment damage!**
Actuators may be connected in parallel. Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required. Power consumption must be observed.
- ⚠️ Actuators may also be powered by 24 VDC.
- ⚠️ Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- ⚠️ Only connect common to neg. (-) leg of control circuits.
- ⚠️ For end position indication, interlock control, fan startup, etc., LF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 6A (1.5A) @ 250 VAC, UL listed, adjustable 0° to 95°.
- ⚠️ The LF24-SR-S US wire 5 is white.

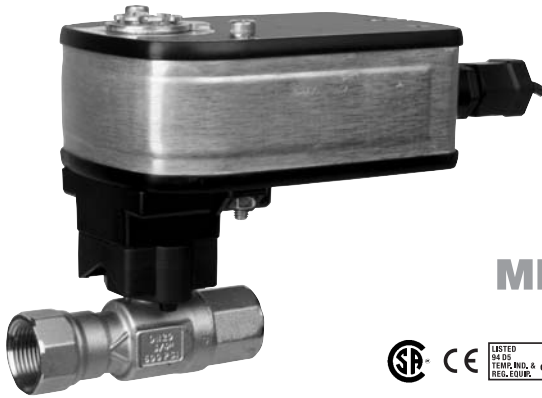
📄 APPLICATION NOTES

- ◆ 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.

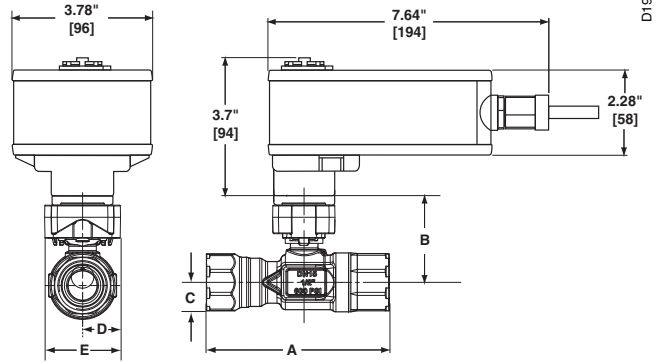
⚠️ **WARNING Live Electrical Components!**
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components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



LF24-MFT Actuators, Multi-Function Technology



Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B220HT	3/4"	20	3.96" [100.6]	2.37" [60.1]	0.67" [17.0]
B225HT	1"	25	5.14" [130.6]	3.14" [79.8]	0.92" [23.25]

Models

- LF24-MFT US
- LF24-MFT-S US w/built-in Aux. Switch

Technical Data	
Control	MFT
Control signal	2 to 10 VDC
Power consumption	running 2.5 W holding 1 W
Transformer sizing	5 VA (class 2 power source)
Electrical connection	3 ft, 18 GA appliance cables (-S model has 2 cables) 1/2" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Input impedance	100k Ω for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20mA 750 Ω for PWM 500 Ω for on/off and floating point
Feedback	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
Running time	<40 to 75 sec. (on-off) 150 sec. independent of load (proportional) spring <25 sec. @-4°F to +122°F [-20°C to +50°C] <60 sec. @-22°F [-30°C]
Ambient temperature	-22° F to 122° F [-30° C to 50° C]
Housing	NEMA 2
Agency listings	UL 873, CSA C22.2 No. 24 certified, CE
Noise level	max. 62 dB(A)
Quality standard	ISO 9001

LF24-MFT-S US	
Auxiliary switch	1 x SPDT, 6A (1.5A) @ 250 VAC, UL Listed, adjustable 0° to 95° (double insulated)

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

✂️ INSTALLATION NOTES

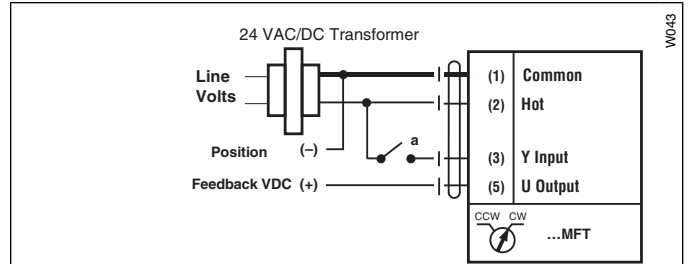
- 2 **CAUTION Equipment damage!**
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 IN4004 or IN4007 diode (IN4007 supplied, Belimo part number 40155).
- 5 Triac 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

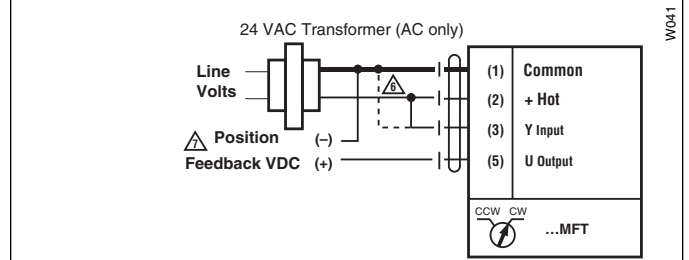
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

⚠️ 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.

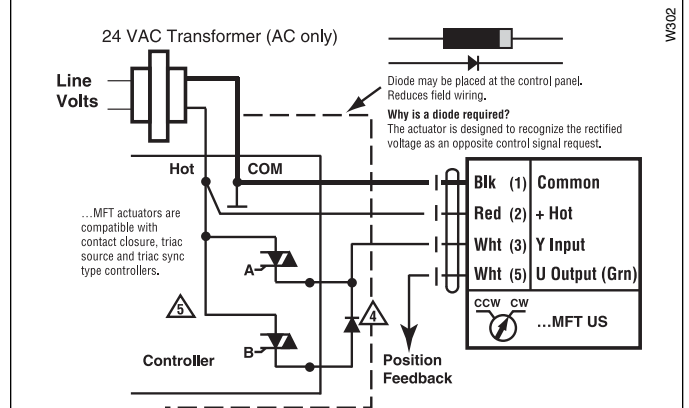
M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.



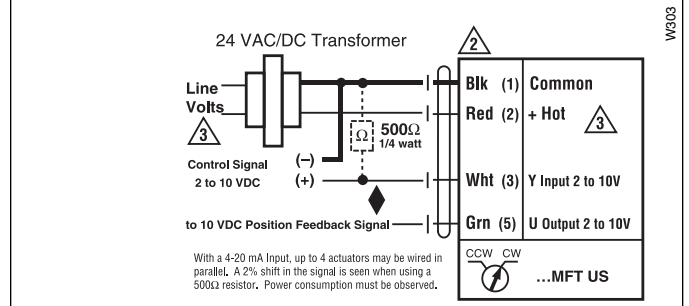
On/Off control



PWM, triac source and sink



Floating Point control



Proportional 2 to 10 or 4 to 20 mA control signal

MFT Standard Configuration



	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 239 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.

PICCV CONFIGURATION CODES						
Description	Code	Control Input	Running Time	Built-in Feedback	List Price	
P-10019	A19	2-10 VDC	100	2-10 VDC	●	
P-10028	A28	0-10 VDC	100	0-10 VDC	●	
P-20031	W31	0.02-5.00 sec. PWM	100	2-10 VDC	●	
P-20032	W32	0.10-25.5 sec. PWM	100	2-10 VDC	●	
P-20034	W34	0.59-2.93 sec. PWM	100	2-10 VDC	●	
P-30003	F03	Floating Point	100	2-10 VDC	●	
P-40013	J13	On/Off	100	2-10 VDC	●	
P-30001	F01	Floating Point	150	2-10 VDC	●	

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

PRODUCTS

	MODEL	Base Actuator Codes	Control Input	Feedback	Running Time	Angle of Rotation/Stroke	Power Supply	VA Rating	Weight (lb)	List Price (add to valve assembly)
45 in-lb [5 Nm]	LRX24-3	LR000	On/Off, Floating Point	—	95 (Default)	95 deg	24 VAC/DC	3	1.08	●
	LRX24-SR	LR030	2-10 VDC (4-20mA*)	—	95 (Default)	95 deg	24 VAC/DC	3	1.08	●
	LRX24-MFT	LR100	2-10 VDC (Default)	2-10 VDC	150 (Default)	95 deg	24 VAC/DC	3	1.08	●

	Configuration (Substitute 'V' for 'P' for NV(F) actuators)	Code	Control		Running Time†	Motion		List Price
			Input Range	Position Feedback		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.

M40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

Custom MFT Configuration Order Form

FAX: USA Toll Free 1-800-228-8283



#1 Select an Actuator

(use one sheet for each unique actuator/configuration)

	Quantity		Quantity
<input type="checkbox"/> AF24-MFT US	_____	<input type="checkbox"/> AMX24-MFT	_____
<input type="checkbox"/> AF24-MFT-S US	_____	<input type="checkbox"/> AMX24-MFTX1	_____
<input type="checkbox"/> NF24-MFT US	_____	<input type="checkbox"/> NMX24-MFT	_____
<input type="checkbox"/> LF24-MFT US	_____	<input type="checkbox"/> NMX24-MFTX1	_____
<input type="checkbox"/> LF24-MFT-S US	_____	<input type="checkbox"/> LMX24-MFT	_____
<input type="checkbox"/> AF24-MFT95 US	_____	<input type="checkbox"/> LMX24-MFTX1	_____
<input type="checkbox"/> NV24-MFT US	_____	<input type="checkbox"/> LRX24-MFT	_____
<input type="checkbox"/> NVF24-MFT US	_____	<input type="checkbox"/> GMX24-MFT95	_____
<input type="checkbox"/> NVF24-MFT-E US	_____	<input type="checkbox"/> AMX24-MFT95	_____
<input type="checkbox"/> NVFD24-MFT US	_____	<input type="checkbox"/> NMX24-MFT95	_____
<input type="checkbox"/> NVFD24-MFT-E US	_____	<input type="checkbox"/> LMX24-MFT95	_____
<input type="checkbox"/> GMX24-MFT	_____	<input type="checkbox"/> LHX24-MFT	_____
<input type="checkbox"/> GMX24-MFTX1	_____	<input type="checkbox"/> LUX24-MFT	_____

(-S=Auxiliary Switch)

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____

Email _____

FIELD LABELING: LBL-MFT

Custom configuration labels required
1-3/8" X 1-1/4" orange labels preprinted to your specifications 12 label sets per sheet.
Includes configuration code and wiring labels.

#2 Create a Custom Configuration

Deactivated (Default) The following settings ② - ⑤ refer to the full angle of rotation of 95°.

Activated The following settings ② - ⑤ are automatically adapted to the effective mechanical angle of rotation.

① Angle of rotation setting

Manual triggering by pressing the push button twice.

Automatic triggering each time the unit is powered up or by pressing the push button twice.

② Control Types

VDC	PWM	Floating Point	On/Off
<input type="checkbox"/> 2 - 10	<input type="checkbox"/> 0.2 to 5.0 seconds	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 0 - 10	<input type="checkbox"/> 0.1 to 25.5 seconds		
<input type="checkbox"/> Variable	<input type="checkbox"/> 0.59 to 2.93 seconds		
Start <input type="checkbox"/> <input type="checkbox"/> · <input type="checkbox"/>	<input type="checkbox"/> Variable		
Stop <input type="checkbox"/> <input type="checkbox"/> · <input type="checkbox"/>	Start <input type="checkbox"/> <input type="checkbox"/> · <input type="checkbox"/>		
	Stop <input type="checkbox"/> <input type="checkbox"/> · <input type="checkbox"/>		

③ Feedback Signals U_s

Position Feedback U DC 2...10 V (Default)

Position Feedback U DC 0...10 V

Position Feedback U Start DC · V (0...8 V) The finish must be at least 2 V above the start!
Finish DC · V (2...10 V)

④ Running Time

150 seconds (Default)

Running time seconds (75...300 seconds) (in 5 second increments)

Note: The sound power level [dB(A)] increases when the running time is below 150 seconds.

LM	35...150 seconds
NM	45...170 seconds
AM	90...300 seconds
GM	90...300 seconds
Others	75...300 seconds

⑤ Override control and electronic angle of rotation limiting

Min. (min. position) = % (0...100%) < (beginning of working range) default 0

ZS (intermediate position) = % (0...100%) (0% = Min.; 100% = Max.) default 50

Max. (max. position) = % (0...100%) < (end of working range) default 100

Section 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

2.15 ACTUATORS

- A. Electronic Damper Actuators:
1. Manufactured, brand labeled or distributed by BELIMO.
 2. Size for torque required for damper seal at load conditions.
 3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to prevent any damage to the actuator during a stall condition.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Internal chemical storage systems, capacitors, or other internal non-mechanical forms of fail-safe operation are not acceptable.
 7. Power Requirements (Two-Position Spring Return): 24 [120] [230] VAC.
 8. Power Requirements (Proportional): Maximum 10 VA at 24 VAC or 8 W at 24 VDC.
 9. Proportional Actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable by use of external computer software Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload and mechanical travel. Programming shall be through an EEPROM without the use of actuator mounted switches.
 10. Temperature Rating: -22 to +122°F -30 to +50°C [-58 to +122°F -50 to +50°C]
 11. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.
 12. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.
 13. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
- B. Electronic Valve Actuators:
1. Manufactured, brand labeled or distributed by BELIMO.
 2. Size for torque required for valve close off at 150% of total system (head) pressure for 2-way valves; and 100% of pressure differential across the valve or 100% of total system (pump) head differential pressure for 3-way valves.
 3. Coupling: Directly couple end mount to stem, shaft, or ISO-style direct-coupled mounting pad.
 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to deactivate the actuator at the end of rotation.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Internal chemical storage systems, capacitors, or other internal non-mechanical forms of fail-safe operation are not acceptable.
 7. Power Requirements: Maximum 10 VA at 24 VAC or 8 W at 24 VDC. Maximum 1 VA at 24 VAC or 1 W at 24 VDC.
 8. Temperature Rating: -22 to +122°F. -30 to +50°C [-58 to +122°F -50 to +50°C]
 10. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.
 11. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.
 12. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
- C. Terminal Unit Actuators:
1. Manufactured, brand labeled or distributed by BELIMO.
 2. Close-off (Differential) Pressure Rating: 200 psi.
 3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle or an ISO-style direct-coupled mounting pad.
 4. Power Requirements: Maximum 1 VA at 24 VAC or 1 W at 24 VDC.
 5. Temperature Rating: -22 to +122°F. -30 to +50°C.

6. Housing Rating: Minimum UL94-5V(B) flammability.
7. Agency Listing: CE, UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC.
8. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.

D. Industrial Actuators

(ONLY TO BE USED WITH BUTTERFLY VALVE SECTION)

1. Manufactured, brand labeled or distributed by BELIMO.
2. The combination of valve and actuator shall meet the close-off requirements as specified in Section 2.16.F – Butterfly Valves.
3. Coupling: ISO 5211 mounting standards.
4. Overload Protection: A self resetting thermal switch embedded in the motor.
5. Manual Override: Actuator shall be equipped with a hand wheel or shaft for manual override to permit operation of the actuator in the event of an electrical power failure
6. Auxiliary Switches: 2 SPDT rated 3A at 250 VAC.
7. Temperature Rating: -4 to +150°F. -20 to +65°C.
8. Housing: Minimum requirement NEMA type 4X/ IP67. Actuator shall have an internal heater. A visual indication beacon shall indicate position status of the device.
9. Agency Listing: ISO, CE, CSA
10. The manufacturer shall warrant for 2 years from the date of production.

2.16 CONTROL VALVES

A. Manufacturer:

1. Manufactured, brand labeled or distributed by BELIMO.

B. Control Valves: Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional (except as noted).

D. Pressure Independent Control Valves

1. NPS 2 and Smaller: Forged brass body rated at no less than 400 psi, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL® characterizing disc.
2. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow. The flow shall not vary more than ±5% due to system pressure fluctuations across the valve with a minimum of 5 psid across the valve.
3. Flow Characteristics: Equal percentage characteristics.
4. Close-off Pressure Rating: 200 psi.
5. All actuators shall be electronically programmed by use of external computer software. Programming using actuator mounted switches or multi-turn actuators are NOT acceptable. **[Actuators for 3-wire floating (tri-state) on ½” to 1” pressure independent control valves shall fail in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow.] [Actuators for two-position ½” to 1” pressure independent control valves shall fail in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow.] [Actuators shall be provided with an auxiliary switch to prove valve position.]**
6. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.
7. The control valve shall require no maintenance and shall not include replaceable cartridges.
8. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
9. The use of pressure independent valves piped in parallel to achieve the rated coil flow shall be permitted. Actuators shall be electronically programmed to permit sequencing the flow with a single control output point. The use of external devices to permit sequencing is NOT acceptable.

SPECIFYING PRESSURE INDEPENDENT CONTROL VALVES REQUIRE THE FOLLOWING ADDITIONS TO SECTIONS 232113 AND 230593.

To be inserted into Section 232113 – HYDRONIC PIPING

2.6 CONTROL VALVES

- K. Calibrated Balancing Valves and Automatic Flow-Control Valves shall not be required on devices where pressure independent control valves are installed.

To be inserted into Section 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

3.11 PROCEDURE FOR HYDRONIC SYSTEMS

- H. Systems installed with pressure independent control valves shall not require hydronic system balancing. **[Flow shall be verified for [10%] [20%] [25%] <Insert Percentage> of the total installed product. Exact locations of tested product to be coordinated with the design engineer.]**

E. Characterized Control Valves:

1. NPS 3 and Smaller: Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, NPT female end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon® seats, and a TEFZEL® flow characterizing disc. **[NPS ¾” and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, NPT female end fittings, with a dual EPDM O-Ring packing design, fiberglass reinforced Teflon® seats, and a TEFZEL® flow characterizing disc.]**
2. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1 psi.
 - b. 2-way Modulating: [3 psig] 5 psig or twice the load pressure drop, whichever is greater.
 - c. 3-way Modulating: Twice the load pressure drop, but not more than [3 psig] 5 psig.
3. Close-off Pressure Rating: 100 psi. [NPS ¾” and Smaller for Terminal Units: 200 psi.]
4. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.

F. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: ANSI Class 250 bronze body, stainless steel stem, brass plug, bronze seat, and a TFE packing.
2. NPS 2-½ and Larger: ANSI Class 125 [250] cast iron body, stainless steel stem, bronze plug, bronze seat, and a TFE V-ring packing.
3. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1 psi.
 - b. 2-way Modulating: [3 psig] 5 psig or twice the load pressure drop, whichever is greater.
 - c. 3-way Modulating: Twice the load pressure drop, but not more than [3 psig] 5 psig.
4. Flow Characteristics: 2-way valves shall have equal percentage characteristics; 3-way valves shall have linear characteristics.
5. Close-off Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system head pressure for 2-way valves and 150% of the design pressure differential across the 3-way valves.
6. 2- and 3-way globe valves shall be used only if characterized control valves do not fit the sizing criteria or application.

G. Steam system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: ANSI Class 250 bronze body; stainless steel seat, stem and plug; and a TFE packing.
2. NPS 2-½ and Larger: ANSI Class 125 [250] cast iron body; stainless steel seat, stem and plug; and a TFE V-ring packing.
3. Sizing:
 - a. Two-Position: Line size or sized using 10% of inlet gauge pressure.
 - b. Modulating: 15 psig or less inlet steam pressure, the pressure drop shall be 80% of inlet gauge pressure. Higher than 15 psig inlet steam pressure the pressure drop shall be 42% of the inlet absolute pressure.
4. Flow Characteristics: Linear or equal percentage characteristics.
5. Close-off Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of operating (inlet) pressure.

H. Butterfly Valves – Resilient Seat:

1. NPS 2 to 12: Valve body shall be full lugged cast iron 200 psig body with a 304 stainless steel disc, EPDM seat, extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize an internal spline. External mechanical methods to achieve this mechanical connection, such as pins or screws, are not acceptable. The shaft shall be supported at four locations by RPTFE bushings.
2. NPS 14 and Larger: Valve body shall be full lugged cast iron 150 psig body with a 304 stainless steel disc, EPDM seat, extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize a dual-pin method to prevent the disc from settling onto the liner. The shaft shall be supported at four locations by RPTFE bushings.
3. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1 psi.
 - b. Modulating: 3 psig [5 psig] or twice the load pressure drop, whichever is greater. Size for the design flow with the disc in a 60° open-position with the design velocity less than 12 feet per second.
4. Close-off Pressure Rating: NPS 2” to 12” 200 psi bubble tight shut-off. NPS 14” and larger, 150 psi bubble tight shut-off.

I. Zone Valves (On/Off, Two-Position Applications):

1. NPS 1 and Smaller: Forged brass body rated at no less than 300 psi, stainless steel stem, female NPT union or sweat with a stainless steel stem and EPDM seals.
2. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1 psi.
3. Close-off Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system head pressure for 2-way valves and 125% of the design pressure differential across the 3-way valves.
4. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory.
5. The manufacturer shall warrant all components for a period of 2 years from the date of production.

IM40017 - 02/10 - Subject to change. © Belimo Aircontrols (USA), Inc.

To be inserted into Section 233300 – AIR DUCT ACCESSORIES

2.8 SMOKE DAMPERS

Replace with the following:

- I. Damper Motors:
 1. Manufactured, brand labeled or distributed by BELIMO.
 2. Size for torque required for damper seal at load conditions.
 3. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.
 4. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
 5. Power Requirements (Two-Position Spring Return): 24 [120] [230] VAC.
 6. Power Requirements (Proportional): Maximum (running) 12 VA at 24 VAC or 8 W at 24 VDC. Maximum (holding) 5VA at 24 VAC or 3 W at 24 VDC holding.
 7. Proportional Actuators (24 VAC/VDC): Control signal shall be 2-10 VDC or 4-20 mA, with a 2-10 VDC position feedback signal.
 8. Actuator timing shall meet 15 seconds [75 seconds] [local codes].
 9. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 350°F [250°F].

The following replaces item 2.8.K.1

10. Auxiliary switches for **[signaling] [fan control] [or] [position indication]**.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

Replace with the following:

- O. Damper Motors:
 11. Manufactured, brand labeled or distributed by BELIMO.
 12. Size for torque required for damper seal at load conditions.
 13. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.

14. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
15. Power Requirements (Two-Position Spring Return): 24 [120] [230] VAC.
16. Power Requirements (Proportional): Maximum (running) 12 VA at 24 VAC or 8 W at 24 VDC. Maximum (holding) 5VA at 24 VAC or 3 W at 24 VDC holding.
17. Proportional Actuators (24 VAC/VDC): Control signal shall be 2-10 VDC or 4-20 mA, with a 2-10 VDC position feedback signal.
18. Actuator timing shall meet 15 seconds [75 seconds] [local codes].
19. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 350°F [250°F].

The following replaces item 2.9.Q.1

20. Auxiliary switches for **[signaling] [fan control] [or] [position indication]**.

NOTE TO SPECIFIER

Any (or all) of the following manufacturers are listed per UL555S with Belimo actuators: Air Balance, Arlan, E.H. Price, Greenheck, Leader, Lloyd Industries, Nailor, Pottorff, Prefco, Ruskin and Safe-Air.

21. Housing: Steel housing, aluminum is unacceptable.
22. Agency Listing: ISO 9001, UL873, or UL60730.
23. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.

I. General

- 1.1. The following Terms and Conditions of Sale ("Terms") apply to the sale of products described in this Product Guide ("Products"). As used herein, "Seller" or "Belimo" refers to Belimo Aircontrols (USA) Inc. or Belimo Aircontrols (CAN) Inc., as applicable, and "Client" refers to the individual or business entity that purchases the Products from Seller. These Terms shall apply unless the parties mutually agree to different terms and memorialize such agreement in a writing signed by both Client and Seller.

II. Price

- 2.1. The Seller's price for Products (the "Price") is net, F.O.B. Point of Origin, and is calculated in US currency for sales made by Belimo Aircontrols (USA), Inc. and calculated in Canadian currency for sales made by Belimo Aircontrols (CAN) Inc.
- 2.1. The Price, unless otherwise agreed upon, does not include freight and packaging (wooden crates, pallets, etc), the costs of which will be charged to Client at cost for each shipment and shall be payable with payment of the Price.
- 2.3. Orders for Products with a net value of less than US\$300 (CAN\$450) will be subject to a US\$20 (CAN\$35) handling fee (the "Handling Fee"). The Handling Fee will not be charged for orders of Products with a net value equal to or greater than US\$300 (CAN\$450) or for Products ordered through Seller's internet ordering system at: www.belimo.com.
- 2.4. Seller reserves the right to make partial deliveries of orders of Products, each of which deliveries may be invoiced separately by Seller.
- 2.5. The Price does include charges for wiring diagrams, installation, and commissioning, which will be charged to Client separately and will be payable on demand.

III. Payment

- 3.1. Invoices are payable in US currency for sales made by Belimo Aircontrols (USA), Inc. and in Canadian currency for sales made by Belimo Aircontrols (CAN) Inc. and are due no later than 30 days from the date of invoice, without any deductions.
- 3.2. If Client fails to pay the entire invoice balance within 60 days from the date of the invoice, Client will be subject to an interest charge of 2% per month (or the maximum rate permitted by law, whichever is less) on the outstanding unpaid balance due to Seller.
- 3.3. Clients who maintain outstanding balances for 45 days or more after the date of invoice may be subject to restricted shipments of Products or may be required to pay for all future deliveries of Products on a cash-on-delivery basis.

IV. Title and Risk

- 4.1. Title to all Products shall remain with Seller and shall not pass to Client until Seller has received full payment for the Products.

V. Damage or Loss in Transit

- 5.1. Seller assumes no liability for damage or loss of shipment of Products, which risk shall at all times remain with the carrier. All shipments must be unpacked and examined by Client immediately upon receipt. Any external evidence of loss or damage must be noted on the freight bill accompanying the shipment of Products or carrier's receipt and signed by the carrier's agent at the time of delivery. Failure to do so will result in the carrier's refusal to honor any claim relating to damage of Products. Client must also notify Seller of such damage by providing Seller with a copy of the freight bill or damage report so that Seller can file a claim for loss or damage in transit with the carrier. If the damage does not become apparent until the shipment is unpacked, customer must make a request for inspection by the carrier's agent and file with the carrier within 15 days after receipt of product and notify Seller of the same. Seller is not liable for consequential damage to Client's property or a third-party's property resulting from the installation of damaged Products.

VI. Delivery

- 6.1. Seller undertakes to make every attempt to adhere to its stated delivery parameters and to make a timely delivery of the Products but does not guarantee any delivery specifications. Each contract entered into for the purchase of Products is not cancelable nor is Seller liable for any direct or indirect losses that may arise, for any reason whatsoever, due to Seller's failure to meet any stated or assumed delivery schedules.

VII. Return of Goods

- 7.1. Products received by Client cannot be returned unless: (i) Client alerts Seller that it intends to return such Products, (ii) Seller agrees to accept the return of such Products, (iii) Client obtains a Return Material Authorization ("RMA") number from Seller for the return of such Products, and (iv) Client follows all return instructions provided by the Seller. The RMA number must be clearly written on the outside of all packaging for any returned Products. Only Products returned to proper the location as instructed by Seller and identified with an RMA number will be considered for credit.
- 7.2. Only Products that are returned in original packaging may be accepted for return. Such returned Products must be received in good condition, adequate for resale as new Products to qualify for credit. Client will be responsible for payment of a restocking charge for all returned Products in an amount no less than 20% of the invoice value of the Products ("Restocking Charges"). All return Products must be shipped to Seller at Client's cost.
- 7.3. Returns that result from Seller errors will be credited in full and will not be subject to Restocking Charges.

VIII. Warranty

VIII.A 5-year Warranty

- 8.1. Products that are listed in this Product Guide as carrying a 5-year warranty and shipped after May 1, 2000 to a location in the United States or Canada shall carry a 5-year warranty. The 5-year warranty is unconditional for the first two years from the date of production of the Products. After the first two years from the date of Production, the warranty shall be conditional and the warranty coverage shall not apply to damage to Products caused by ordinary wear and tear, negligence or improper use by Client, or other causes beyond the control of the Seller. Product -specific terms of warranty with regard to warranty period or conditions of warranty may apply to certain specified Products as stated in the documentation for those Products.

VIII.B 2-year Conditional Warranty

- 8.2. Products that are listed in this Product Guide as carrying a 2-year warranty and shipped after May 1, 2005 to a location in the United States or Canada shall carry a 2-year warranty. The 2-year warranty is conditional and the warranty coverage shall not apply to damage to Products caused by ordinary wear and tear, negligence or improper use by Client, or other causes beyond the control of the Seller. Product -specific terms of warranty with regard to warranty period or conditions of warranty may apply to certain specified Products as stated in the documentation for those Products.

VIII.C General Warranty Terms

- 8.3. Seller's warranty may be null and void in the event of any: (a) modification or unauthorized repairs of Products by Client, (b) unauthorized incorporation or integration of Products into or with Client's equipment, (c) use of Products in an unauthorized manner, or (d) damage to Products not caused by Seller.
- 8.4. Client must promptly notify Seller of Products' alleged defect and provide Seller with other evidence and documentation reasonably requested by Seller. Before removing Products from service, Client should contact a Seller-authorized support technician by calling Belimo customer service. The contact information for Belimo customer service is listed on the back page of Belimo's Product Guide and Price List ("PGPL") or may be found at www.belimo.com. Belimo customer service will work with field technicians to troubleshoot problems. Many problems can be resolved over the phone.
- 8.5. If a problem cannot be resolved over the phone, an RMA number will be issued by Seller for return of the Products. Prior to returning any Products under a warranty, Client must obtain an RMA number from Seller, along with shipping instructions for the return. The RMA number must be clearly written on the outside of the box containing the returned Products. Only Products returned to the proper location and identified with an RMA number will be accepted by the Seller.
- 8.6. All returned Products should be packaged appropriately to prevent further damage. Seller reserves the right to refuse any returned material if improperly packaged or labeled (without an RMA number). Products returned without proper RMA documentation will void Seller's warranty.
- 8.7. Products found to be defective for which a warranty is applicable will either be replaced or repaired at the Seller's discretion. Seller is not responsible for charges that Client may incur as a result of the removal or replacement of Products.

- 8.8. Repaired or replacement Products are shipped from Seller via ground shipment. Other shipping methods are available at the sole expense of the Client.
- 8.9. Repaired, replaced or exchanged Products will carry a warranty for a period of time equal to the greater of: (i) the remainder of the original 5-year warranty or 2-year warranty that was applicable to the repaired, replaced or exchanged Products, or (ii) six months, effective from the date the repaired, exchanged or replaced Products are shipped by Seller (the "Replacement Warranty Period").
- 8.10. Advanced replacement Products for Products covered under warranty may be obtained from Seller after the Belimo customer service troubleshooting process has been completed. For industrial products (such as butterfly valves), a purchase order is required. The purchase order will be credited upon the receipt and verification by Seller of the returned defective Products. For non-industrial products, an invoice will be issued and shall be due and payable is the returned Products are not received by Seller within 60 days from the date of that the replacement Products are shipped. Additional charges may apply if the nature of the problem has been misrepresented by Client.
- 8.11. Both the conditional and unconditional warranties cover the Products only, and do NOT cover labor associated with the troubleshooting, removal or replacement of such Products.
- 8.12. New Products ordered in an attempt to circumvent the warranty process may NOT be reimbursed if, upon receipt of returned Products, it is determined that the defect in the returned Products is actually field related, or the Products have been returned for cosmetic reasons only.
- 8.13. Advanced replacement Products for butterfly valve actuators may not be new, but have been verified by the Seller for electrical and mechanical operation. Such Products carry the full warranty for the entire Replacement Warranty Period.

IX. No Warranty for Non-HVAC Application

- 9.1. All Seller warranties shall extend only to HVAC use of the Products. If Products are used in non-HVAC application (e.g., aircraft, industrial processes, etc.), Seller's warranties shall not cover such Products. Client will be solely responsible for any damage to or malfunction of Products or for any damage resulting from such use of Products.

X. Liability Disclaimer

- 10.1. These Terms constitute the entire understanding and agreement between Seller and Client regarding the warranties that cover Products and supersedes all previous understandings, agreements, communications and representations. Seller shall not be responsible for and Client does not have any right to make any claim for, damage that occurs to any property other than Products. Seller shall in no way be responsible for any costs incurred by Client in the determination of the causes of damage to any of Client's property, for expert opinions, or for any punitive or special, incidental or consequential damages of any kind whatsoever.
- 10.2. Seller shall not be liable for any damage resulting from or contributed by Client or third parties acting within the scope of responsibility of Client or such third party when:
 1. Products are used for non-HVAC applications, such as in aircrafts, industrial processes, etc.;
 2. Client uses the Products without complying with applicable law or institutional regulations or Belimo data and installation sheets or Client uses the Products without following good industry practice;
 3. Products are used by personnel who have not received suitable instruction; or
 4. Products are modified or repaired without the written approval of Seller. When requested to do so, Client shall immediately release Seller in full from any possible third party claims resulting in connection with the circumstances listed above. This also applies to claims in connection with product liability.
- 10.3. If Client becomes aware that any third party has made or appears likely to make any claim regarding Products (including, without limitation, regarding Product defects or rights infringed by Products), then Client shall immediately inform Seller and afford to Seller all assistance that Seller may require to enforce its rights and defend such claim.

XIII. Proper Law and Jurisdiction

- 11.1. All sales of Products under these Terms and the warranties described herein shall be governed by the laws of the State of Connecticut, and the parties agree to submit to the exclusive jurisdiction of the Federal and state courts located in the State of Connecticut with respect to any dispute arising from the subject matter hereof. The parties hereby waive all rights to a jury trial in connection with any claims relating to the subject matter hereof.

USA
ACR Supply Company Inc.

2719 Hillsborough Road
Durham, NC 27705
Phone: 919-286-2228

With branches in NC

Aireco Supply

9120 Washington Boulevard
Savage, MD 20763-0414
Phone: 301-953-8800

With branches in MD, VA

Amcon Controls, Inc.

11906 Warfield Street
San Antonio, TX 78216
Phone: 210-349-6161
Houston, TX branch 713-464-7002

Applied Automation

A Wilson Mohr Company
3186 South Washington Street, #230
Salt Lake City, UT 84115
Phone: 801-486-6454

Boston Aircontrols, Inc.

8 Blanchard Road
Burlington, MA 01803
Phone: 781-272-5800

Charles D. Jones Co.

445 Bryant Street, Unit #1
Denver, CO 80204-4800
Phone: 800-777-0910

With branches in CO, MO, KS

Climatic Control Div/ICD

5061 W. State Street
Milwaukee, WI 53208
Phone: 800-242-1656

With branches in WI

Cochrane Supply and Engineering, Inc.

30303 Stephenson Highway
Madison Heights, MI 48071-1633
Phone: 800-482-4894

With branches in MI and Maumee, OH

Columbus Temperature Control

1053 E. 5th Avenue
Columbus, OH 43201
Phone: 800-837-1837

Controlco

5600 Imhoff Drive, Suite G
Concord, CA 94520
Phone: 925-602-7728

With branches in CA, NV

Control Products

9101 Jameel, Suite 130
Houston, TX 77447
Concord, CA 94520
Phone: 713-690-6300

Edward C. Smyers & Co.

223 Fort Pitt Boulevard
Pittsburgh, PA 15222-1505
Phone: 412-471-3222

Engineered Control Systems

4805 N.W. 79th Avenue
Suite 11
Miami, FL 33166

Phone: 305-418-8901

With branches in FL

G & O Thermal Supply

5435 N. Northwest Highway
Chicago, IL 60630
Phone: 773-763-1300

**With branches in IL
Industrial Controls Distributors LLC**

1776 Bloomsbury Avenue
Wanamassa, NJ 07712
Phone: 800-631-2112

**With branches in
GA, KY, IN, MA, ME, NC, NY, OH, PA, TN**

Interstate HVAC Controls

30 Vineland Street
Brighton, MA 02135
Phone: 617-782-9000

Jackson Controls

1708 E. 10th Street
Indianapolis, IN 46201
Phone: 317-231-2200

M & M Controls

9E West Aylesbury Road
Timonium, MD 21093
Phone: 410-252-1221

With a branch in Alexandria, VA

MICONTROLS, Inc.

6516 5th Place South
Seattle, WA 98124
Phone: 800-877-8026

With branches in WA, OR

Meier Supply

123 Brown Street
Johnson City, NY 13790
Phone: 607-797-7700

With branches in NY, PA

Minvalco, Inc.

3340 Gorham Avenue
Minneapolis, MN 55426-4267
Phone: 952-920-0131

With branches in MN

RSD/Refrigeration Supply Distribution

26021 Atlantic Ocean Drive
Lake Forest, CA 92630
Phone: 949-380-7878

**With branches in
CA, NV, OR, AK, AZ, ID, UT, WA, MT**

Saint Louis Boiler Supply, Co.

617 Hanley Industrial Court
St. Louis, MO 63144
Phone: 314-962-9242

South Side Control Supply, Co.

488 N. Milwaukee Avenue
Chicago, IL 60610-3923
Phone: 312-226-4900

With branches in IL, IN

Stromquist and Company

4620 Atlanta Road
Smyrna, GA 30080
Phone: 404-794-3440

With a branch in Orlando, FL

Temperature Control Systems

10315 Brockwood Road
Dallas, TX 75238
Phone: 214-343-1444

With branches in OK, TX

Tower Equipment Co., Inc.

1320 West Broad Street
Stratford, CT 06615
Phone: 800-346-4647

Twinco Supply Corporation

55 Craven Street
Huntington Station, NY 11746-2143
Phone: 800-794-3188

With branches in NY

Wilson-Mohr, Inc.

12610 West Airport Blvd, Suite 100
Sugarland, TX 77478
Phone: 281-295-8850

CANADA

**For a complete list of distributors
in Canada, please visit our
website: www.belimo.ca
or call toll free: 866-805-7089**

Belimo worldwide: www.belimo.com

BELIMO Americas

USA Locations, 43 Old Ridgebury Road, Danbury, CT 06810
Tel. 800-543-9038, Fax 800-228-8283, marketing@us.belimo.com

1049 Fortunato Loop, Sparks, NV 89436
Tel. 800 987-9042, Fax 800-987-8875, marketing@us.belimo.com

Canada Locations, 14/16 – 5716 Coopers Avenue, Mississauga, Ontario L4Z 2E8
Tel. 866-805-7089, Fax 905-712-3124, marketing@us.belimo.com

Latin America Customer Service, Tel. 203-791-8396, Fax 203-791-9139, marketing@us.belimo.com

