EvoPICV

Pressure Independent Control Valve

Technical manual

ADVANCE VALVES

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CLIMATE SYSTEMS TECHNOLOGY

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Introduction

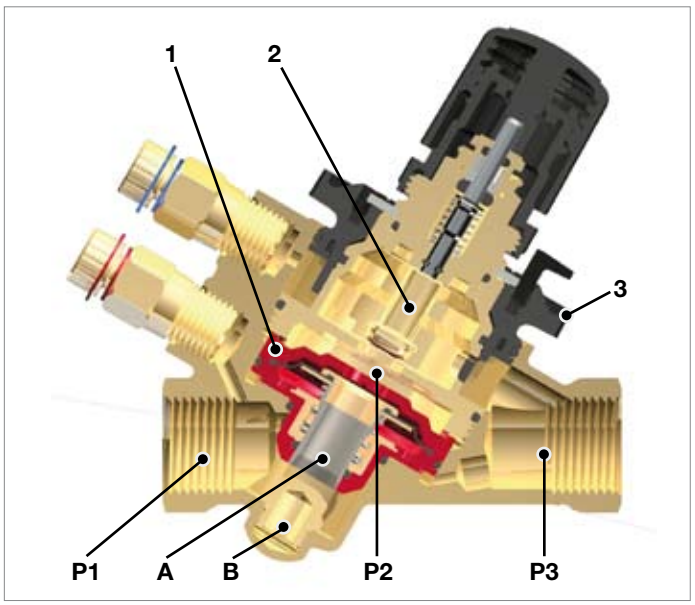
The **EvoPICV** Pressure Independent Control Valve "PICV" is a combined constant flow limiter and full stroke, full authority equal percentage temperature control valve.
The **EvoPICV** is suitable for use in variable and constant temperature systems and may be used as constant flow limiter in constant volume systems (without an actuator head) or as a true PICV in variable volume systems.

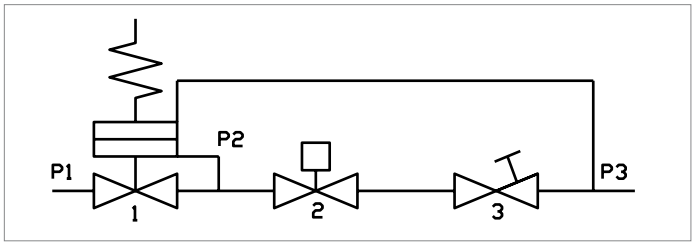
Operating principle

EvoPICV valve is made by three main parts:
1. differential pressure regulator
2. regulating valve for flow adjustment
3. flow pre-setting knob

1. Differential pressure regulator

The differential pressure regulator is the heart of the pressure independent control valve, by keeping a constant differential pressure across the valve seats constant flow and full authority temperature control can be achieved.
Incoming pressure P1 is transmitted to the top face of the diaphragm, outgoing pressure P3 is transmitted to the underside of this same diaphragm. A constant effective differential pressure is maintained between P2 and P3. As P1 increases relative to P3 it acts on the diaphragm closing the shutter (A) against a seat (B) thereby lowering the effective differential pressure. As P1 decreases relative to P3 the diaphragm acts to open the shutter (A) from the seat (B) thus increasing the effective differential pressure. The diaphragm acts against a spring in order to balance the pressure control and stop the diaphragm oscillating.





Functional schematic

2. Regulation valve

Water flow through a valve varies as a function of the area of passage and the pressure differential across that valve. Due to the incorporation of the differential pressure regulator the differential across the valve seats P2 – P3 is constant meaning that flow is now only a function of area of passage.
Setting any flow rate value and maintaining it stable is also possible. The regulation valve presents an equal percentage characteristic.

3. Adjustment knob

The maximum value of the flow can be preset, choking the outlet section of the control valve, using the graduated adjustment knob.
The percentage value, indicated on the scale, matches the maximum flow rate percentage. This value can be changed turning the adjustment knob until it reaches the selected position (matching the percentage indicated on the scale). A locking mechanism avoids the valve set values from being changed inadvertently.

Advantages and user-friendliness

1. Advantages

– **EvoPICV** valve allows to adjust the temperature also in case of partial load of the system and it always ensures a stable commissioning of the heat emitter connected to it.
– The regulator corrects any differential pressure variation. This leads to a considerable reduction in temperature variations and adjustment movements and to the extension of the life of the moving devices connected to it.
– **EvoPICV** valves offer a remarkable adjustment flexibility. They can be accurately set to a specific flow rate value and they allow precise modulating control.
– The valves always guarantee a suitable flow rate, therefore avoiding too high energy consumption.
– Since **EvoPICV** valve performs the functions of two valves (balancing and adjustment), the installation costs are considerably reduced.
– The automatic flow rate limitation eliminates system commissioning costs.
– Since commissioning is very easy to perform, design flow rates can be modified at any time and at low costs.
– Since it is not necessary to commissioning the valve after its installation, the valve can work immediately after it has been assembled, for example, on the floors where works are already finished.

2. User-friendliness

In order to adjust the flow rate, just set the selected value using the adjustment knob.
Since flow rate is the only parameter to be considered, choosing the suitable valve is easy and fast.
EvoPICV valve maximum adjustment matches the maximum flow rate allowed by the pipe size, on the basis of the values established by international standards.
– Setting ratio calculation is not necessary.
– Valve authority calculation is not required.
– Specific devices or knowledge are not necessary.
– Compact design that allows installing the valve also in small spaces such as fan-coils or narrow supply spaces.
– The special adjustment knob allows to set flow rate without disassembling the actuators.

Applications examples

1. Systems with modulating power (radiant panels)

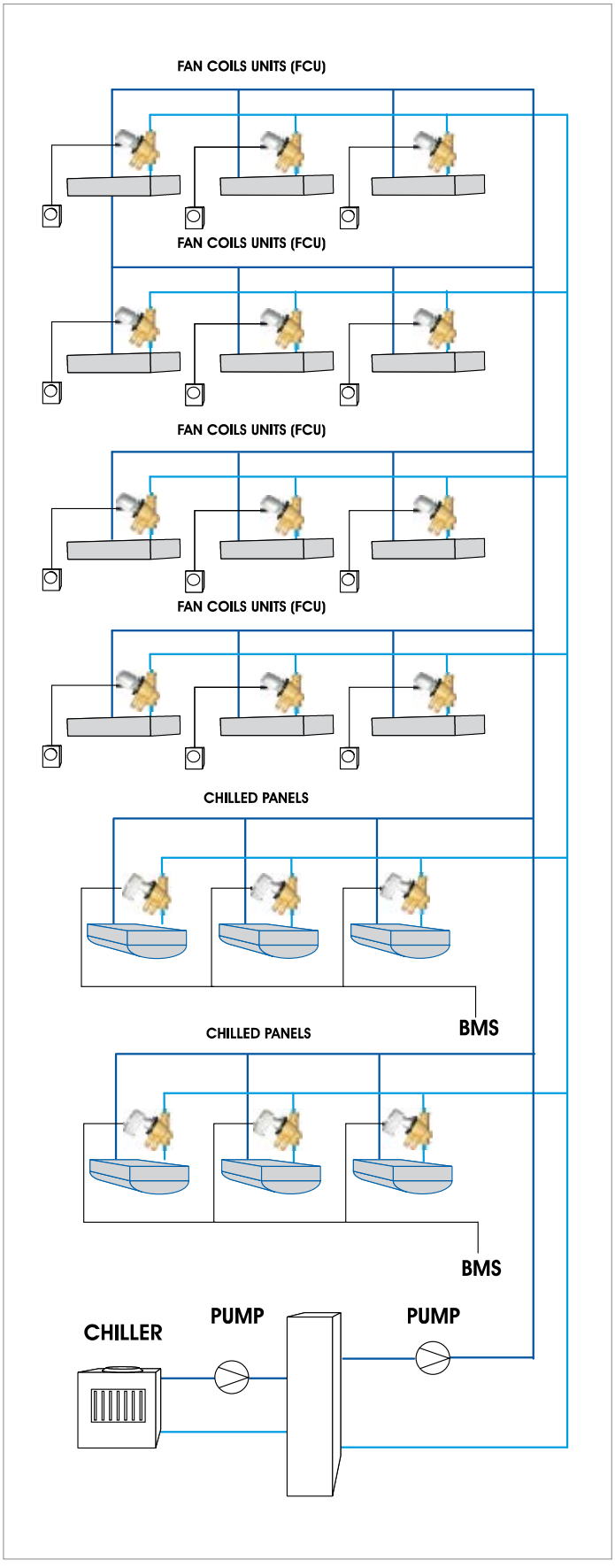
The use of a motorized control valve that automatically limits the flow rate, ensures stable energy supply, independently from the available pressures and, at the same time, thanks to the possibility of controlling the flow rate regulator, it allows effective adjustment of ambient temperature.

2. Systems with fixed power (fan-coils)

If the valve is used to adjust fan-coil flow, it ensures the required flow rate to the equipment and it favors the hydraulic balance of the system. The exchanger always works in the best conditions possible with any differential pressure and the system is split into hydraulically separated areas.

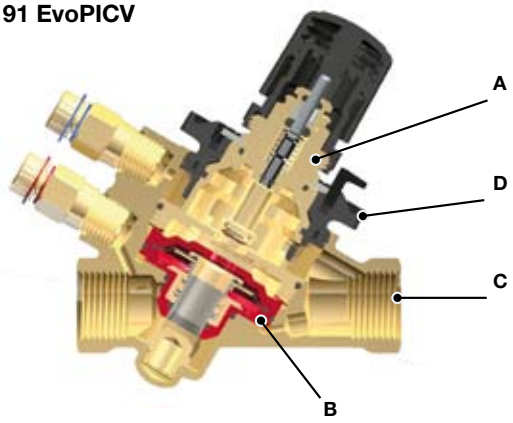
3. Single-pipe heating systems

An automatic valve placed on the system return line ensures a stable flow rate on the main branches at any thermostatic valve opening, thus reducing the possible sudden changes due to pressure variations in the system.



Technical specifications

91 EvoPICV

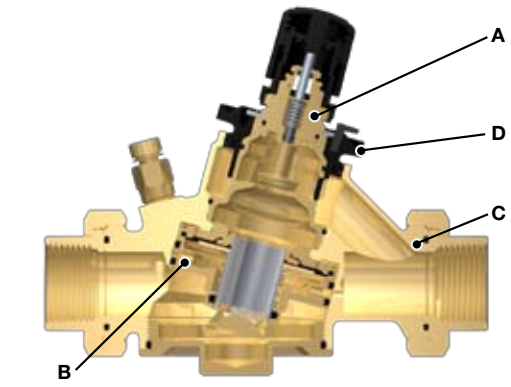


	Material list
Regulating valve (A)	Brass CW602N Stainless stee 18/8
Cartridge (B)	High resistance polymer - EPDM Stainless steel AISI 303
Presetting (D)	High resistance polymer Brass CW602N
Body (C)	Brass CW602N
Gaskets	EPDM-x

Accuracy 0 ÷ 1 bar	ΔP max.	Temperature	Working pressure max.	Stroke
± 5%	400 kPa / 4 bar	-10 ÷ 120 °C	2500 kPa / 25 bar	2,7 mm

	91VL ½”	91L ½”	91H ½”	91L ¾”	91H ¾”
Flow rate max.	150 l/h 0,042 l/s	600 l/h 0,167 l/s	780 l/h 0,217 l/s	1000 l/h 0,278 l/s	1500 l/h 0,417 l/s
Start-up max.	20 kPa 0,20 bar	20 kPa 0,20 bar	20 kPa 0,20 bar	25 kPa 0,25 bar	25 kPa 0,25 bar
Fittings	Rc ½" F EN 10226-1	Rc ½" F EN 10226-1	Rc ½" F EN 10226-1	Rc ¾" F EN 10226-1	Rc ¾” F EN 10226-1

93 EvoPICV

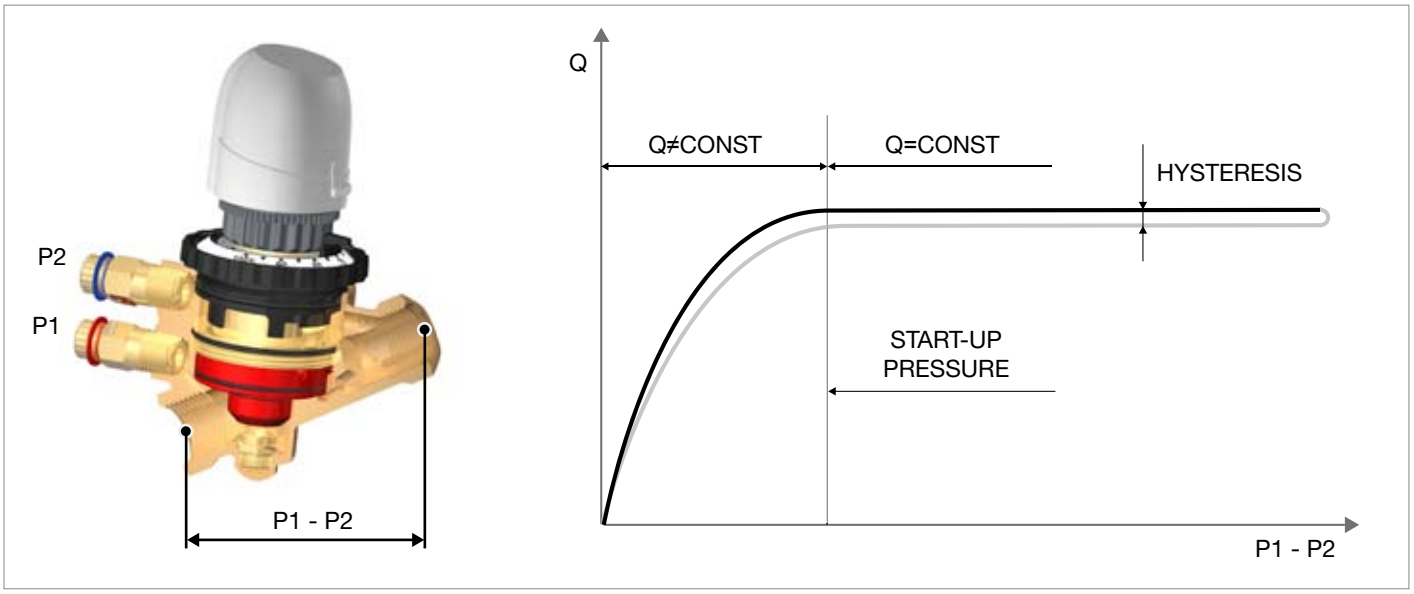


	Material list
Regulating valve (A)	Brass CW602N Stainless steel 18/8
Cartridge (B)	Brass CW602N - EPDM Stainless steel AISI 303
Presetting (D)	High resistance polymer Brass CW602N
Body (C)	Brass CW602N
Gaskets	EPDM-x

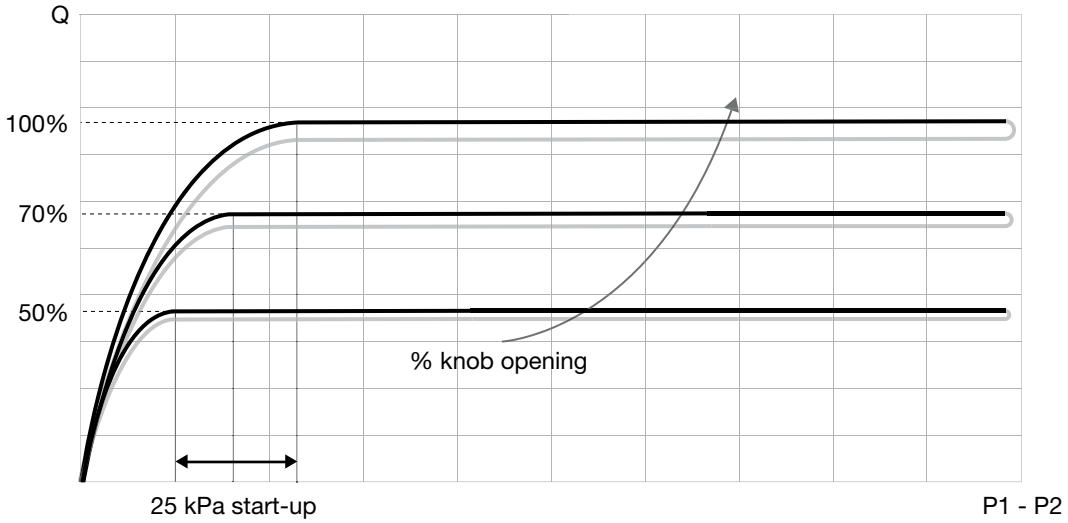
Accuracy 0 ÷ 1 bar	ΔP max.	Temperature	Working pressure max.	Stroke
± 5%	400 kPa / 4 bar	-10 ÷ 120 °C	2500 kPa / 25 bar	6 mm

	93L ¾”	93H ¾”	93L 1”	93H 1”	93L 1 1/4”	93H 1 1/4”
Flow rate max.	2200 l/h 0,611 l/s	2700 l/h 0,750 l/s	2200 l/h 0,611 l/s	2700 l/h 0,750 l/s	2700 l/h 0,750 l/s	3000 l/h 0,833 l/s
Start-up max.	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar
Fittings	Rc ¾" union F EN 10226-1	Rc ¾” union F EN 10226-1	Rc 1” union F EN 10226-1	Rc 1” union F EN 10226-1	Rc 1 1/4” union F EN 10226-1	Rc 1 1/4” union F EN 10226-1

Dynamic characteristic curves



Using a differential pressure gauge to measure the pressure drop the valve absorbs, allows to check whether the valve is in the operating range (and, therefore, whether there actually is a flow control) by simply verifying that the measured value P1 - P2 is higher than the start-up value.
If the ΔP measured value is lower than the start-up value, then the valve works as a fixed orifice valve.



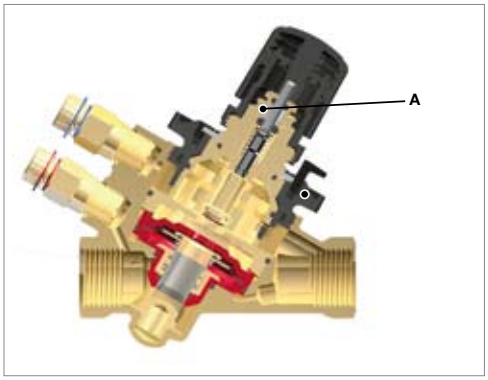
Flow pre-setting 91 EvoPICV

Presetting %	91VL ½"		91L ½"		91H ½"		91L ¾"		91H ¾"	
	Flow rate		Flow rate		Flow rate		Flow rate		Flow rate	
	l/h	l/s	l/h	l/s	l/h	l/s	l/h	l/s	l/h	l/s
100	150	0,042	600	0,167	780	0,217	1000	0,278	1500	0,417
90	135	0,038	540	0,150	702	0,195	900	0,250	1350	0,375
80	120	0,033	480	0,133	624	0,173	800	0,222	1200	0,333
70	105	0,029	420	0,117	546	0,152	700	0,194	1050	0,292
60	90	0,025	360	0,100	468	0,130	600	0,167	900	0,250
50	75	0,021	300	0,083	390	0,108	500	0,139	750	0,208
40	60	0,017	240	0,067	312	0,087	400	0,111	600	0,167
30	45	0,013	180	0,050	234	0,065	300	0,083	450	0,125
20	30	0,008	120	0,033	156	0,043	200	0,056	300	0,083
10	15	0,004	60	0,017	78	0,022	100	0,028	150	0,042

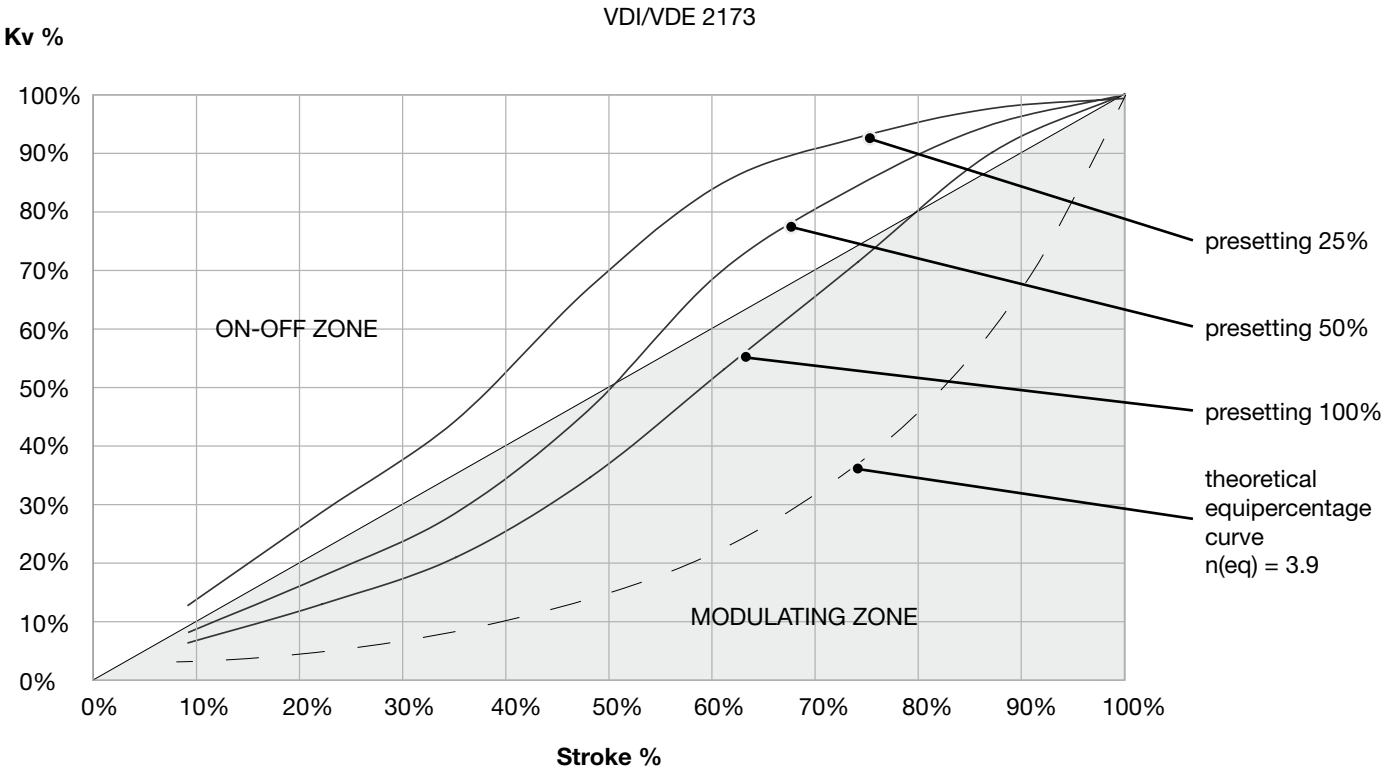
Flow pre-setting 93 EvoPICV

Presetting %	93L ¾"		93H ¾"		93L 1"		93H 1"		93L 1 1/4"		93H 1 1/4"	
	Flow rate		Flow rate		Flow rate		Flow rate		Flow rate		Flow rate	
	l/h	l/s	l/h	l/s	l/h	l/s	l/h	l/s	l/h	l/s	l/h	l/s
100	2200	0,611	2700	0,750	2200	0,611	2700	0,750	2700	0,750	3000	0,833
90	1980	0,550	2430	0,675	1980	0,550	2430	0,675	2430	0,675	2700	0,750
80	1760	0,489	2160	0,600	1760	0,489	2160	0,600	2160	0,600	2400	0,667
70	1540	0,428	1890	0,525	1540	0,428	1890	0,525	1890	0,525	2100	0,583
60	1320	0,367	1620	0,450	1320	0,367	1620	0,450	1620	0,450	1800	0,500
50	1100	0,306	1350	0,375	1100	0,306	1350	0,375	1350	0,375	1500	0,417
40	880	0,244	1080	0,300	880	0,244	1080	0,300	1080	0,300	1200	0,333
30	660	0,183	810	0,225	660	0,183	810	0,225	810	0,225	900	0,250
20	440	0,122	540	0,150	440	0,122	540	0,150	540	0,150	600	0,167
10	220	0,061	270	0,075	220	0,061	270	0,075	270	0,075	300	0,083

Control characteristic curve



Operating on the position of the regulating valve control stem A will modify the valve Kv.
The relation between Kv and stroke is shown in the graph below.

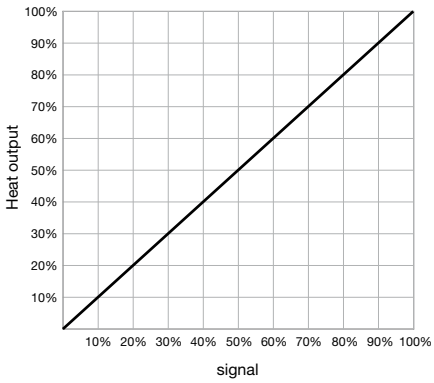


Combining the **EvoPICV** valve characteristic with heat exchanger results in a linear control system.
* Control curve characteristic may change according to valve version.

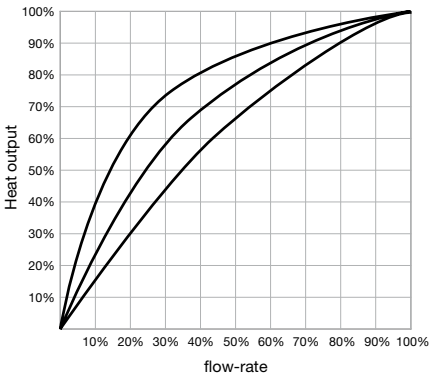
Flow control and characteristic curves

The type of characteristic of the control valve (ON/OFF, linear, equipercentage) should be chosen according to the heat exchanger and to the type of control to be performed on the system. For ON/OFF control, a valve with ON/OFF curve will be sufficient, while a modulating control requires a linear or equal percentage characteristic.
The following graphs show the optimal characteristic curve for the remote control of a heating system (A), the typical curve of the heat exchangers normally used in thermo-hydraulic systems (B), the typical curves of the control valves of these systems (C) and, finally, the resulting curves (D), obtained joining the curve (B) with the different valve curves.
As showed, the curve (D3), obtained combining an equal percentage valve with a heat exchanger, corresponds to the optimal control curve (A).

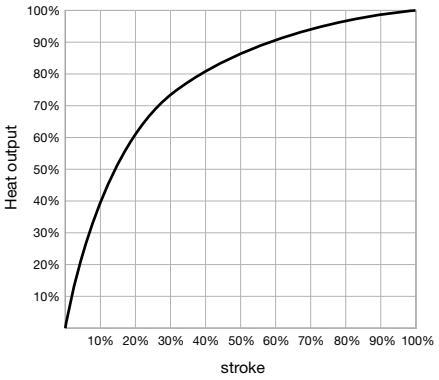
(A) Characteristic of a linear heat rating control system



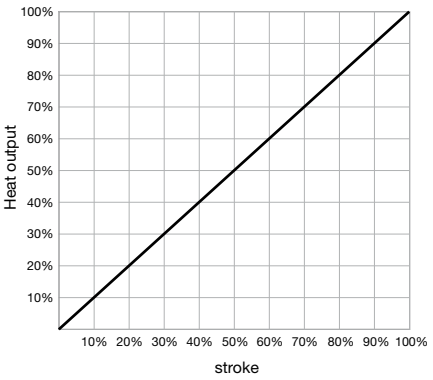
(B) Typical characteristic curve of a generic heat exchanger (heat rating/flow rate)



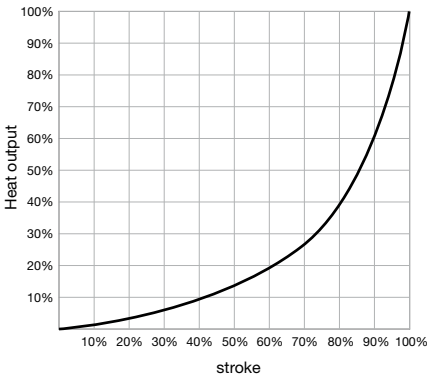
(C1) ON/OFF valve characteristic curve



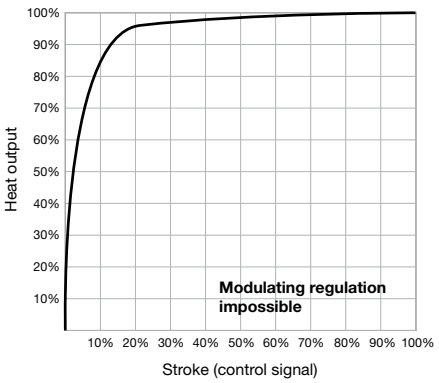
(C2) Linear valve characteristic curve



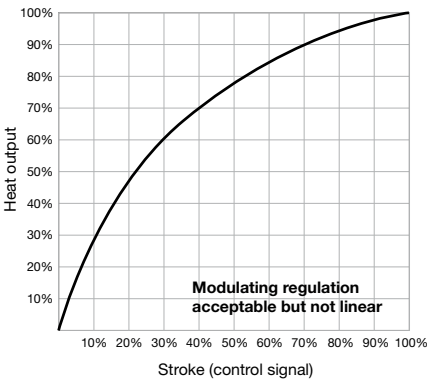
(C3) Equal percentage **EvoPICV** control valve characteristic curve



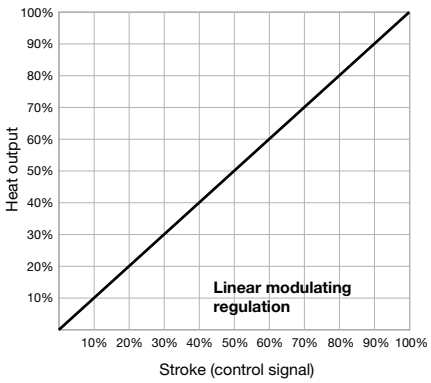
(D1) ON/OFF valve + heat exchanger system resulting graph



(D2) Linear valve + heat exchanger system resulting graph



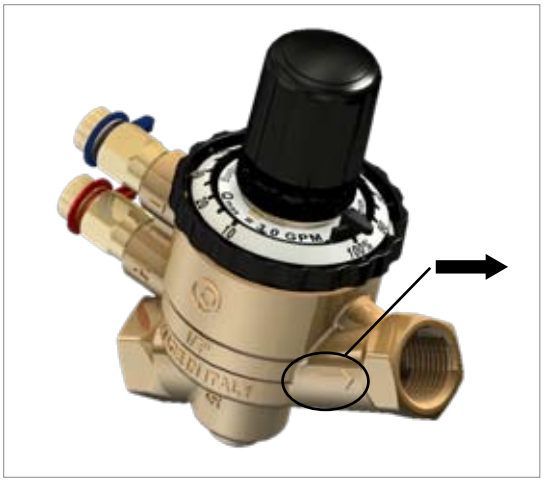
(D3) Equal percentage **EvoPICV** valve + heat exchanger system resulting graph



Installation and maintenance

1. Use conditions

The valve has to be mounted with the arrow in the direction of the flow. Mounting it in the wrong direction may damage the system and the valve itself.
If flow reversal is possible, a non-return valve should be mounted.



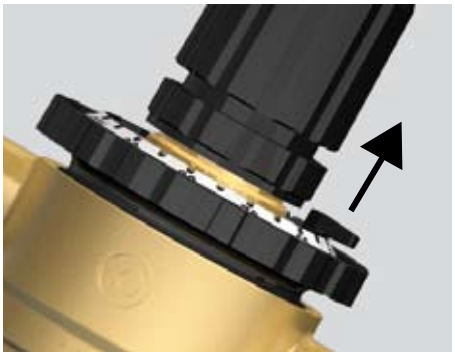
Minimum differential pressure above which the valve begins to exercise its regulating effect:

	91VL ½”	91L ½”	91H ½”	91L ¾”	91H ¾”
Start-up ΔP	20 kPa 0,20 bar	20 kPa 0,20 bar	20 kPa 0,20 bar	25 kPa 0,25 bar	25 kPa 0,25 bar

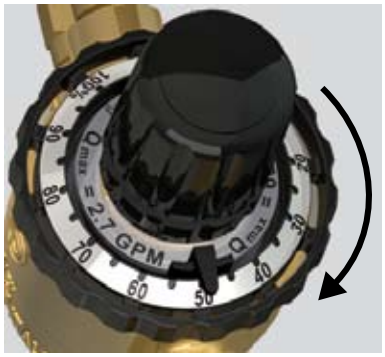
	93L ¾”	93H ¾”	93L 1”	93H 1”	93L 1 1/4”	93H 1 1/4”
Start-up ΔP	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar	25 kPa 0,25 bar

2. Flow preset

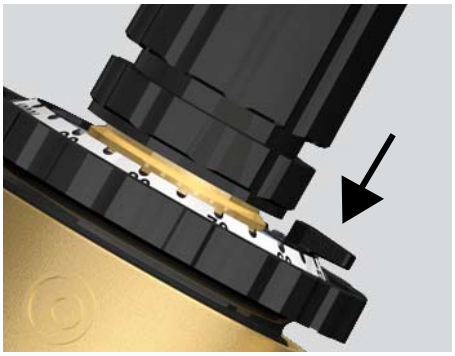
To set the selected flow, follow these steps:



Lift the lock pin to unlock the selector



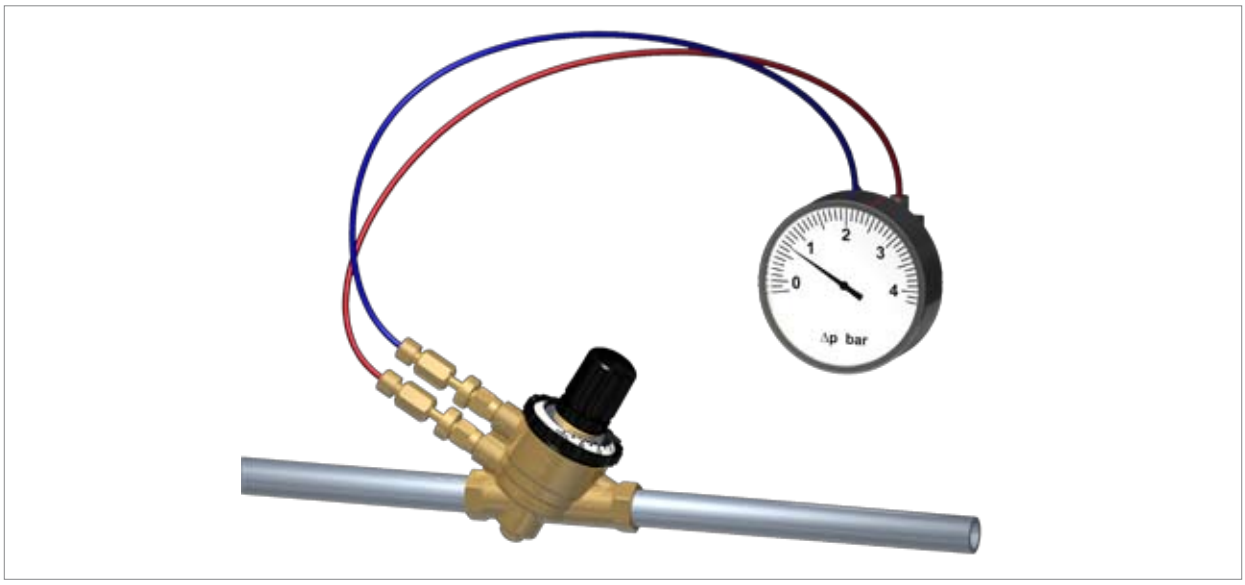
Turn the selector to the target position



Press the lock pin to lock the selector in the final position

3. Operating control

It is necessary to be sure that the valve is actually working in the operating range. In order to verify it, just measure the differential pressure across the valve, as shown in the picture.
If the measured differential pressure is higher than the start-up pressure, the valve is actually keeping the flow constant at the set value.



4. Maintenance and cleaning

During valve cleaning operations, use a damp cloth. DO NOT use any detergent or chemical product that may seriously damage or compromise the proper functioning and the reliability of the valve.

5. Actuator assembly

The valve can be equipped with a series of thermal-electric or electro-mechanical actuators, according to the requirements of the system. Actuators come along with an adaptor for proper mounting on the valve and for proper functioning of the whole device.

1

2

3

Thermo-electric actuators

1. Art. AA4000 / Art. AA4021

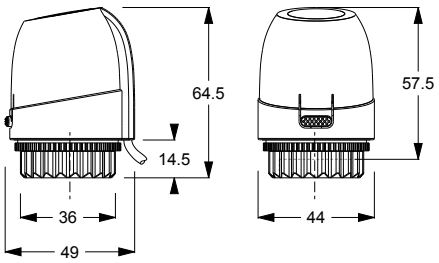
24V DC ON-OFF

Technical features	
Supply voltage	24 AC / DC, +20% ÷ -10%, 0 - 60 Hz
Absorbed power	1.8 W
Max current	250 mA max. 2 min.
Operating current	75 mA
Max fluid temperature	0 - 100 °C
Max ambient temperature	0 - 65 °C
Degree of protection	IP 54 (EN 60529)
Class of protection	II (IEC 60730) (with cable connector only)
Relative umidity	max 80 %rh without condensation
Actuating force	100 N ± 5 %
Stroke	4 mm

Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

Overall dimensions

Dimensions (mm)



2. Art. AA2000 / Art. AA2021

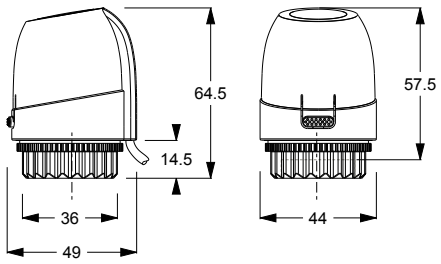
230V AC ON-OFF

Technical features	
Supply voltage	230 V, 50/60 Hz
Absorbed power	1.8 W
Max current	300 mA max. 200ms
Operating current	8mA
Max fluid temperature	0 - 100 °C
Max ambient temperature	0 - 65 °C
Degree of protection	IP 54 (EN 60529)
Class of protection	II (IEC 60730) (with cable connector only)
Relative umidity	max 80 %rh without condensation
Actuating force	100 N ± 5 %
Stroke	4 mm

Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

Overall dimensions

Dimensions (mm)



3. Art. A5030

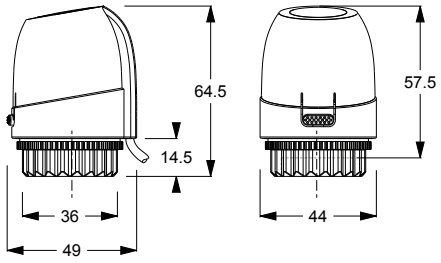
24V DC proportional 0-10V

Technical features	
Supply voltage	24 AC / DC, +20% ÷ -10%, 0 - 60 Hz
Absorbed power	1.8 W
Max current	< 250 mA max. 2 min.
Operating voltage	0 – 10 V DC 100 kΩ (10 kΩ optional)
Degree of protection	IP 54 (EN 60529)
Class of protection	II (IEC 60730) (with cable connector only)
Relative umidity	max 80 %rh without condensation
Actuating force	100 N ± 5 %
Stroke	4 mm (minus over-elevation) : max. 3.5 mm
Travelling time	120 s (4 mm stroke)

Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

Overall dimensions

Dimensions (mm)



Electromotive actuators

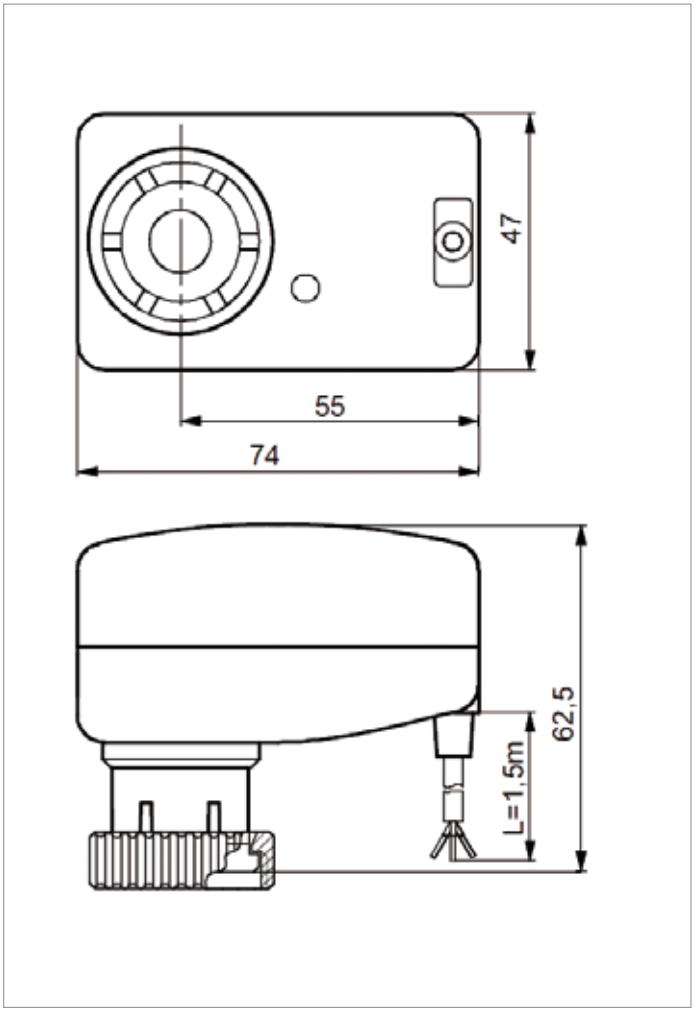
1. Art. A7010

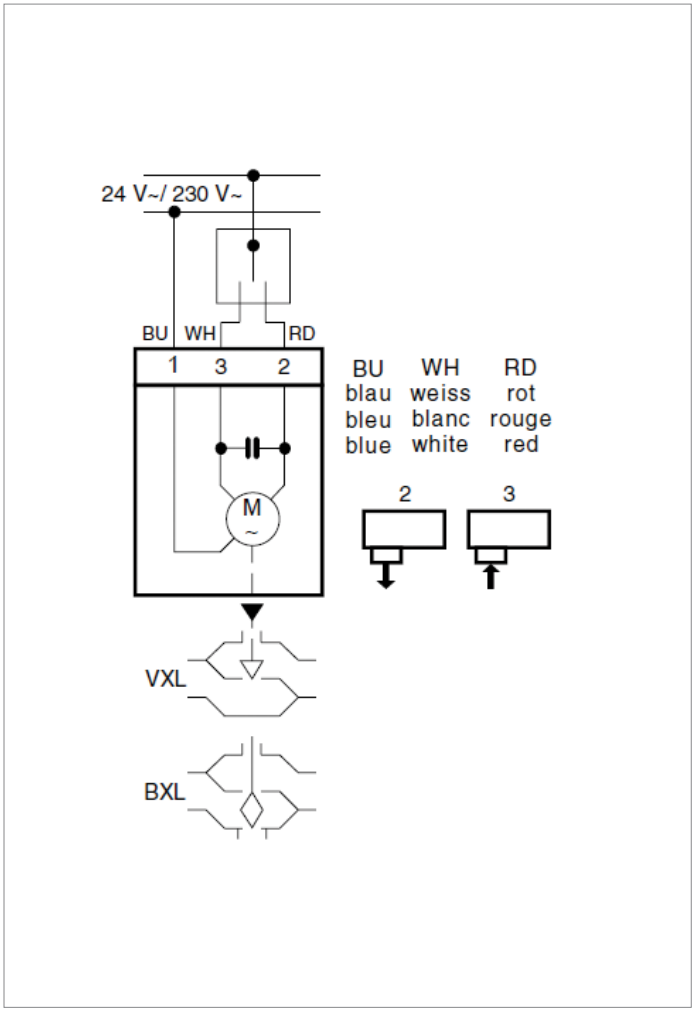
24V DC 3 point actuator

Technical features	
Supply voltage	24 V =/~ ± 15%, 50...60 Hz
Absorbed power	5 VA
Start-up power	5 VA
Operating current	0,5 mA
Max fluid temperature	100 °C
Max ambient temperature	0 - 50 °C
Degree of protection	IP 40 (EN 60529)
Class of protection	II (IEC 60730)
Relative umidity	< 75 % rh
Actuating force	120 N
Max stroke	4 mm
Travelling time	60 s (4 mm stroke)

Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

Overall dimensions and connection diagram





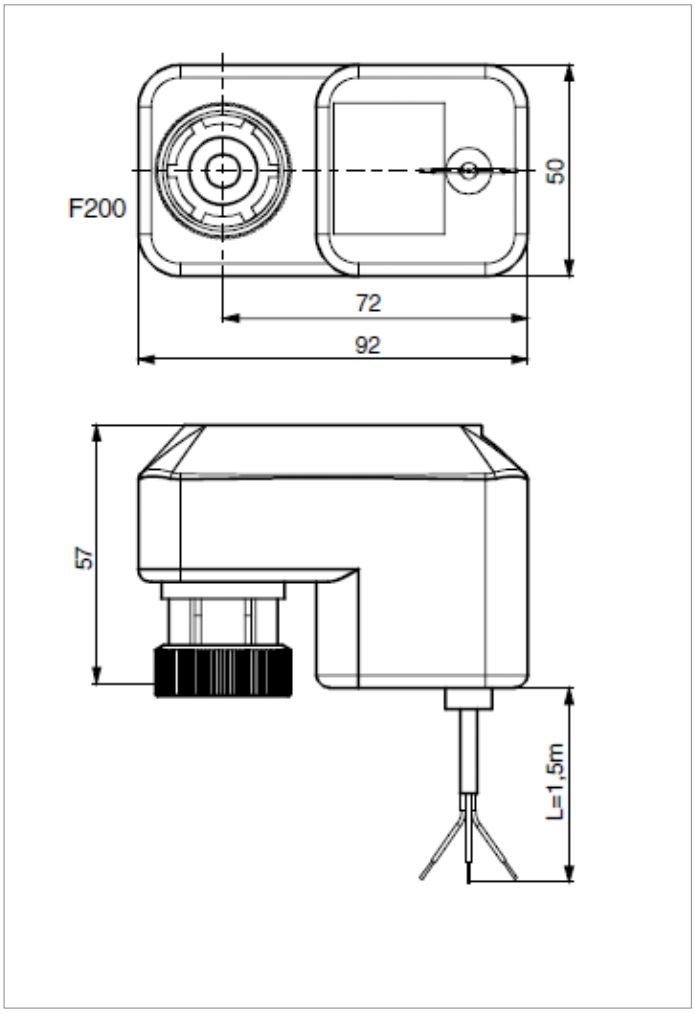
2. Art. A7010

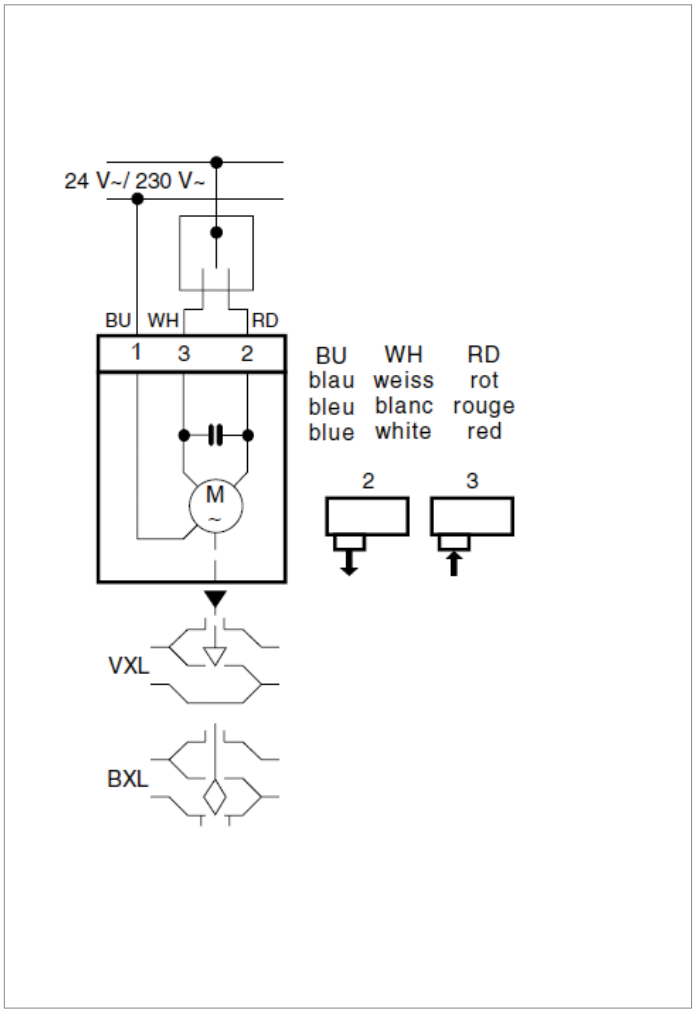
230V AC 3 point actuator

Technical features	
Supply voltage	230 V ~ ± 15%, 50...60 Hz
Absorbed power	7 VA
Start-up power	7 VA
Operating current	0,5 mA
Max fluid temperature	100 °C
Max ambient temperature	0 - 50 °C
Degree of protection	IP 40 (EN 60529)
Class of protection	II (IEC 60730)
Relative umidity	< 75 % rh
Actuating force	120 N
Max stroke	8 mm
Travelling time	100 s (4 mm stroke)

Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

Overall dimensions and connection diagram





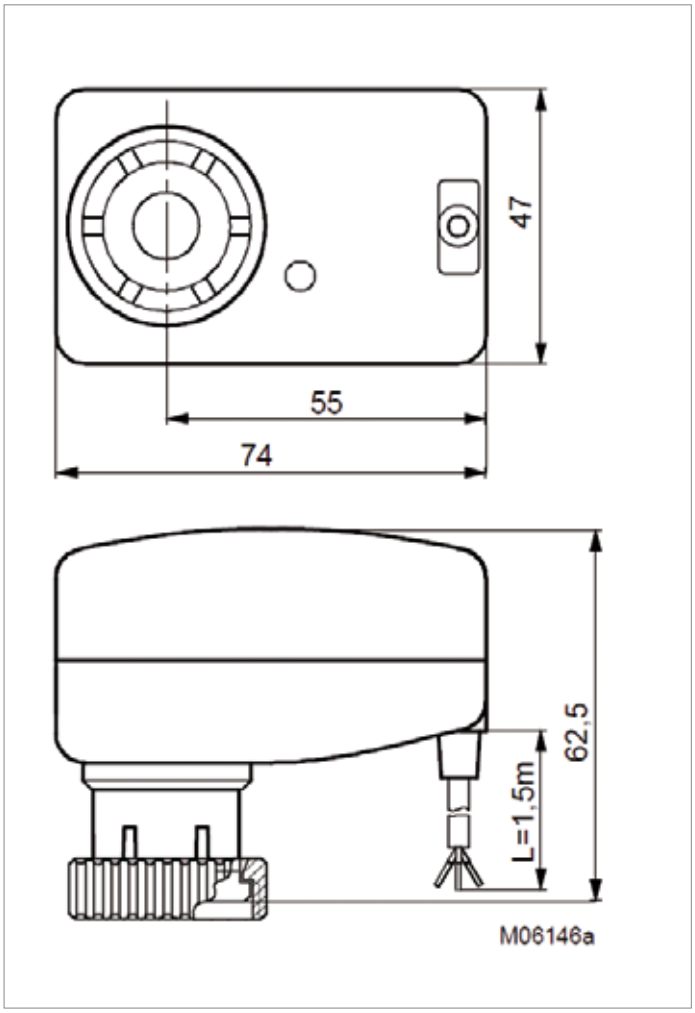
1. Art. 7030

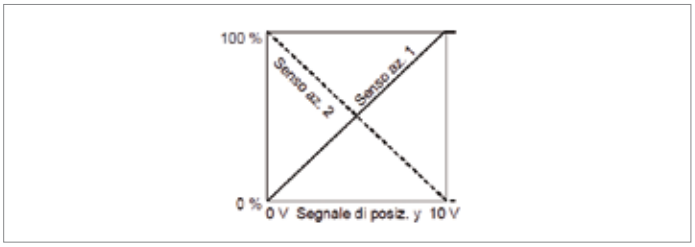
24V DC proportional 0 - 10V

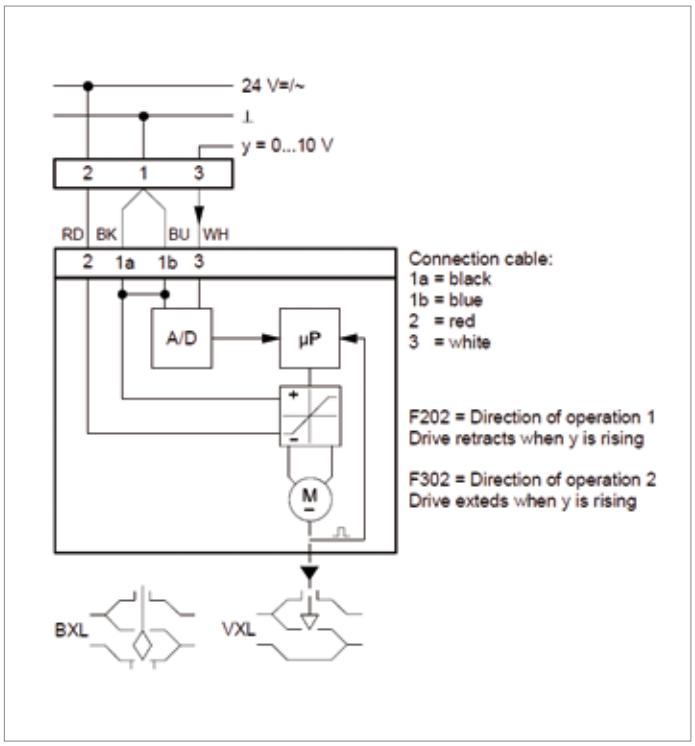
Technical features	
Supply voltage	24 V =/~ ± 15%, 50...60 Hz
Absorbed power	5 VA
Start-up power	5 VA
Operating current	0,5 mA
Max fluid temperature	100 °C
Max ambient temperature	0 - 50 °C
Degree of protection	IP 40 (EN 60529)
Class of protection	III (IEC 60730)
Relative umidity	< 75 % rh
Actuating force	120 N
Max stroke	4 mm
Travelling time	60 s (4 mm stroke)

To be assembled on to the valve by means of M30 x 1,5 adaptor ring , code 0A7010
Mounting positions: any positions between vertical and horizontal. Upside down mounting (actuator underneath the valve) should be avoid.

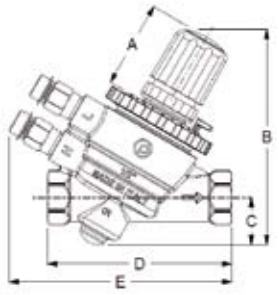
Overall dimensions and connection diagram



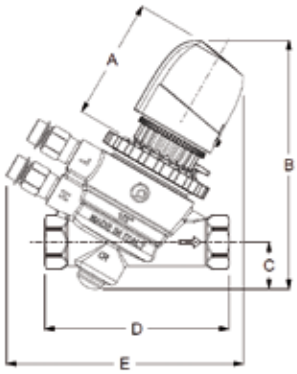




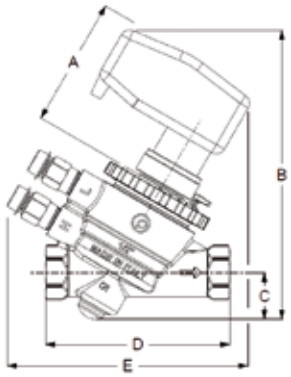
91 EvoPICV dimensional data



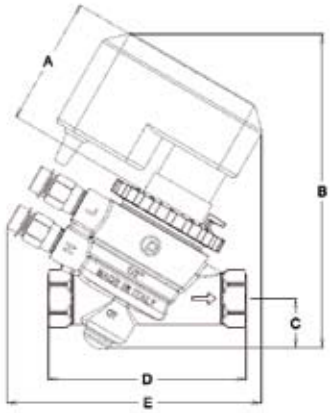
Manual valve					
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D (mm)**	**E (mm)**
91VL ½"	47	115	25	99	120
91L ½"	47	115	25	99	120
91H ½"	47	115	25	99	120
91L ¾"	47	115	25	108	120
91H ¾"	47	115	25	108	120



Valve with thermo-electric actuator					
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D (mm)**	**E (mm)**
91VL ½"	65	133	25	99	127
91L ½"	65	133	25	99	127
91H ½"	65	133	25	99	127
91L ¾"	65	133	25	108	127
91H ¾"	65	133	25	108	127

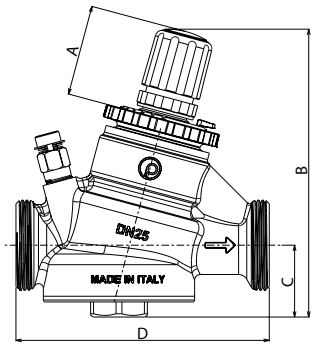


Valve with electromotive actuator 24V					
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D (mm)**	**E (mm)**
91VL ½"	70	156	25	99	130
91L ½"	70	156	25	99	130
91H ½"	70	156	25	99	130
91L ¾"	70	156	25	108	130
91H ¾"	70	156	25	108	130



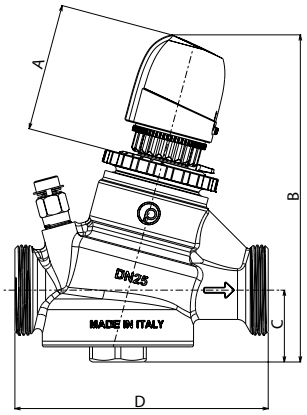
Valve with electromotive actuator 230V					
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D (mm)**	**E (mm)**
91VL ½"	63	157	25	99	127
91L ½"	63	157	25	99	127
91H ½"	63	157	25	99	127
91L ¾"	63	157	25	108	127
91H ¾"	63	157	25	108	127

93 EvoPICV dimensional data



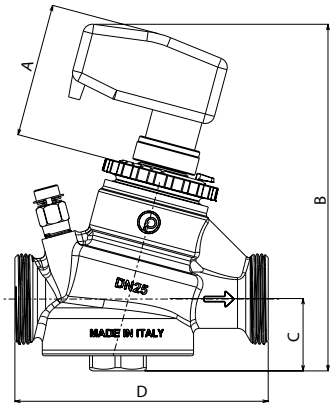
Manual valve				
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D* (mm)**
93L ¾"	47	152	38	134
91H ¾"	47	152	38	134
93L 1"	47	152	38	134
93H 1"	47	152	38	134
93L 1 1/4"	47	152	38	134
93H 1 1/4"	47	152	38	134

* Dimensional data without fittings



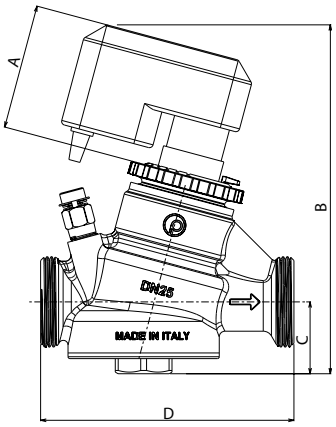
Valve with thermo-electric actuator				
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D* (mm)**
93L ¾"	68	175	38	134
91H ¾"	68	175	38	134
93L 1"	68	175	38	134
93H 1"	68	175	38	134
93L 1 1/4"	68	175	38	134
93H 1 1/4"	68	175	38	134

* Dimensional data without fittings



Valve with electromotive actuator 24V				
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D* (mm)**
93L ¾"	70	183	38	134
91H ¾"	70	183	38	134
93L 1"	70	183	38	134
93H 1"	70	183	38	134
93L 1 1/4"	70	183	38	134
93H 1 1/4"	70	183	38	134

* Dimensional data without fittings
Maximum flow is reduced when A7030 actuator is used



Valve with electromotive actuator 230V				
Art.	**A (mm)**	**B (mm)**	**C (mm)**	**D* (mm)**
93L ¾"	63	184,5	38	134
91H ¾"	63	184,5	38	134
93L 1"	63	184,5	38	134
93H 1"	63	184,5	38	134
93L 1 1/4"	63	184,5	38	134
93H 1 1/4"	63	184,5	38	134

* Dimensional data without fittings

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