Electronic Pressure Independent Valves (ePIV)

Valve Innovations

- Pressure independent valves compensate for pressure variations, performing a continual balancing function to maintain system performance at varying loads.
- Precise flow control eliminates over-pumping and provides favorable energy savings.
- Equal percentage flow characteristics leads to system controllability.
- Pressure independent valves prevent energizing additional chillers by maintaining desirable Delta T.
- Pressure independent valves are selected based on coil flow rate and no Cv calculations are needed.

Features and Benefits

- Simplified valve sizing and selection, no Cv calculations required.
- Electronic flow sensor, no maintenance required with no moving parts.
- True flow feedback or valve position feedback is available as 0-10 VDC or 2-10 VDC.
- Settings can be viewed or changed using the optional ZTH US or with a computer using the PC-Tool software.

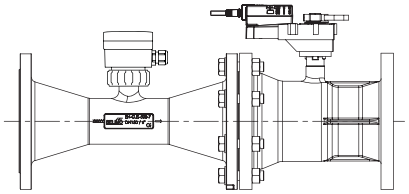
Set-Up

		2-WAY VALVE SPECIFY UPON ORDERING			
NON-SPRING RETURN STAYS IN LAST POSITION	**LRX…Series** **NRX…Series** **ARX…Series** **GRX…Series**	**NC:** Normally Closed-valve will open as voltage increases.	**NO:** Normally Open-valve will close as voltage increases.		
ELECTRONIC FAIL-SAFE STAYS IN FAIL-SAFE POSITION	**AKRX…Series** **GKRX…Series**	**NC/FO Valve:** Normally Closed-valve will open as voltage increases. Fail Action: Will fail open upon power loss.	**NC/FC Valve:** Normally Closed-valve will open as voltage increases. Fail Action: Will fail closed upon power loss.	**NO/FC Valve:** Normally Open-valve will close as voltage increases. Fail Action: Will fail closed upon power loss.	**NO/FO Valve:** Normally Open-valve will close as voltage increases. Fail Action: Will fail open upon power loss.

NOTE: Feedback signal is always direct acting (2V close, 10V open).

Functionality

The ePIV is a pressure independent control valve that incorporates a flow meter and a 2-way control valve. The actuator has a powerful algorithm that modulates the control valve to maintain the flow regardless of variations in system differential pressure. In addition, the ePIV provides a feedback as a 0-10 VDC or 2-10 VDC to the BMS system. Depending on the system requirement, this feedback can be configured to be either True Flow or Valve Position using the PC-Tool software.

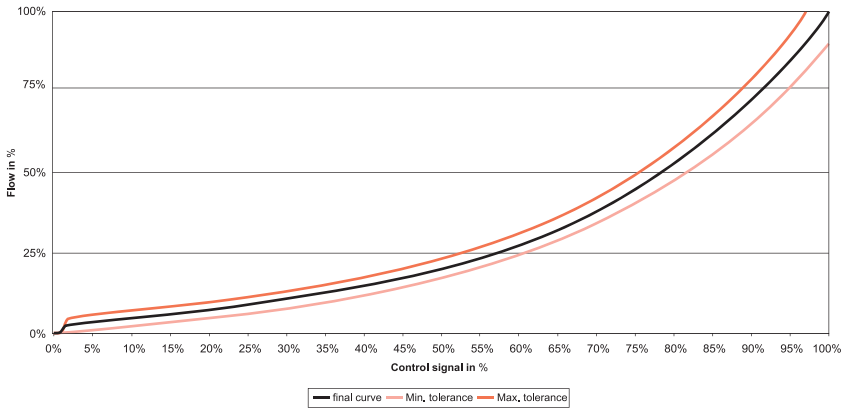


Flow Characteristics and Tolerances

Flow Control Tolerance of the ePIV:
±5% of the actual Flow
Flow measurement tolerance ± 2% of the nominal flow.

V'nom = flow rating of valve as listed in catalog

The ePIV has an equal percentage flow curve.
The equal percentage curve offers a more stable control for heating and cooling applications.
The flow characteristic can be changed from equal percentage to linear using the Belimo PC-Tool.
Linear flow characteristic is used when controlling applications other than cooling/heating coils; like bypass control.



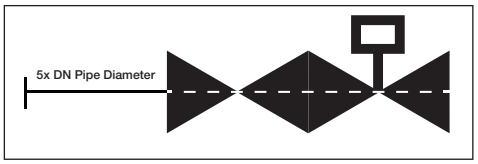
Equal Percentage, Control Signal Vs. Flow Percentage

Controller Signal Actuator Feedback: Y/U5			Controller Signal Actuator Feedback: Y/U5			Controller Signal Actuator Feedback: Y/U5		
0.5-10 VDC Signal	2-10 VDC Signal	Water Flow in %	0.5-10 VDC Signal	2-10 VDC Signal	Water Flow in %	0.5-10 VDC Signal	2-10 VDC Signal	Water Flow in %
0.50	2.00	0%	3.73	4.72	12%	6.96	7.44	36%
0.60	2.08	0%	3.83	4.80	12%	7.06	7.52	37%
0.69	2.16	0%	3.92	4.88	13%	7.15	7.60	38%
0.79	2.24	0%	4.02	4.96	13%	7.24	7.68	39%
0.88	2.32	0%	4.11	5.04	14%	7.34	7.76	41%
0.98	2.40	0%	4.21	5.12	14%	7.43	7.84	42%
1.07	2.48	0%	4.30	5.20	15%	7.53	7.92	43%
1.17	2.56	2%	4.40	5.28	15%	7.62	8.00	45%
1.26	2.64	3%	4.49	5.36	15%	7.72	8.08	46%
1.36	2.72	3%	4.59	5.44	16%	7.81	8.16	48%
1.45	2.80	4%	4.68	5.52	16%	7.91	8.24	49%
1.55	2.88	4%	4.78	5.60	17%	8.00	8.32	51%
1.64	2.96	4%	4.87	5.68	18%	8.10	8.40	53%
1.74	3.04	5%	4.97	5.76	18%	8.20	8.48	54%
1.83	3.12	5%	5.06	5.84	19%	8.29	8.56	56%
1.93	3.20	5%	5.16	5.92	19%	8.39	8.64	58%
2.02	3.28	6%	5.25	6.00	20%	8.48	8.72	60%
2.12	3.36	6%	5.35	6.08	21%	8.58	8.80	62%
2.21	3.44	6%	5.44	6.16	21%	8.67	8.88	64%
2.31	3.52	7%	5.54	6.24	22%	8.77	8.96	66%
2.40	3.60	7%	5.63	6.32	23%	8.86	9.04	68%
2.50	3.68	7%	5.73	6.40	24%	8.96	9.12	70%
2.59	3.76	8%	5.82	6.48	24%	9.05	9.20	73%
2.69	3.84	8%	5.92	6.56	25%	9.15	9.28	75%
2.78	3.92	8%	6.01	6.64	26%	9.24	9.36	77%
2.88	4.00	9%	6.11	6.72	27%	9.34	9.44	80%
2.97	4.08	9%	6.20	6.80	28%	9.43	9.52	83%
3.07	4.16	9%	6.30	6.88	29%	9.53	9.60	85%
3.16	4.24	10%	6.39	6.96	29%	9.62	9.68	88%
3.26	4.32	10%	6.49	7.04	30%	9.72	9.76	91%
3.35	4.40	11%	6.58	7.12	31%	9.81	9.84	94%
3.45	4.48	11%	6.68	7.20	32%	9.91	9.92	97%
3.54	4.56	11%	6.77	7.28	33%	10.00	10.00	100%
3.64	4.64	12%	6.87	7.36	35%			

Installation

Inlet Length
The ePIV requires a section of straight pipe on the valve inlet to guarantee sensor accuracy. This section should be at least 5 pipe diameters long with respect to the size of the valve.

DN15 5 x DN = 2.5" [63.5 mm]
DN20 5 x DN = 3.75" [95.2 mm]
DN25 5 x DN = 5" [127 mm]
DN32 5 x DN = 6.25" [158.7 mm]
DN40 5 x DN = 7.5" [190.5 mm]
DN50 5 x DN = 10" [254 mm]
DN65 5 x DN = 12.5" [317 mm]
DN80 5 x DN = 15" [381 mm]
DN100 5 x DN = 20" [508 mm]
DN125 5 x DN = 25" [635 mm]
DN150 5 x DN = 30" [762 mm]



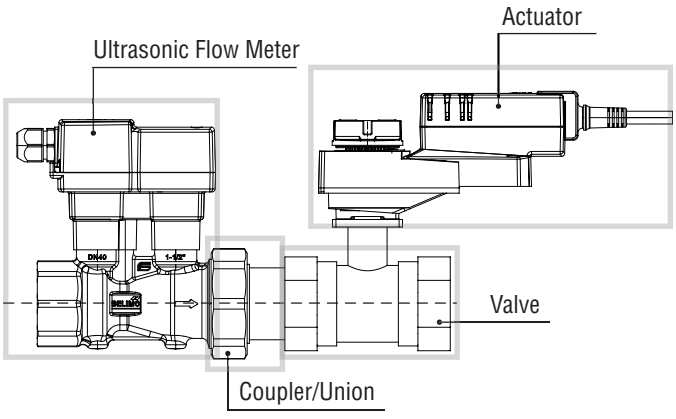
Outlet Length
No requirements for outlet length. Elbows can be installed directly after the valve.

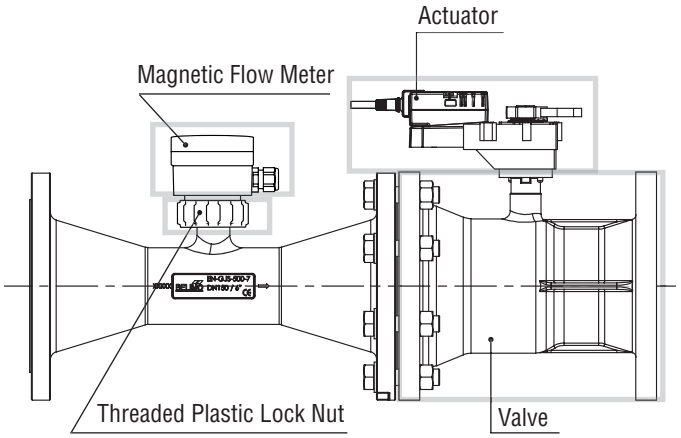
Actuator & Flow Sensor Removal

To replace flow sensor, isolation valves need to be closed or system needs to be drained.

½" to 2" ePIV
The flow sensor cannot be separated from the flow housing. However, it can be separated from the valve using the coupler/union connecting both.

2½" to 6" ePIV
The flow sensor assembly can be separated from the sensor housing. To remove the flow sensor from the housing, loosen the threaded plastic locking nut. Before assembly, ensure the o-ring and plastic C-shaped flange washer are in place. Only hand tighten the plastic locking nut. Do not use any tools.

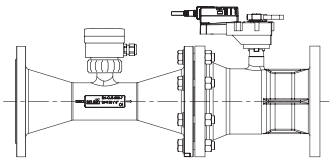


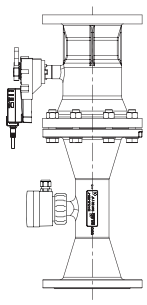


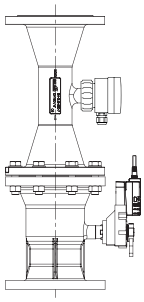
Orientation

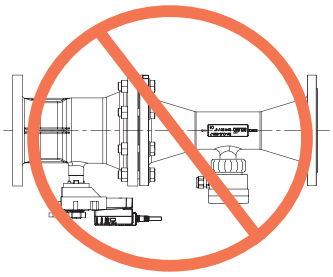
ePIVs shall be installed with flow in the direction of the arrow on the valve body.

The valve assembly can be installed in a vertical or horizontal arrangement, as long as the actuator is positioned to avoid condensation from dripping onto the actuator.









(Not for use with weather shields)

Flow Reduction Chart

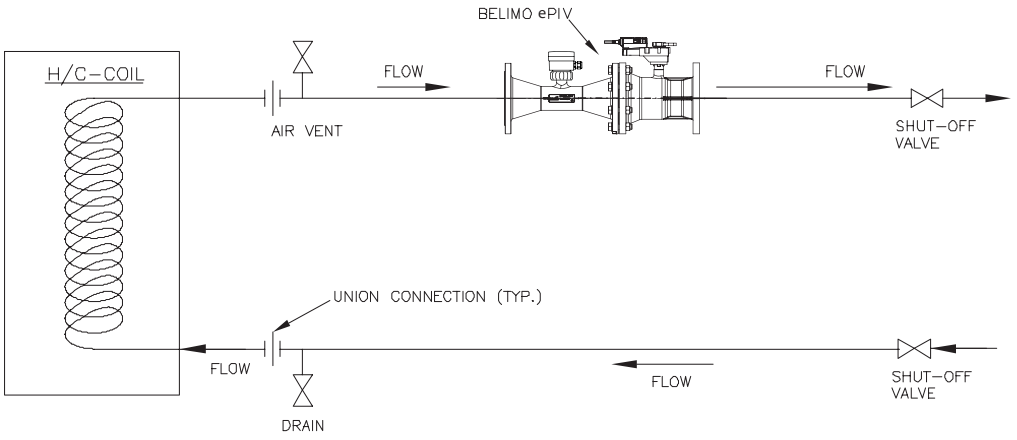
MAXIMUM FLOW BASED ON MINIMUM DIFFERENTIAL PRESSURE

Size		8 psi	5 psi*	4 psi	3 psi	2 psi	1 psi
Inches	DN [mm]						
½	15	5.5 GPM	5.5 GPM	5.5 GPM	5.5 GPM	4.8 GPM	3.4 GPM
¾	20	10.3 GPM	10.3 GPM	10.3 GPM	9.9 GPM	8.1 GPM	5.7 GPM
1	25	18.2 GPM	18.2 GPM	18.2 GPM	17.2 GPM	14.1 GPM	9.9 GPM
1¼	32	28.5 GPM	28.5 GPM	28.5 GPM	28.5 GPM	23.3 GPM	16.5 GPM
1½	40	39.6 GPM	39.6 GPM	39.6 GPM	39.6 GPM	34.9 GPM	24.7 GPM
2	50	100 GPM**	76.1 GPM	74 GPM	64.1 GPM	52.3 GPM	37 GPM
2½	65	127 GPM	127 GPM	93 GPM	81 GPM	66 GPM	47 GPM
3	80	180 GPM	180 GPM	138 GPM	120 GPM	97 GPM	69 GPM
4	100	317 GPM	317 GPM	235 GPM	203 GPM	166 GPM	117 GPM
5	125	495 GPM	495 GPM	367 GPM	318 GPM	260 GPM	183 GPM
6	150	713 GPM	713 GPM	550 GPM	476 GPM	389 GPM	275 GPM

* Select valve based on a minimum of 5 PSI differential.
** Applies to 2" EPIV models P2200S-800 through P2200S-1000 only.

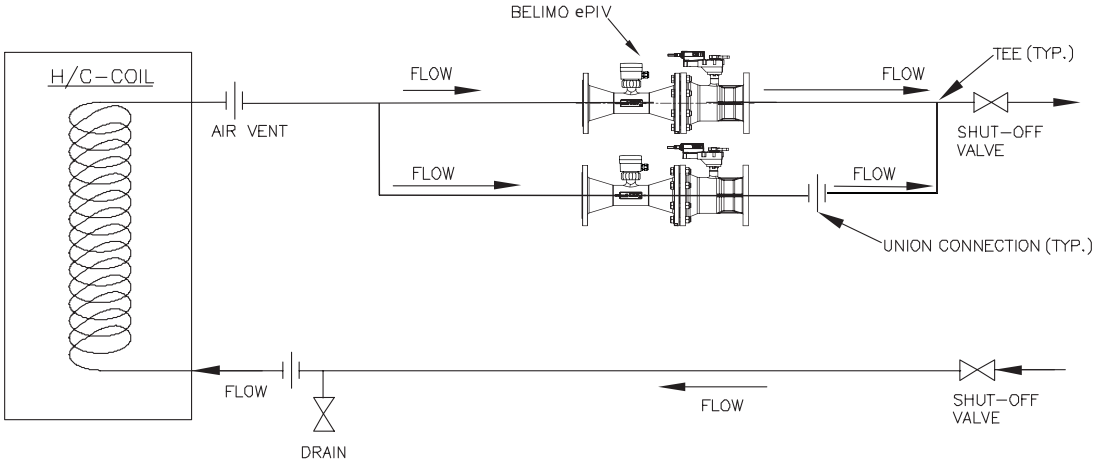
Piping

The ePIV is recommended to be installed on the return side of the coil. This diagram is for typical applications only. Consult engineering specification and drawings for particular circumstances. Refer to Belimo documentation for flow verification and commissioning procedures.
It is not necessary to install one strainer per unit. Belimo recommends installing one strainer per system. If the system has multiple branches, it is recommended to install one strainer per branch.



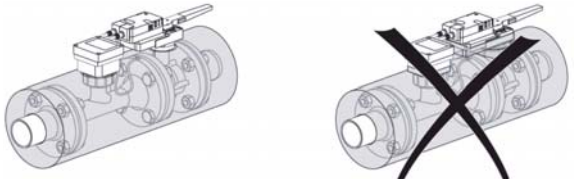
Typical Parallel Piping in Relation to the Input and Output

To achieve flows larger than V'nom or nominal flow, it is recommended to connect two valves in parallel leading to a common manifold. To correctly operate these valves, the Multi-Function Technology (MFT) will be employed to utilize one common control signal. It is recommended to use the same signal in parallel (2-10 VDC); the two actuators are wired from the same control signal and the two valves control the flow in an identical pattern, the resulting flow will be double an individual valve.



Insulation:

The insulation should be below the actuator.



P6	250S	-127	+ARX	24	-PI
Electronic Pressure Independent Valve P2- NPT 2-way (½" to 2") P6- Flanged 2-way (2½" to 6")	**Valve Size** 050 = ½" 075 = ¾" 100 =1" 125 = 1¼" 150 = 1½" 200 = 2" 250 = 2½" 300 = 3" 400 = 4" 500 = 5" 600 = 6" S = Stainless Steel Ball and Stem	**Flow Rate** 127 GPM Refer to pages 8 and 9 for a full list	**Actuator Type** Non-Spring Return LRX NRX ARX GRX Electronic Fail-Safe AKRX GKRX	**Power Supply** 24 = 24 VAC/DC	EP = ½" to 2" PI = 2½" to 6" Proportional Control

Ordering Example

1 Choose the valve actuator combination.

P6250S-127+ARX24-PI

+NC

+Tagging (if needed)

2 Specify preference or configuration.

3 **Select programming code**

Set-Up

Non-Spring Models
NO = Normally Open
NC = Normally Closed

Electronic Fail-Safe Models
NO/FO = Normally Open/Fail Open
NO/FC = Normally Open/Fail Closed

NC/FO = Normally Closed/Fail Open
NC/FC = Normally Closed/Fail Closed

Refers to valve ports from inlet to outlet, per flow arrow.

D01

D00	0.5 to 10 VDC
D01	2 to 10 VDC

4 Does order require tagging?

Tagging:
Valves may be tagged per customer specification. ($10.00 charge per tag)

Example:
AHU-1
FCU-2

Part number for tagging:
99981-00101

5 Complete Ordering Example: P6250S-127+ARX24-PI+NC+D01

Electronic Pressure Independent Valves (ePIV)
Product Range Overview – P2..., 2-way
Available Flow Rates

	Valve Nominal Size		Type	Suitable Actuators	
GPM	Inches	DN [mm]	2-way NPT	Non-Spring Return	Electronic Fail-Safe
1.65	½	15	P2050S-165	LRX24-EP	AKRX24-EP
2			P2050S-020		
2.5			P2050S-025		
3			P2050S-030		
3.5			P2050S-035		
4			P2050S-040		
4.5			P2050S-045		
5			P2050S-050		
5.5*			P2050S-055		
6	¾	20	P2075S-060		
6.5			P2075S-065		
7			P2075S-070		
7.5			P2075S-075		
8			P2075S-080		
8.5			P2075S-085		
9			P2075S-090		
9.5			P2075S-095		
10.3*			P2075S-103		
11.1	1	25	P2100S-111		
12			P2100S-012		
13.1			P2100S-131		
14.2			P2100S-142		
15.1			P2100S-151		
16			P2100S-016		
16.9			P2100S-169		
18.2*			P2100S-182		
18	1¼	32	P2125S-018	NRX24-EP	
19.1			P2125S-191		
20			P2125S-020		
21.1			P2125S-211		
22			P2125S-222		
23.1			P2125S-231		
24.2			P2125S-242		
25.1			P2125S-251		
26.2			P2125S-262		
27.1			P2125S-271		
28.5*			P2125S-285		
26.1	1½	40	P2150S-261		
27.3			P2150S-273		
28.1			P2150S-281		
29.3			P2150S-293		
30			P2150S-030		
31.3			P2150S-313		
32.1			P2150S-321		
33			P2150S-033		
34.1			P2150S-341		
35.2			P2150S-352		
36			P2150S-036		
37.2			P2150S-372		
38			P2150S-038		
39.6*			P2150S-396		
32.7	2	50	P2200S-327	ARX24-EP	
34.2			P2200S-342		
35.8			P2200S-358		
38.1			P2200S-381		
40.3			P2200S-403		
44.1			P2200S-441		
47.9			P2200S-479		
52.5			P2200S-525		
56.3			P2200S-563		
60.1			P2200S-601		
65.4			P2200S-654		
70			P2200S-070		
76.1*	2	50	P2200S-761		
80			P2200S-800**		
85			P2200S-850**		
90			P2200S-900**		
95			P2200S-950**		
100*			P2200S-1000**		

ePIV

Equal Percentage Characteristic

Mode of Operation
The Electronic Pressure Independent Control Valve is a two-way valve which maintains constant flow regardless of pressure variations in the system.

Product Features
Provides constant flow regardless of pressure variations in the system. Maximizes chiller ΔP, preventing energizing additional chillers due to low ΔT. Simplified valve sizing and selection, no Cv calculations required.

Actuator Specifications

Control type	proportional
Manual override	LR, NR, AR, AK
Electrical connection	3 ft [1m] cable with ½" conduit fitting

Valve Specifications

Service	chilled or hot water, 60% glycol (open loop and steam not allowed)
Flow characteristic*	equal percentage/linear
Controllable flow range	75°
Sizes	½", ¾", 1", 1¼", 1½", 2"
End fitting	NPT female ends
Materials	
Body	
Valve	brass, nickel plated
Sensor housing	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Seats	Teflon® PTFE
Characterizing disc	Tefzel® (½"- 2")
O-rings	EPDM (lubricated)
Media temp range	14°F to 250°F [-10°C to +120°C], 39°F to 250°F [4°C to 120°C]**
Body pressure rating	250 psi
Close-off pressure	200 psi
Differential pressure range (ΔP)	1 to 50 psi (Refer to page 5.) 5 to 50 psi 8 to 50 psi**
Leakage	0%
Inlet length to meet specified measurement accuracy	5x DN

* V'nom = Maximum flow for each valve body size.

** Applies to 2" EPIV models P2200S-800 through P2200S-1000 only.

	Valve Nominal Size		Type	Suitable Actuators	
GPM	Inches	DN [mm]	2-way Flanged	Non-Spring Return	Electronic Fail-Safe
105	2½	65	P6250S-105	ARX24-PI	AKRX24-PI
110			P6250S-110		
115			P6250S-115		
121			P6250S-121		
127*			P6250S-127		
133	3	80	P6300S-133		
141			P6300S-141		
149			P6300S-149		
157			P6300S-157		
173			P6300S-173		
180*			P6300S-180		
195	4	100	P6400S-195	GRX24-PI	GKRX24-PI
210			P6400S-210		
225			P6400S-225		
240			P6400S-240		
255			P6400S-255		
270			P6400S-270		
285			P6400S-285		
300			P6400S-300		
317*			P6400S-317		
335	5	125	P6500S-335		
353			P6500S-353		
371			P6500S-371		
389			P6500S-389		
407			P6500S-407		
425			P6500S-425		
443			P6500S-443		
461			P6500S-461		
479			P6500S-479		
495*			P6500S-495		
515	6	150	P6600S-515		
537			P6600S-537		
559			P6600S-559		
581			P6600S-581		
603			P6600S-603		
625			P6600S-625		
647			P6600S-647		
669			P6600S-669		
691			P6600S-691		
713*			P6600S-713		

*V'nom = Maximum flow for each valve body size.

ePIV

Equal Percentage Characteristic

Mode of Operation

The Electronic Pressure Independent Control Valve is a two-way valve which maintains constant flow regardless of pressure variations in the system.

Product Features

Provides constant flow regardless of pressure variations in the system. Maximizes chiller ΔP, preventing energizing additional chillers due to low ΔT. Simplified valve sizing and selection, no Cv calculations required.

Actuator Specifications

Control type	proportional
Manual override	AR, GR, AKR, GKR
Electrical connection	3 ft [1m] cable with ½" conduit fitting

Valve Specifications

Service	chilled or hot water, 60% glycol (open loop and steam not allowed)
Flow characteristic*	equal percentage/linear
Controllable flow range	75°
Sizes	2½", 3", 4", 5", 6"
End fitting	pattern to mate with ANSI 125 flange
Materials	
Body	
Valve	cast iron-GG25
Sensor housing	ductile iron- GGG50
Ball	stainless steel
Stem	stainless steel
Seats	Teflon® PTFE
Characterizing disc	stainless steel
O-rings	EPDM (lubricated)
Media temp range	14°F to 250°F [-10°C to +120°C]
Body pressure rating	ANSI 125, Class B
Close-off pressure	100 psi
Differential pressure range (ΔP)	1 to 50 psi** 5 to 50 psi
Leakage	0%
Inlet length to meet specified measurement accuracy	5x DN
Conductivity	min. 20uS/cm (no fully desalinated systems)

*The flow characteristic can be changed by using the Belimo PC-Tool software.

**See flow reduction table on page 5.

P2... Series Electronic Pressure Independent Valves (ePIV)
Stainless Steel Ball, NPT Female Ends

Application

Water-side control of heating and cooling systems for AHUs and heat pumps.
Equal Percentage: Heating / cooling applications.
Linear Characteristic: Bypass control.

Mode of Operation

The Electronic Pressure Independent Control Valve is a two-way valve which maintains constant flow regardless of pressure variations in the system.

Product Features

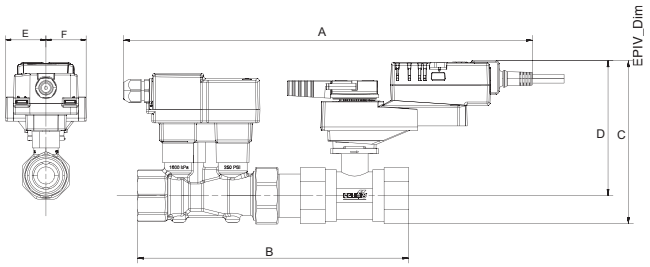
Provides constant flow regardless of pressure variations in the system.
Maximizes chiller ΔP, preventing energizing additional chillers due to low ΔT.
Simplified valve sizing and selection, no Cv calculations required.

Valve Specifications	
Service	chilled or hot water, 60% glycol max (open loop/steam not allowed)
Flow characteristic	equal percentage / linear
Controllable flow range	75° rotation
Size	½", ¾", 1", 1¼", 1½", 2"
End fitting	NPT female ends
Materials	
Body	forged brass, nickel plated
Sensor Housing	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Seat	Teflon® PTFE
Characterizing disc	Tefzel®
O-ring	EPDM
Packing	EPDM
Body pressure rating	250 psi
Media temperature range	14°F to 250°F [-10°C to +120°C], 39°F to 250°F [4°C to 120°C]**
Noise level	<35 dB(A)
Leakage	0%
Close-off pressure	200 psi
Differential pressure range(ΔP)	1 to 50 psi*, 5 to 50 psi, 8 to 50 psi**
Inlet length required to meet specified measurement accuracy	5x nominal pipe size (NPS)
Humidity	<95% RH non-condensing
Flow metering technology	ultrasonic with temperature and glycol compensation
Flow control tolerance	±5%
Flow measurement tolerance	±2%
Flow measurement repeatability	±0.5%
Rated impulse voltage	actuator/sensor: 0.8 kV (in accordance with EN 60730-1)
Power supply for the flow sensor	sensor is powered by the actuator
Quality standard	ISO 9001
Agency listings	UL 60730-1/2-14, 2-18, CE according to 2004/108/EC and 2006/95/EC

All flow accuracies are @ 68°F (20°C).

* See flow reduction chart on page 5.
** Applies to 2" EPIV models P2200S-800 through P2200S-1000 only

Dimensions



Valve Nominal Size		Dimensions (Inches [mm])					
Inches	DN [mm]	A	B	C	D	E	F
½"	15	14.56" [370]	7.50" [191]	5.47" [139]	4.92" [125]	1.55" [39]	1.55" [39]
¾"	20	14.83" [377]	8.00" [203]	5.57" [141]	4.92" [125]	1.55" [39]	1.55" [39]
1"	25	15.30" [390]	9.10" [231]	5.80" [147]	5.00" [127]	1.55" [39]	1.55" [39]
1¼"	32	16.37" [416]	10.00" [254]	6.08" [154]	5.15" [131]	1.73" [44]	1.73" [44]
1½"	40	16.76" [426]	10.78" [274]	6.65" [169]	5.55" [141]	1.73" [44]	1.73" [44]
2"	50	17.04" [433]	11.18" [284]	6.89" [175]	5.59" [142]	1.73" [44]	1.73" [44]

	Valve Nominal Size		Type	Actuator Type	
GPM Range	Inches	DN [mm]	2-way Female NPT	Non-Spring Return	Electronic Fail-Safe
1.65-5.5	½"	15	P2050S	LRX	AKRX
6-10.3	¾"	20	P2075S	LRX	AKRX
11.1-18.2	1"	25	P2100S	LRX	AKRX
18.0-28.5	1¼"	32	P2125S	NRX	AKRX
26.1-39.6	1½"	40	P2150S	NRX	AKRX
32.7-100**	2"	50	P2200S	ARX	AKRX

Application

Water-side control of heating and cooling systems for AHUs and heat pumps.
Equal Percentage: Heating / cooling applications.
Linear Characteristic: Bypass control.

Mode of Operation

The Electronic Pressure Independent Control Valve is a two-way valve which maintains constant flow regardless of pressure variations in the system.

Product Features

Provides constant flow regardless of pressure variations in the system.
Maximizes chiller ΔP, preventing energizing additional chillers due to low ΔT.
Simplified valve sizing and selection, no Cv calculations required.

Valve Specifications

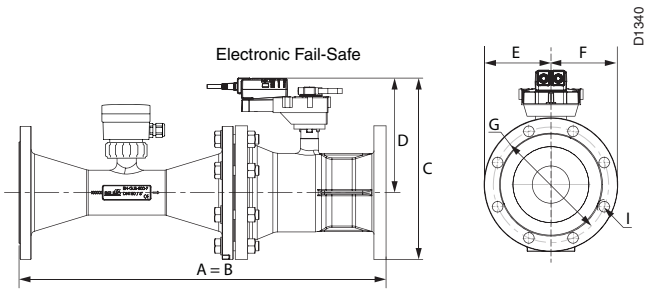
Service	chilled or hot water, 60% glycol max (open loop/steam not allowed)
Flow characteristic	equal percentage / linear
Controllable flow range	75° rotation
Size	2½", 3", 4", 5", 6"
End fitting	pattern to mate with ANSI 125 flange
Materials	
Body	cast iron - GG25 and ductile iron - GGG50
Ball	stainless steel
Seat	PTFE
Characterizing disc	stainless steel
Packing	2 EPDM O-rings, lubricated
Body pressure rating	according to ANSI 125, standard class B
Media temperature range	14°F to 250°F [-10°C to +120°C]
Conductivity	Min. 20uS/cm (no fully desalinated systems)
Leakage	0%
Close-off pressure	100 psi
Differential pressure range(ΔP)	1 to 50 psi*, 5 to 50 psi
Inlet length required to meet specified measurement accuracy	5x nominal pipe size (NPS)
Humidity	<95% RH non-condensing
Flow metering technology	electromagnetic
Flow control tolerance	±5%
Flow measurement tolerance	±2%
Flow measurement repeatability	±0.5%
Power supply for the flow sensor	sensor is powered by the actuator
Quality standard	ISO 9001
Agency listings	UL 60730-1/2-14, 2-18, CE according to 2004/108/EC and 2006/95/EC

All flow accuracies are @ 68°F (20°C).
*See flow reduction chart on page 5.

Weights

Valve Nominal Size		Weights
Inches	DN [mm]	Pounds [kg]
2½"	65	52.0 [23.3]
3"	80	63.0 [28.3]
4"	100	89.0 [40.1]
5"	125	120.0 [54.3]
6"	150	154.0 [69.6]

Dimensions



Valve Nominal Size		Dimensions (Inches [mm])							
Inches	DN [mm]	A	B	C	D	E	F	G	I
2½"	65	17.9" [454]	17.9" [454]	10.82" [275]	7.18" [182]	3.64" [92]	3.64" [92]	7.28" [185]	0.75" [19]
3"	80	10.7" [499]	10.7" [499]	10.82" [275]	7.18" [182]	3.64" [92]	3.64" [92]	7.87" [200]	0.75" [19]
4"	100	22.85" [581]	22.85" [581]	11.92" [303]	8.17" [208]	3.75" [95]	3.75" [95]	7.5" [191]	0.75" [19]
5"	125	25.18" [640]	25.18" [640]	14.42" [366]	9.42" [239]	5" [127]	5" [127]	10" [254]	0.88" [22]
6"	150	30.2" [767]	30.2" [767]	14.92" [379]	9.42" [239]	5.5" [140]	5.5" [140]	11" [279]	0.88" [22]

Valve Nominal Size		Type	Actuator Type	
GPM Range	Inches	DN [mm]	2-way Flanged	Non-Spring Return	Electronic Fail-Safe
80-127	2½"	65	P6250S	ARB, ARX	AKRB, AKRX
128-180	3"	80	P6300S	ARB, ARX	AKRB, AKRX
200-317	4"	100	P6400S	GRB, GRX	AKRB, AKRX
337-495	5"	125	P6500S	GRB, GRX	GKRB, GKRX
513-713	6"	150	P6600S	GRB, GRX	GKRB, GKRX

Non-Spring Return Actuators

AR Series LR Series
GR Series NR Series

Actuator Specifications	
Power supply	24 VAC ± 20% 24 VDC ± 10%
Electric Frequency	50/60 Hz
Power consumption	
LR Series	3.2W
NR Series	4.2W
AR Series	4.2W (2½" to 6") 8.5W (½" to 2")
GR Series	9W
Transformer sizing	
LR Series	6 VA (class 2 power source)
NR Series	7 VA (class 2 power source)
AR Series	7 VA (class 2 power source) (2½" to 6") 11 VA (class 2 power source) (½" to 2")
GR Series	7 VA (class 2 power source)
Electrical connection	18 GA, Plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3ft [1m] cable
Overload protection	electronic throughout 0° to 90° rotation
Operation range Y	2 to 10 VDC (default) VDC variable
Control	Proportional
Input impedance	100 kΩ (0.1 mA), 500Ω
Feedback	2 to 10VDC (default), VDC variable
Torque	
LR Series	45 in-lbs [5 Nm]
NR Series	90 in-lbs [10 Nm]
AR Series	180 in-lbs [20 Nm]
GR Series	360 in-lbs [40 Nm]
Direction of rotation	electronically variable
Manual override	external push button
Running time normal operation	90 seconds
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 2, IP54, UL enclosure type 2
Agency listings	cULus acc. to UL60730-1A/-2-14, CAN/CSA, CE acc. to 2004/108/EC and 2006/95/EC
Noise level	<45dB(A) at 90 seconds
Servicing	maintanence free
Quality standard	ISO 9001
Weight	
LR Series	1.50 lbs [.68 kg]
NR Series	1.20 lbs [.54 kg]
AR Series	2.65 lbs [1.2 kg]
GR Series	4.85 lbs [2.2 kg]

The ZTH US and the PC-Tool are tools created to easily adapt the flow settings for the ePIV in the field. It directly connects to the Belimo actuator.

Operation

The actuator is electronically protected against overload.

The actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

Electronic Fail-Safe Actuators

AKR Series
GKR Series

Actuator Specifications	
Power supply	24VAC ±20% 24VDC ±10%
Electric Frequency	50/60 Hz
Power consumption	
AKR Series	12W
GKR Series	14W
Transformer sizing	24 VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0° to 90° rotation
Operation range Y	2 to 10VDC (default), VDC variable
Input impedance	100 kΩ (0.1 mA), 500Ω
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Torque	
AKR Series	180 in-lb [20Nm]
GKR Series	360 in-lb [40 Nm]
Direction of rotation	electronically variable
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Manual override	external push button
Running time normal operation	90 seconds
Running time fail-safe	35 seconds
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	NEMA2, IP54, UL enclosure type 2
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	
AKR Series	3.30 lb [1.5 kg]
GKR Series	5.51 lb [2.5 kg]

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.

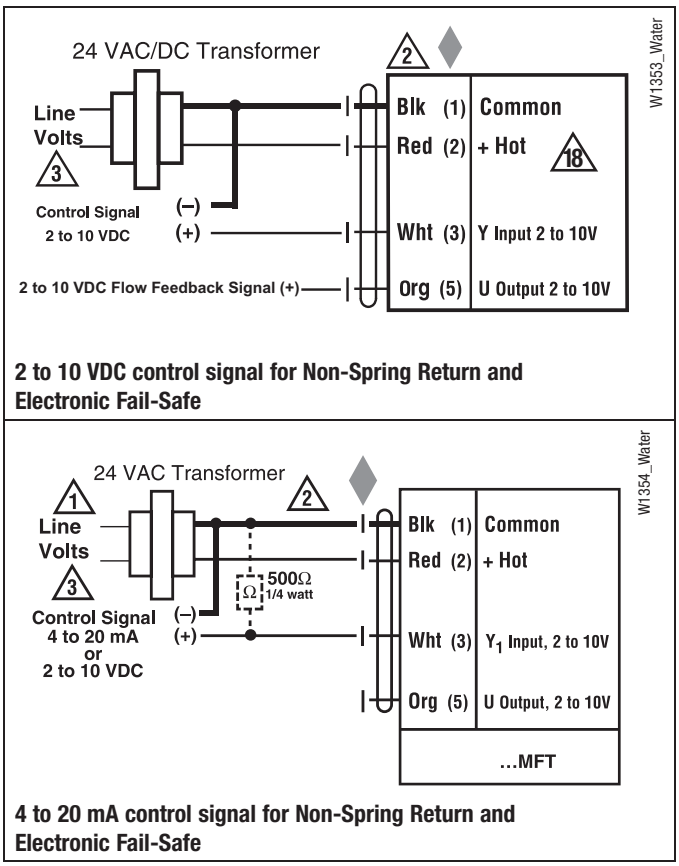
3 Actuators may also be powered by 24 VDC.

18 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Wire numbers are provided for reference.

APPLICATION NOTES

◆ Meets UL 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.



2 to 10 VDC control signal for Non-Spring Return and Electronic Fail-Safe

4 to 20 mA control signal for Non-Spring Return and Electronic Fail-Safe

System Ground

In cases where the valve body is electrically isolated from the water pipe, an earth ground should be installed in order for the sensor to work properly. Earth ground can be connected directly on the sensor body. A connection point is provided on the flange of the sensor body (2½" to 6" only).

General Warnings

Valve should not be used for combustible gas applications. Gas leaks and explosions may result. Do not install in systems, which exceed the ratings of the valve.

- Avoid installations where valve may be exposed to excessive moisture, corrosive fumes, vibration, high ambient temperatures, elements, or high traffic areas with potential for mechanical damage.
- Valve assembly location must be within ambient ratings of actuator. If temperature is below -22°F a heater is required.
- The valve assembly will require heat shielding, thermal isolation, or cooling if combined effect of medium and ambient temperatures – conduction, convection, and radiation– is above 122°F for prolonged time periods at the actuator.
- Visual access must be provided. Assembly must be accessible for routine schedule service. Contractor should provide unions for removal from line and isolation valves.
- Avoid excessive stresses. Mechanical support must be provided where reducers have been used and the piping system may have less structural integrity than full pipe sizes.
- Sufficient upstream piping runs must be provided to ensure proper valve capacity and flow response. See installation section for details.
- Life span of valve stems and O-rings is dependent on maintaining non-damaging conditions. Poor water treatment or filtration, corrosion, scale, other particulate can result in damage to trim components. A water treatment specialist should be consulted.
- It is not necessary to install one strainer per unit. Belimo recommends installing one strainer per system. If the system has multiple branches, it is recommended to install one strainer per branch.

WARNING: Lift ePIV from valve body. Do not lift this valve by the actuator. Lifting the valve body by the actuator can break the linkage and void the warranty.

1. Inspect shipping package, valve, linkage, and actuator for physical damage. If shipping damage has occurred notify appropriate carrier. Do not install.
2. When replacing the ePIV, remove existing valve, linkage and actuator from the piping system.
3. If actuator and linkage are removed, they must be reinstalled correctly. The actuator must be rotated so that the valve seats properly for close off.
4. Install valve with the proper ports as inlets and outlets. Check that inlet and outlet of 2-way valves are correct. Flow direction arrows must be correct.
5. Blow out all piping and thoroughly clean before valve installation.
6. Clean fittings with wire brush and rag. Clean pipes, fittings, and valve before installation; check for any foreign material that can become lodged in trim components. Strainers should be cleaned after initial startup.
7. Valve must be installed with the stem towards the vertical, not below horizontal.
8. These valves are designed to be installed between ANSI Class 125/150 flanges and NPT.
9. Carefully follow installation using ANSI piping practices.

Parameter	PC-Tool	ZTH US	Description
Volume	Read Only	Read Only	The actual GPM flowing through the valve.
Setpoint	Read Only	Read Only	The limiting GPM for which the valve has been set.
Position	Read Only	Read Only	The valve position displayed in % of V'max.
Step			Override Command. The following commands are available:
- Open	Read/Write	Read/Write	Open - Overrides the valve to the fully open position.
- Close	Read/Write	Read/Write	Close - Overrides the valve to the fully closed position.
V'max	Read/Write	Read/Write	This is the limiting GPM for which the valve is set. Range is 30% - 100% of maximum flow of the valve.
PF-Delay	Read/Write	Read/Write	Power Fail-Safe Delay - Delay for the time to react on fail-safe operation.
MP Address	Read/Write	Read/Write	Belimo's proprietary communication protocol. Can be set from 1 to 8.
Valve Size	Read Only		The valve size set by the manufacturer.
Control Signal	Read/Write		The input from the DDC controller; 0.5V - 10 VDC and 2-10 VDC are available.
Control Signal Inverted	Read/Write		Inverts control signal, i.e. 2 VDC open, 10 VDC closed.
Feedback	Read/Write		The feedback signal from the actuator; 0.5V - 10 VDC and 2-10 VDC are available.
Valve Charactersitic	Read/Write		The valve can be configured for pressure dependent or pressure independent operation.
Bus Fail Position			The predetermined fail position of the valve. The following options are available:
- Last Setpoint	Read/Write		Last Setpoint - Volumetric flow in accordacnce with the last setpoint received.
- Open	Read/Write		Open - Overrides the valve to the fully open position.
- Close	Read/Write		Close - Overrides the valve to the closed position.
- V'max	Read/Write		The limiting GPM for which the valve is set.

The ZTH US is a tool created to easily adapt the flow settings for the ePIV in the field. It directly connects to the Belimo actuator.

CONNECTION PROCESS:

AR, GR, LR, NR, AK, GK Series
Use the interface on the top of the actuator. (Leave all of the wires of the actuator installed.)

Technical Information

Supply	24 VAC/DC
Communication	PP
Used with actuator types	ARX24 AKRX24 GRX24 GKRX24 LRX24 NRX24

RE-PROGRAMMING PROCESS:

Initial Screen
Connect cable to actuator port, twist to lock in place. Will display the handheld software and hardware versions for 5 seconds then it will display the actuator being connected

Screen 1
Start ePIV process by pressing the up arrow (ESC)
The first screen displays the MFT adress, press ESC to continue to the next screen.

Screen 2

To change the Vmax value press the – button until you reach the required value then press the OK button.

Screen 3

A message is displayed “Y and U5 Adjusted” for 5 seconds. Then the new Vmax value is displayed. Press ESC to continue to the next screen or simply disconnect the device from the actuator.

Screen 4

Press the +/- buttons to select different override commands, once selected press OK to execute.
AUTO: Automatic Operation
OPEN: Overrides the valve to the maximum rotation (90°)
CLOSE: Overrides the valve to minimum rotation (0°)
Vmax: Overrides the valve to its maximum GPM
STOP: Overrides the valve to the last valve position

Note: The override remains active even after you disconnect the ZTH US, it is released using the AUTO command or cycling power on the actuator.

Screen 5

This screen displays the current GPM and valve position. This is used for troubleshooting. A small valve position and large GPM reading might indicate overpressure in the system. A small flow and a big valve position might indicate that there is not enough flow or pressure in the system.

Screen 6

This screen displays the current GPM and the setpoint send by the controller. The voltage signal is converted to GPM in the actuator. This can be used to troubleshooting to verify the signal send by the controller and to verify Setpoint vs. Actual flow.

DISPLAY SCALING PROCEDURE

During flow verification it is possible to have a different reading from an external calibrated flow measuring instrument compared to the flow feedback received from the ePIV sensor. The ZTH US can be used to rescale the ePIV feedback signal to match the reading from the external calibrated instrument. To rescale the ePIV signal please use the following procedure:

Example
Valve Configuration: Vnom: 127 GPM (Maximum Capacity of the valve)
Vmax: 110 GPM (Coil size, the valve should already be configured for this setting prior to this procedure).

During flow verification the valve is overridden from the DDC controller to its maximum GPM (Vmax: 110 GPM). Use the ZTH US verify the flow, for this example it should be 110 GPM. If the valve position is 100% and the flow is not reached the flow must be increased from the pump. Then and external calibrated instrument is used to measure flow and compare it to the ZTH US reading. For this scenario lets say that the instrument reading is 120 GPM. Based on this reading, the ePIV needs to be rescaled to reflect the same value measured by the external instrument.

CALIBRATION INSTRUCTIONS

Step 1
Enable the Advanced and Expert Modes. Press the OK button before powering up the ZTH US.Then connect the handheld to the actuator and release the OK button when the Configuration Menu screen appears. Using the arrow keys scroll down to the Advanced Mode screen, press the + button to change the value to 1, press OK to set the value. Scroll down to the Expert Mode screen and change its value to 1. Then scroll down to leave config-menu screen and press OK. This procedure enables a new screen called Display Scaling.

Step 2
From the DDC controller override the valve to 100% open (10 VDC for NC, or 2 VDC for NO),
Note: The valve will not necessarily rotate to 90° position, since it will try to maintain Vmax. The valve position will vary depending on the system pressure.

Step 3
Using the arrow keys scroll down to the Volume and Setpoint screen. The Setpoint coming from the DDC controller should be Vmax (100%). The Volume should be the same as the setpoint ± 2. If the valve can't reach the setpoint and the valve position is 100% open (90° position) the flow should be increased from the pump. Compare the Volume value with the measurement from the external calibrated instrument, and follow the following steps to adjust the reading.

Step 4
Using the arrow keys scroll down to the Display Scaling screen and press OK, then using the + / – buttons change the Vol. value to the value read by the external calibrated flow instrument. In our example it is 120. Finally press OK.
And the Vnom value will also change.

Step 5
Using the arrow keys scroll down to the Vmax screen and use the +/- keys to set the Vmax back to the Coil value. Press OK to set the value. In our example, Vmax is 110 GPM, this step will reposition the valve so the flow feedback matches the reading taken by the external calibrated flow instrument.

Step 6
Scroll down to the Volume and Setpoint screen. Verify that the Volume value matches the flow reading from the external calibrated device.

Troubleshooting

Problem	Green LED	Valve Position	Feedback Signal	Possible Cause	Possible Solution
The LED on the actuator is not green.	OFF	Static on the last position.	-	• The actuator is not powered. • The actuator is out of service.	• Verify the power supply and the electrical components (fuse, on/ switches, etc). • If the actuator is out of service send the actuator and the sensor back to Belimo, please do not disconnect the assembly.
Requested flow can not be reached: U5 is lower than Y.	ON	Fully Open	Below setpoint U5<Y	Dp is too low. The requested flow can not be reached.	Increase the pump power.
Wrong flow rate measurements.	ON	-	-	• “Scaling adjusted” PC-Tool or ZTH US. • Requirements regarding media are not taken into consideration. • 5x DN as an inlet length is not taken into consideration. • The installation wiring is not equipotential. • Dp too high.	• Default to factory settings. • Check the datasheet for media options. • Piping should be modified to fulfill the minimum inlet length. • Check earth ground connection. • Adjust the Dp to lower value.
Flow measurements are not stable.	ON	Cyclic Movement	-	The electrodes are not in proper contact with the fluid.	• Remove air from the system. • Verify proper installation. • Ensure electrodes are always in contact with the fluid.

Actuator Adaptation

The adaptation button calibrates the actuator input signal range (2-10V) to the actuator's angle of rotation range. It does that by driving the actuator to the mechanical end stops. After the adaptation cycle, the actuator will follow the current input signal. By default, the actuator will run the adaptation cycle after the first power up.

Belimo recommends performing a manual adaptation to the actuator after changing the actuator V'max or direction settings. The manual adaptation can be activated by pressing the translucent "Adaptation" LED button for three seconds.

5 YEAR WARRANTY · GLOBAL SUPPORT · TESTED QUALITY · ON TIME DELIVERY · WWW EXTENSIVE SERVICE

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, 5845 Kennedy Road, Mississauga, Ontario L4Z 2G3
Tel. 866-805-7089, Fax 905-712-3124, marketing@us.belimo.com

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

Belimo Brasil Comércio de Automação Ltda.
Tel: 55 11 3643-5656, Fax: 55 11 3643 5657, customerservice@br.belimo.com