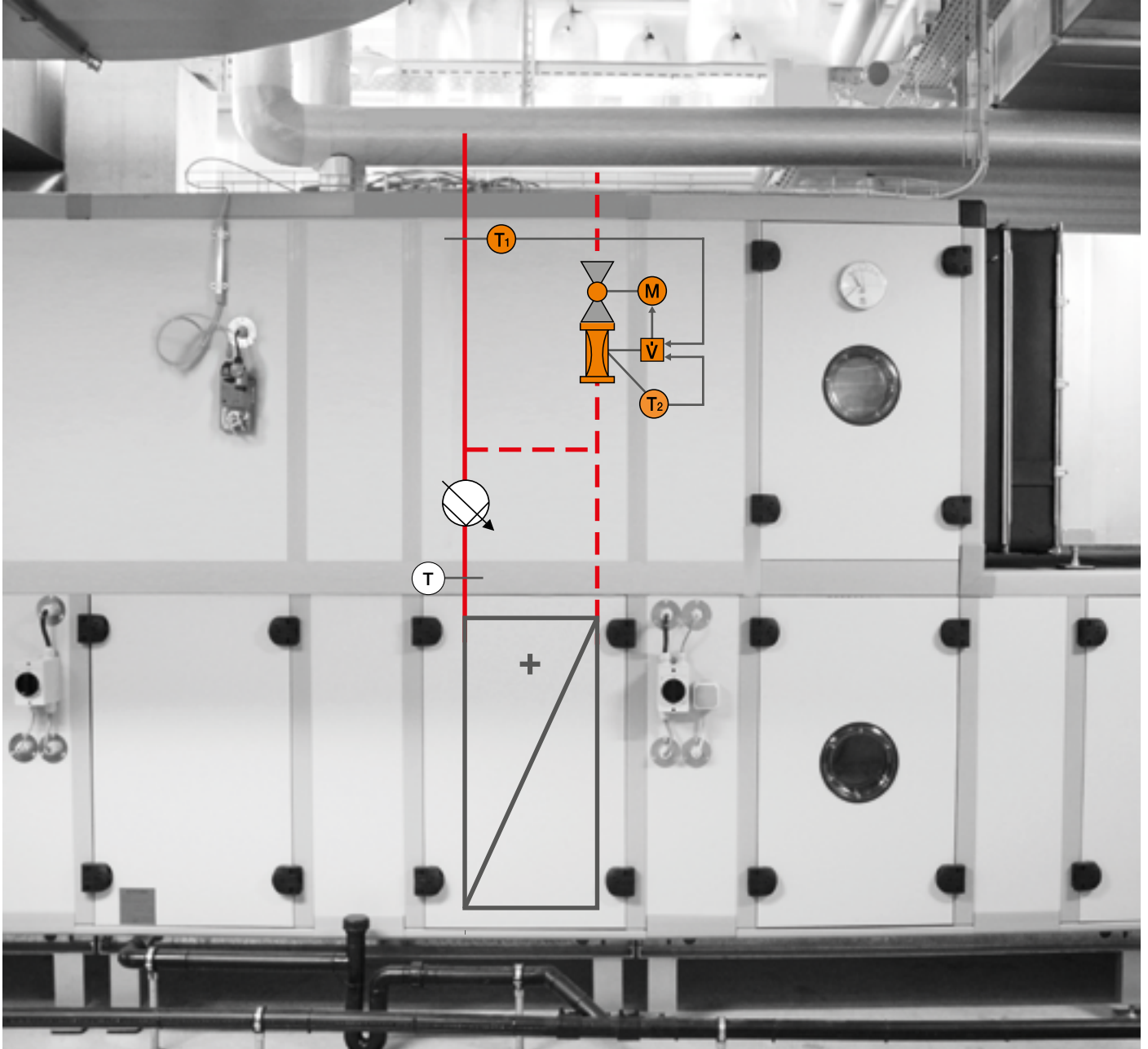


Belimo – Applications

Air handling units



International 2017



Preface

Thank you for your interest in our products. In this brochure you will find information regarding the planning of an air handling unit. The described solutions from Belimo will allow you to create an optimum room climate with minimum energy consumption.

All chapters are structured as follows:

- Description of the application
- Bill of material
- Tender specification
- Belimo – features and benefits


The description focuses on the respective colour-coded hydraulic circuit. The list of materials comprises water-side components of this highlighted circuit. Air solutions and sensors offered by Belimo are also included therein.


Water-side valves, balancing valves and pumps are presented in diagrams; other components such as non-return valves and strainers are not depicted for the sake of simplicity.


Furthermore, starting on page 46, the last section provides an overview of other solutions from Belimo relating to room and system solutions, bus and system integration, air handling units and sensors. Please contact us for more information.


For detailed information on room and zone control, please refer to our application brochure with the same name (available separately).

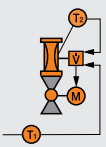
Legend – Water products


 2-way characterised control valve

 3-way characterised control valve


 Electronic pressure-independent characterised control valve (EPiV)


 Pump

 Belimo Energy Valve™

 Balancing valve


Legend – Air solutions


 Air damper actuator


 Volumetric flow controller VAV





Legend – Sensors


 Temperature sensor


 Frost protection thermostat

 Pressure sensor


 Differential pressure switch


 CO₂ and temperature sensor


 Humidity and temperature sensor


 Outside temperature sensor


Legend – Other ducting components


 Air filter


 Fan

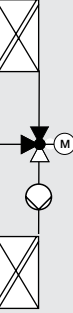
 Heating register

 Cooling register

 Humidifier

 Plate heat exchanger

 Rotational heat exchanger

 Combined circulation system

Disclaimer

Please note that the illustrations are examples only and may therefore vary, depending on the air handling unit. Subject to modifications and amendments. Please get in touch with your Belimo contact person to verify the specifications.

Belimo – your partner for more comfort, safety and efficiency in buildings.

Behind, there is Belimo

Solutions from Belimo ensure balanced temperatures, a controlled air exchange at workplaces and in public areas, individual air-conditioning control in zones, individual rooms and apartments as well as safe air solutions in trade, industry and sensitive working areas.

Innovative valve solutions drastically reduce both energy consumption and costs. This creates an added value for people and the environment.

Your requirement – our actuator

All our thoughts and actions are aimed at giving you the certainty of having chosen the best – from consultation to purchasing, from delivery to service. Belimo is your partner for actuator solutions for controlling heating, ventilation and air-conditioning systems.



Comfort

Health, well-being and performance increase when the climate is right. Belimo ensures a perfect climate for ideal utilisation of your rooms, depending on the specific application.



Security

When it comes to protecting people, tangible assets and investments, there are no compromises. What counts here is not trust in safety, but the certainty of having made the right choice with Belimo.



Energy efficiency

Products and technologies from Belimo save energy and reduce operating costs. You can rely on "Experience Efficiency" – our initiative for maximum energy efficiency.

Facts that count

Research and development are a high priority at Belimo. Here we can offer you the most innovative actuator, valve and sensor technologies. With Belimo's offices in more than 80 countries, you can order products locally and benefit from short delivery times. Wherever you plan your building: Products from Belimo are available in over 80 countries. For you, this means: simple logistics and procurement, thanks to a complete product range from a single source.

As a listed company with a turnover of approximately 540 million CHF, we have been growing solidly and continuously since our founding in 1975.

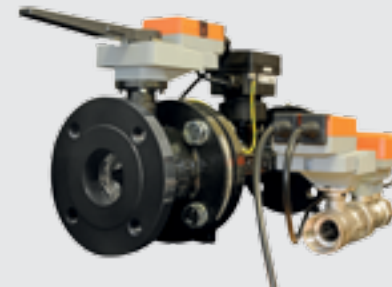
Characterised control valve. Proven millions of times over.



As a result of their spherical design, the ball valves – which have already proven themselves a million times over – are air bubble-tight, thus helping to avoid energy losses. The characterising disk additionally ensures excellent control stability throughout the entire flow range.

- Resistant against soiling due to spherical design
- Thanks to its compact size, the characterised control valve is a flexible and space-saving solution
- Motorised with proven Belimo actuator technology
- The valve closes air bubble-tight and is resistant against poor water quality
- Minimum energy costs due to efficient motor technology

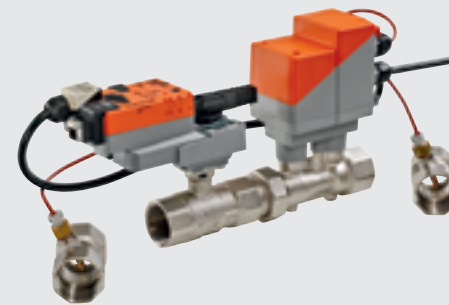
EPIV pressure-independent characterised control valve. The clever way to control the flow rate.



The EPIV combines 4 functions in one ready-to-install unit: measuring, controlling, balancing and shutting. This is how you increase efficiency during planning, implementation and operation.

- Time-saving and reliable valve selection in accordance with maximum volumetric flow
- Rapid, simple installation and commissioning
- Automatic, permanent hydronic balancing through the valve
- Securing the correct amount of water with differential pressure changes and with partial load
- Real-time information on the measured flow rate

Belimo Energy Valve™ with intelligent web server. A further step into the future.



The new Belimo Energy Valve™ has not only been improved, it has also become more intelligent. In addition to measuring, controlling, balancing and shutting, the energy monitoring feature is now also fully integrated in the Belimo Cloud.

- The power output of the heat exchanger is no longer influenced by water temperature and differential pressure
- Bus connections with BACnet, MP-Bus® and Modbus with the same valve
- Thanks to the newly designed user interface with its guided commissioning procedure, the valve can be made ready for operation in just a few steps
- Increase in system efficiency by using the Delta-T manager to ensure the temperature spread
- The Belimo Cloud provides analyses, optimisation, updates and support



Other advantages of the Belimo Cloud

Thanks to the Belimo Cloud, the Belimo Energy Valve™ can be easily and quickly connected with the Internet. This allows the use of other services.

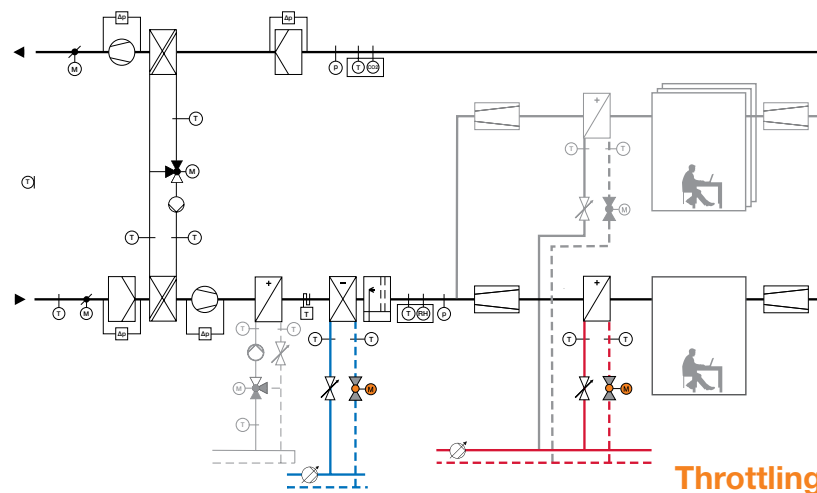
- Optimisation of the Delta-T values by experienced professionals at Belimo
- Regular reporting with a full overview of the current and past performance data such as flow rates, energy consumption, supply and return temperature as well as Delta-T
- The Belimo Cloud enables even better support
- The online updates ensure that the Belimo Energy Valve™ is fully up-to-date at all times
- Straightforward access to all data over the entire life-cycle of the Belimo Energy Valves™



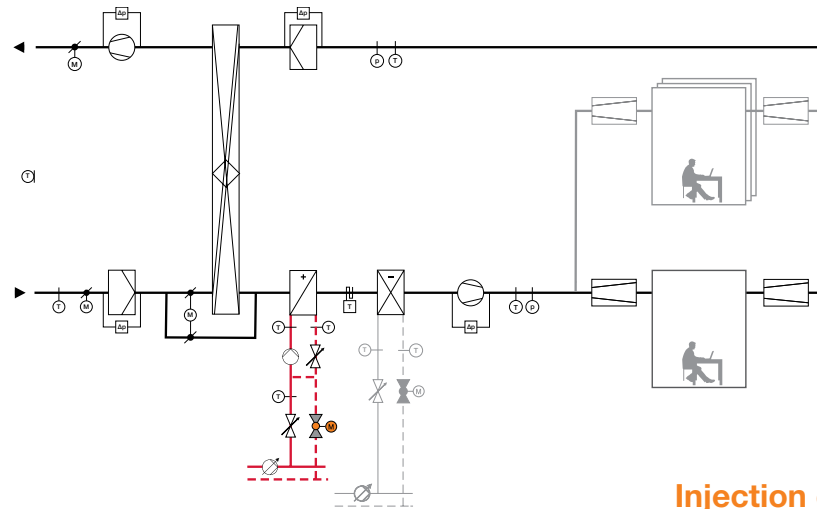
Comparison of characterised control valve, electronic pressure-independent characterised control valve (EPIV) and Belimo Energy Valve™

		Characterised control valve	Electronic pressure-independent characterised control valve (EPIV)	Belimo Energy Valve™
Closes air bubble-tight	<ul style="list-style-type: none">No activation lossesSaving of heating / cooling energyReplaces control valve and shut-off valve	✓	✓	✓
Equal percentage characteristic curve thanks to the characterising disc	<ul style="list-style-type: none">Very good control stabilityHigh control qualityReduced tendency to oscillate	✓	✓	✓
Low power consumption	<ul style="list-style-type: none">Reduced energy consumptionLower energy costs	✓	✓	✓
Self-cleaning spherical design	<ul style="list-style-type: none">No stickingHigh operating safetyMaintenance-free	✓	✓	✓
5-year guarantee	<ul style="list-style-type: none">Long-term safety	✓	✓	✓
Simple design for maximum volumetric flow	<ul style="list-style-type: none">Fast planningSafe valve design		✓	✓
Simple setting of maximum volumetric flow	<ul style="list-style-type: none">Considerably simplified hydronic balancingFlexibility in planning and later conversion		✓	✓
No balancing valve required	<ul style="list-style-type: none">Fewer componentsCost savingsFast and simple commissioning		✓	✓
Pressure-independent flow control thanks to dynamic balancing	<ul style="list-style-type: none">Correct amount of water after a differential pressure change and with partial-load operationExternal stability of controlIncreased comfort		✓	✓
Real-time flow measurement	<ul style="list-style-type: none">Transparency		✓	✓
All-in-One solution	<ul style="list-style-type: none">Fewer componentsLow installation outlays		✓	✓
Energy monitoring	<ul style="list-style-type: none">Creates system transparencyIndicates optimisation potentialIncreases system efficiency and reduces operational costs			✓
Pressure-independent and temperature-independent power control	<ul style="list-style-type: none">No influence on heating / cooling performance as a result of pressure and temperature fluctuationsOptimised comfort at all times			✓
Delta-T manager	<ul style="list-style-type: none">Avoidance of "Low Delta-T syndrome"Guaranteed required return temperature to the heat generator / cooling machineIncreased system efficiencyReduced operating costs			✓
Connection to the Belimo Cloud	<ul style="list-style-type: none">Automatic optimisation of Delta-T settingsRegular performance reportsSupport via Belimo CloudAutomatic software updatesLifetime data storageWarranty extended to 7 years			✓

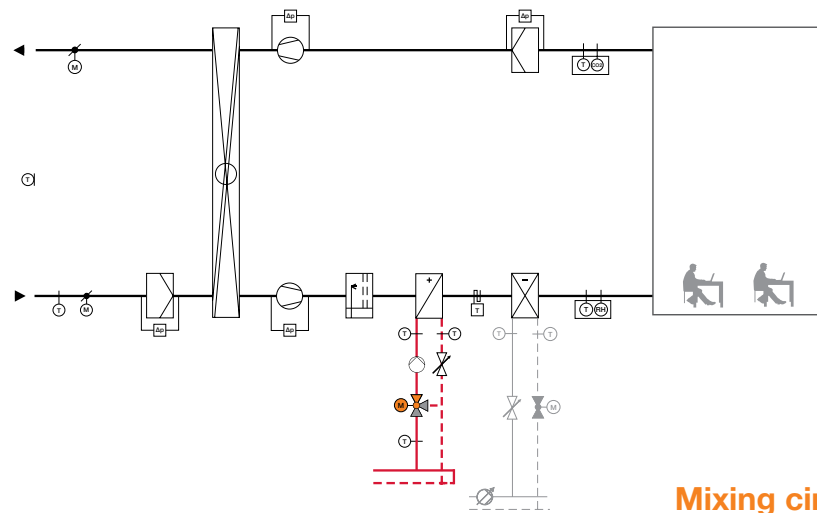
	Page	
Pressure-dependent flow control	8	1
Electronic pressure-independent flow control	26	2
Electronic pressure-independent flow control with monitoring function	36	3
Other solutions from Belimo	46	



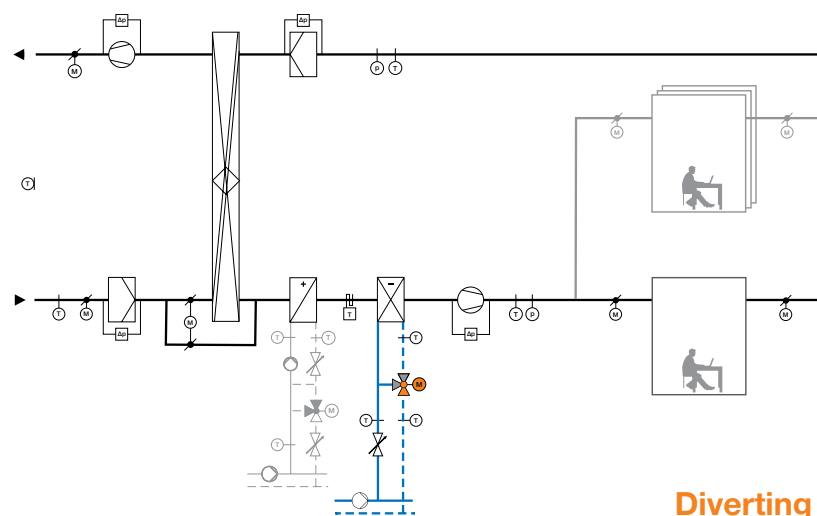
Throttling circuit



Injection circuit with 2-way valve



Mixing circuit



Diverting circuit

1

Pressure-dependent flow control

Pressure-dependent flow control	1.1	Throttling circuit	10
	1.2	Injection circuit with 2-way valve	14
	1.3	Mixing circuit	18
	1.4	Diverting circuit	22



1.1 Throttling circuit

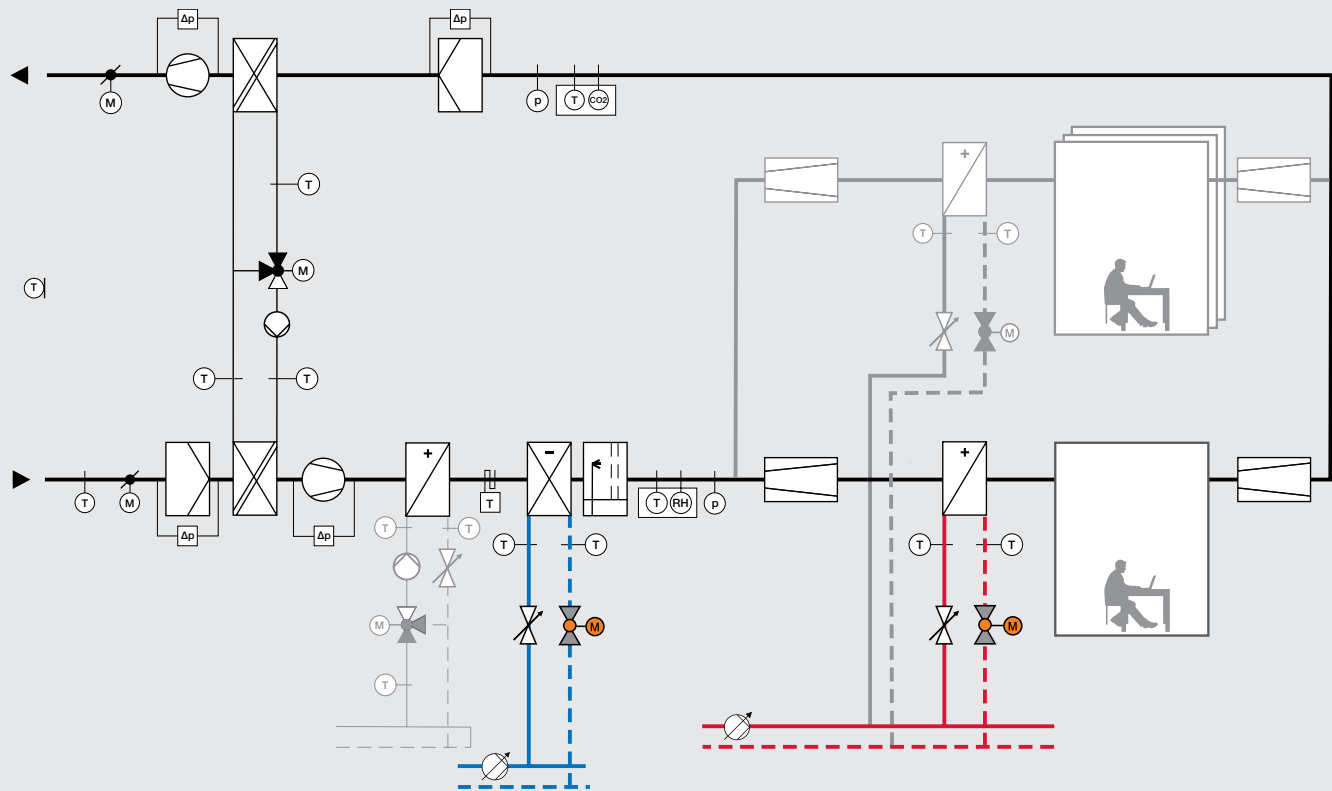


Illustration example

Application description

- A change in position at the valve causes the change in the volumetric flow in both the generator and the consumer circuits
- The power output at the heat exchanger is regulated by volumetric flow change
- Flow at heat generator / cooling machine: quantity-variable
- Flow at heat / cooling consumer: quantity-variable
- Pressure ratio at the manifold: pressurised
- Manual balancing valve for static hydronic balancing of water amount

Application notes

- Strong reciprocal influence when there is more than one consumer present
- The hydronic balancing is performed for the full load operating point
- When starting, take into account dead time induced by cooling; use circulation bypass to avoid this if necessary.
- To avoid overheating with valve closed, equip with variable speed pumps
- Saturation operation of the heat exchanger leads to a reduced temperature spread. "Low Delta-T syndrome" increases the energy consumption by the pumps and reduces the efficiency of the generator.

Typical applications

- Air reheater is permissible in the event of temperature stratification in partial-load operation
- Air cooler with dehumidification

Disturbance variables

- Differential pressure changes result in a change in the flow rate → Change in power output
- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Valve position

Bill of material

Belimo type	Description	Quantity	Costs
R2..xx-S.. (DN 15...50) ¹⁾	2-way characterised control valve, internal thread, DN, k_{VS} m ³ /h	1	
R6..W..-S8 (DN 65...150)	2-way characterised control valve, flange, DN, k_{VS} m ³ /h	+ 1 per zone	
LR24A-SR, NR24A-SR, SR24A-SR, GR24A-SR-5, GR24A-SR-5 ³⁾	Rotary actuator, Nm, AC/DC 24 V, modulating	1 + 1 per zone	
–	Balancing valve DN	1 + 1 per zone	
–	Work time required: hydronic balancing	½ h + ½ h per zone	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	1	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	5 + 2 per zone	
01DTS-10..	Frost protection thermostat	1	
22DTH-1.. ⁸⁾	Humidity and temperature duct sensor DC 0...5/10 V	1	
22DTC-1.. ⁸⁾	CO ₂ and temperature duct sensor DC 0...5/10 V	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
NF24A, SF24A, EF24A, GK24A ¹⁰⁾	Rotary actuator with emergency control function Nm, <8 m ² , AC/DC 24 V, open-close	2	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

¹⁾ Also available with external thread (R4..) or flange (R6..Rxx-B..)

³⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- Open-close or 3-point control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch

⁶⁾ Also available with active output signal

⁷⁾ Also available as strap-on temperature sensor

⁸⁾ Also available with output signal 4...20 mA

⁹⁾ Also available with display

¹⁰⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

2-way characterised control valve from Belimo

Supply and installation of tight-closing 2-way valve with equal-percentage characteristic curve and high resistance to soiling.

With integrated characterising disk for water-side modulating control of air-handling and heating systems.

Construction type:	straight-through valve 2-way, DN 15...150
Connection:	internal thread Rp" (DN 15...50) flange PN 16 (DN 65...150)
k _{VS} value:	0.25...320 m³/h
Media:	cold and warm water, water with glycol up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in the opening range
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
Differential pressure dpmax:	350 kPa (DN 65...150: 400 kPa)
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM (DN 65...150: EPDM Perox)
Valve seat:	PTFE, O-ring EPDM
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
Manufacture:	Belimo
Type:	R2..xx-S.. (DN 15...50)
Type:	R6..W..-S8 (DN 65...150)

Other versions available: external thread or flange connection (DN 15...50)

Rotary actuator from Belimo

(example LR24A-SR for CCV up to DN 25)

Rotary actuator for the modulating adjustment of 2-way, 3-way and 6-way characterised control valves.
Direct mounting on the ball valve with central screw. The assembly tool is integrated in the add-on position indication. Overload protected and without end switch, current reduction in rest position.

Torque:	5 Nm
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V
Operating range:	DC 2...10V
Position feedback:	DC 2...10 V
Power consumption:	- in operation: 1.5 W - in rest position: 0.4 W - for wire sizing: 3 VA
Connection:	cable 1 m, 4 x 0.75 mm²
Manual override:	gear disengagement with pushbutton
Running time:	90 s / 90°
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC
Manufacture:	Belimo
Type:	LR24A-SR
10 Nm to DN 40:	NR24A-SR
20 Nm to DN 50:	SR24A-SR
20 Nm for DN 65 and DN 80:	SR24A-SR-5
40 Nm for DN 65...150:	GR24A-SR-5



Other actuator variants:

- AC 230 V
- Various bus communication protocols
- Open-close, 3-point
- Modulating 0.5...10 V
- Fast runner
- Emergency control function

Including electrical and mechanical accessories

5 year warranty

Belimo – features and benefits

Water applications

Feature	Benefit
Equal-percentage flow characteristic due to characterising disk	Very good control stability throughout the entire flow range
No inlet jump	Good controllability of low outputs
Air bubble tight-closing characterised control valve	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
Compact dimensions	Great flexibility in planning and design
5 year warranty	Long-term safety

1.2 Injection circuit with 2-way valve

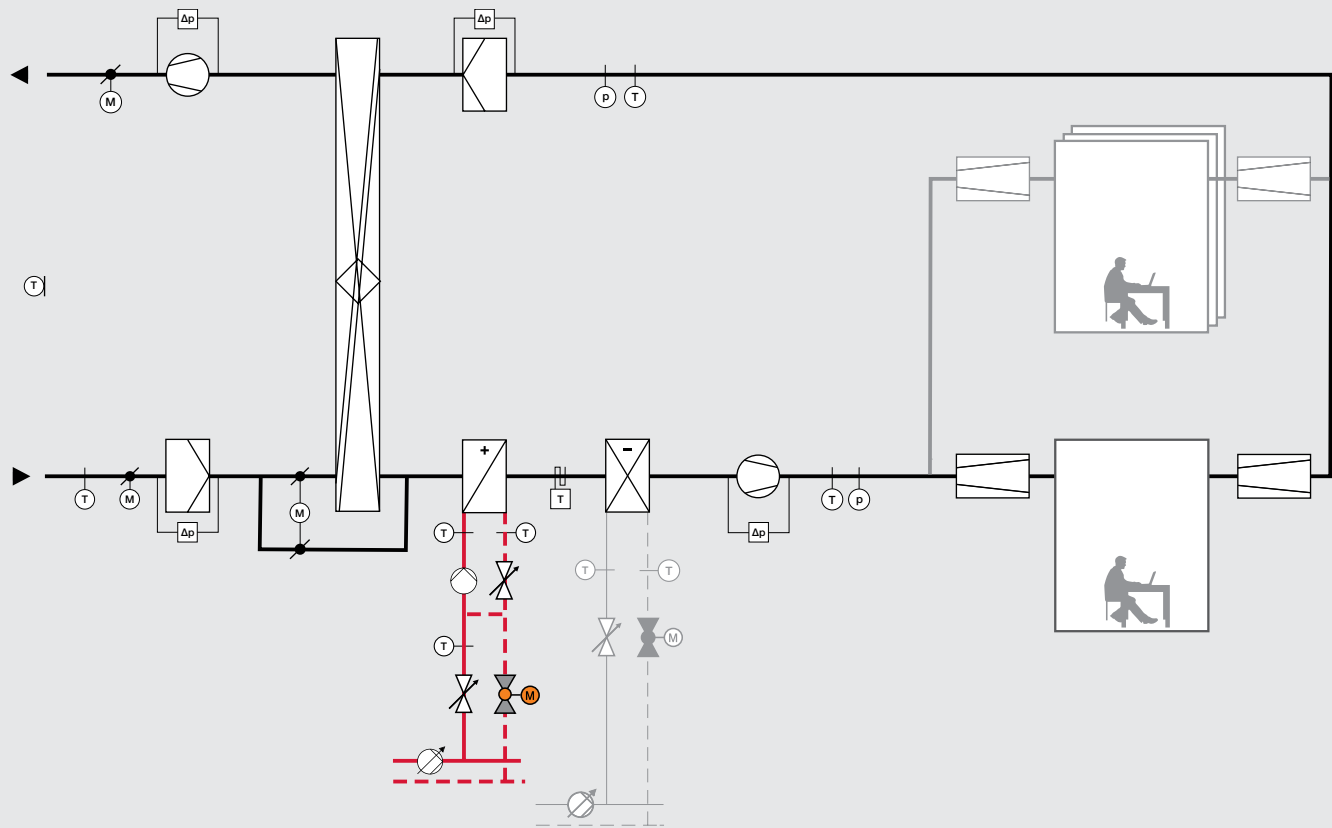


Illustration example

Application description

- Valve position determines the water flow injected into the consumer circuit
- Regulation of power output on heat exchanger by changing the temperature
- Flow at heat generator: quantity-variable
- Flow at heat consumer: quantity-constant
- Pressure ratio at the manifold: pressurised
- Manual balancing valve for static hydronic balancing of injected water amount

Application notes

- Strong reciprocal influence when there is more than one consumer present
- The hydronic balancing is performed for the full load operating point
- To avoid overheating with valve closed, equip with variable speed pumps

Typical applications

- Air preheater with frost hazard
- Air reheater

Disturbance variables

- Differential pressure changes result in a change in the flow rate → Change in power output
- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Valve position

Bill of material

Belimo type	Description	Quantity	Costs
R2..xx-S.. (DN 15...50) ¹⁾	2-way characterised control valve, internal thread, DN, k_{VS} m ³ /h	1	
R6..W..-S8 (DN 65...150)	2-way characterised control valve, flange, DN, k_{VS} m ³ /h		
LR24A-SR, NR24A-SR, SR24A-SR, SR24A-SR-5, GR24A-SR-5 ³⁾	Rotary actuator, Nm, AC/DC 24 V, modulating	1	
–	Balancing valve DN	2	
–	Work time required: hydronic balancing	½ h	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	3	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	3	
01DTS-10..	Frost protection thermostat	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
LF24, NF24A, SF24A, EF24A ¹⁰⁾	Rotary actuator with emergency control function, Nm, <6 m ² , AC/DC 24 V, open-close	2	
LM24A-SR, NM24A-SR, SM24A-SR ¹⁰⁾	Rotary actuator, Nm, <4 m ² , AC/DC 24 V, modulating	1	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

¹⁾ Also available with external thread (R4..) or flange (R6..Rxx-B..)

³⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- Open-close or 3-point control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch

⁶⁾ Also available with active output signal

⁷⁾ Also available as strap-on temperature sensor

⁹⁾ Also available with display

¹⁰⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

2-way characterised control valve from Belimo

Supply and installation of tight-closing 2-way valve with equal-percentage characteristic curve and high resistance to soiling.

With integrated characterising disk for water-side modulating control of air-handling and heating systems.

Construction type:	straight-through valve 2-way, DN 15...150
Connection:	internal thread Rp" (DN 15...50) flange PN 16 (DN 65...150)
k _{VS} value:	0.25...320 m³/h
Media:	cold and warm water, water with glycol up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in the opening range
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
Differential pressure dpmax:	350 kPa (DN 65...150: 400 kPa)
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM (DN 65...150: EPDM Perox)
Valve seat:	PTFE, O-ring EPDM
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
Manufacture:	Belimo
Type:	R2..xx-S.. (DN 15...50)
Type:	R6..W..-S8 (DN 65...150)

Other versions available: external thread or flange connection (DN 15...50)

Rotary actuator from Belimo

(example LR24A-SR for CCV up to DN 25)

Rotary actuator for the modulating adjustment of 2-way, 3-way and 6-way characterised control valves.
Direct mounting on the ball valve with central screw. The assembly tool is integrated in the add-on position indication. Overload protected and without end switch, current reduction in rest position.

Torque:	5 Nm
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V
Operating range:	DC 2...10V
Position feedback:	DC 2...10 V
Power consumption:	- in operation: 1.5 W - in rest position: 0.4 W - for wire sizing: 3 VA
Connection:	cable 1 m, 4 x 0.75 mm²
Manual override:	gear disengagement with pushbutton
Running time:	90 s / 90°
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC
Manufacture:	Belimo
Type:	LR24A-SR
10 Nm to DN 40:	NR24A-SR
20 Nm to DN 50:	SR24A-SR
20 Nm for DN 65 and DN 80:	SR24A-SR-5
40 Nm for DN 65...150:	GR24A-SR-5



Other actuator variants:

- AC 230 V
- Various bus communication protocols
- Open-close, 3-point
- Modulating 0.5...10 V
- Fast runner
- Emergency control function

Including electrical and mechanical accessories

5 year warranty

Belimo – features and benefits

Water applications

Feature	Benefit
Equal-percentage flow characteristic due to characterising disk	Very good control stability throughout the entire flow range
No inlet jump	Good controllability of low outputs
Air bubble tight-closing characterised control valve	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
Compact dimensions	Great flexibility in planning and design
5 year warranty	Long-term safety

1.3 Mixing circuit

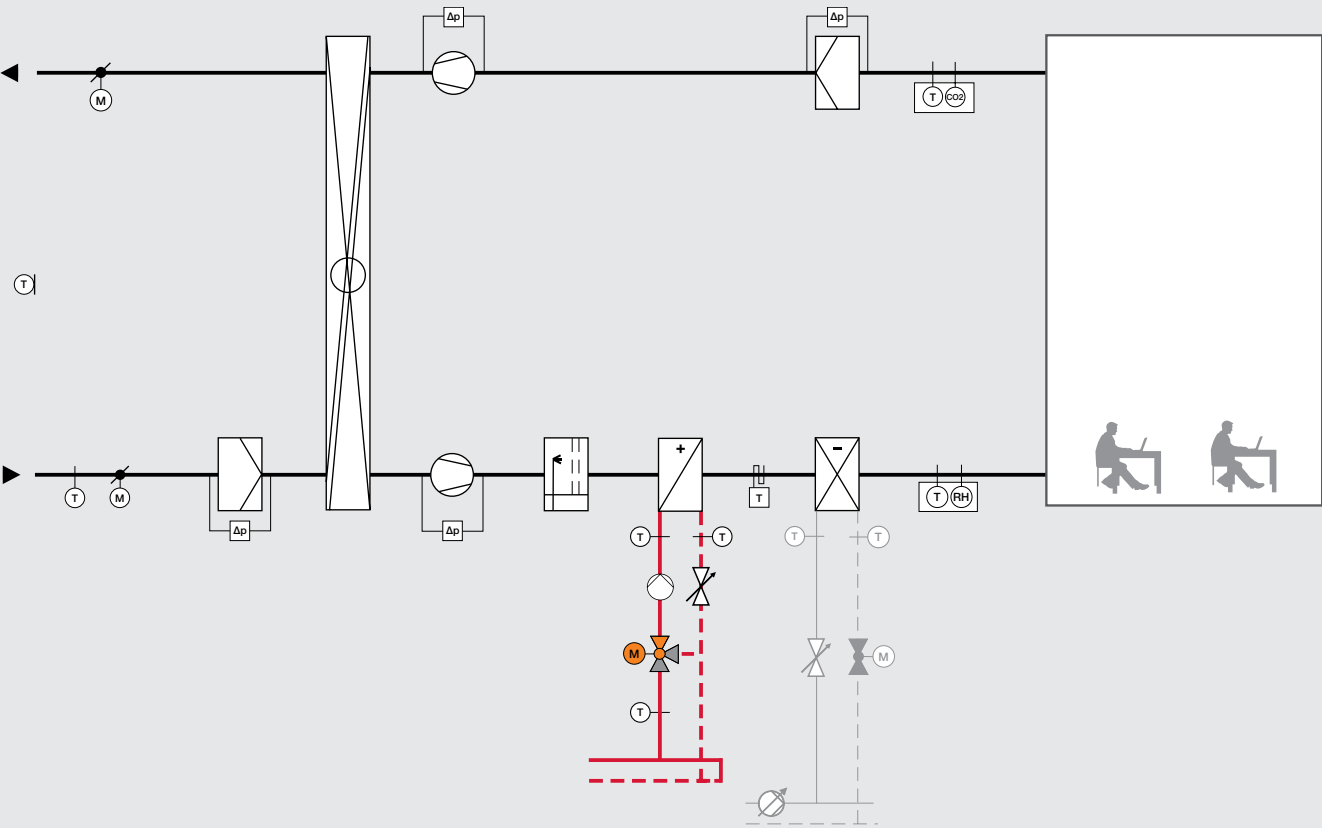


Illustration example

Application description

- The valve position is used to influence the quantity of return water that is added to the supply via the bypass
- Regulation of power output on heat exchanger by changing the temperature
- Flow at heat generator: quantity-variable
- Flow at heat consumer: quantity-constant
- Pressure ratio at the manifold: low-pressure

Application notes

- Recommended only for low-pressure manifolds, in case of a pressurised manifold use an injection circuit with 2-way valve
- Because of the dead time, this is not recommended for systems with a distance of more than 20 m between bypass and temperature sensor
- If the temperature difference between the consumer flow and the generator flow is high, a mixing circuit with fixed premixing (double mixing circuit) is to be provided

Typical applications

- Air preheater with frost hazard
- Air reheater
- Air cooler without controlled dehumidification

Disturbance variables

- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Valve position

Bill of material

Belimo type	Description	Quantity	Costs
R3..xx-S.. ²⁾	3-way characterised control valve from Belimo, internal thread, DN, k _{VS} m ³ /h	1	
LR24A-SR, NR24A-SR, SR24A-SR, SR24A-SR-5, GR24A-SR-5 ³⁾	Rotary actuator, Nm, AC/DC 24 V, modulating	1	
–	Balancing valve DN	1	
–	Work time required: hydronic balancing of consumer circuit with constant amount	½ h	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	1	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	3	
01DTS-10..	Frost protection thermostat	1	
22DTH-1.. ⁸⁾	Humidity and temperature duct sensor DC 0...5/10 V	1	
22DTC-1.. ⁸⁾	CO ₂ and temperature duct sensor DC 0...5/10 V	1	
01APS-10..	Differential pressure switch	4	
NF24A, SF24A, EF24A, GK24A ¹⁰⁾	Rotary actuator with emergency control function, Nm, <8 m ² , AC/DC 24 V, open-close	2	

²⁾ Also available with external thread (R5..) or flange (R7..Rxx-B..)
³⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- Open-close or 3-point control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch
⁶⁾ Also available with active output signal
⁷⁾ Also available as strap-on temperature sensor
⁸⁾ Also available with output signal 4...20 mA
¹⁰⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

3-way characterised control valve from Belimo

Supply and installation of a 3-way valve with high resistance to soiling. Equal-percentage characteristic curve and tight-closing control path A-AB.

With integrated characterising disk for water-side modulating control of air-handling and heating systems.

Design:	mixing valve 3-way, DN 15 ... DN 50
Connection:	internal thread Rp"
k _{VS} value:	0.25...58 m³/h
Media:	cold and warm water with glycol of up to max. 50% vol.
Leakage rate control path A-AB:	leakage rate A, tight (EN 12266-1)
Leakage rate bypass B-AB:	1...2% of the highest possible k _{VS} value of the nominal diameter (DN) used
Characteristic curve control path A-AB:	equal percentage (VDI/VDE 2178), optimised in the opening range
Characteristic curve bypass B-AB:	linear (VDI/VDE 2178)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa
Differential pressure dpmax:	350 kPa

Housing:	brass body nickel-plated
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM
Valve seat:	PTFE, O-ring EPDM
Characterising disk:	TEFZEL (R3040-25-S4, R3050-40-S4, R3050-58-S4: stainless steel)

Manufacture:	Belimo
Type:	R3..xx-S..

Other versions available: external thread or flange connection

Rotary actuator from Belimo

(example LR24A-SR for CCV up to DN 25)

Rotary actuator for the modulating adjustment of 2-way, 3-way and 6-way characterised control valves. Direct mounting on the ball valve with central screw. The assembly tool is integrated in the add-on position indication. Overload protected and without end switch, current reduction in rest position.

Torque:	5 Nm
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V
Operating range:	DC 2...10V
Position feedback:	DC 2...10 V
Power consumption:	- in operation: 1.5 W - for rest position: 0.4 W - for wire sizing: 3 VA
Connection:	cable 1 m, 4 x 0.75 mm²
Manual override:	gear disengagement with pushbutton
Running time:	90 s / 90°
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC

Manufacture:	Belimo
Type:	LR24A-SR

10 Nm to DN 40:	NR24A-SR
20 Nm to DN 50:	SR24A-SR
20 Nm for DN 65 and DN 80:	SR24A-SR-5
40 Nm for DN 65...150:	GR24A-SR-5



- Other actuator variants:
- AC 230 V
 - Various bus communication protocols
 - Open-close, 3-point
 - Modulating 0.5...10 V
 - Fast runner
 - Emergency control function

Including electrical and mechanical accessories

5 year warranty

Belimo – features and benefits

Water applications

Feature	Benefit
Equal-percentage flow characteristic (A-AB) due to characterising disk	Very good control stability throughout the entire flow range
No inlet jump	Good controllability of low outputs
Air bubble tight-closing characterised control valve	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
Compact dimensions	Great flexibility in planning and design
5 year warranty	Long-term safety

1.4 Diverting circuit

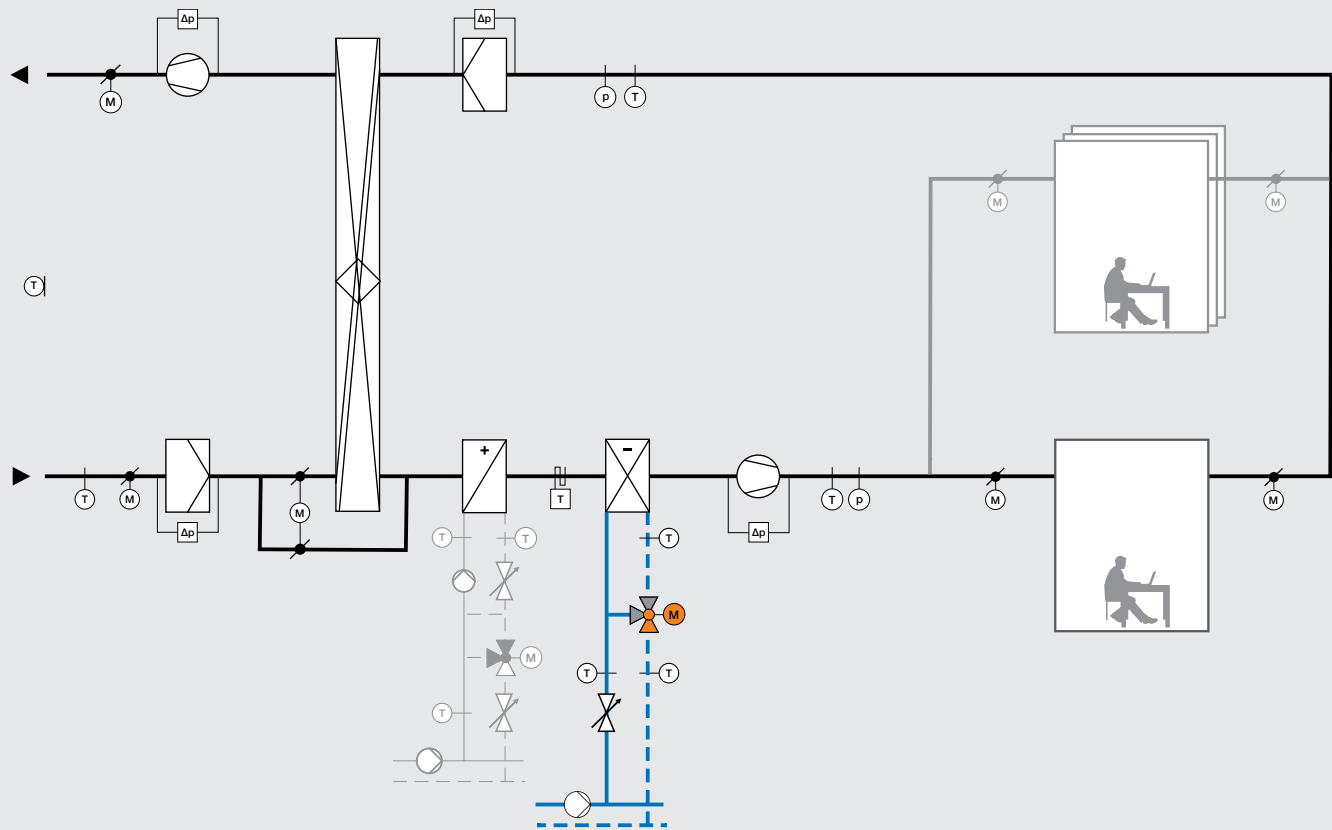


Illustration example

Application description

- Valve position determines the amount of water flowing to the heat exchanger and the amount flowing via the bypass directly from supply to return
- Regulation of power output on heat exchanger by changing the volume
- Flow at the cooling machine: quantity-constant
- Flow at cooling consumer: quantity-variable
- Pressure ratio at the manifold: pressurised
- Manual balancing valve for static hydronic balancing of water amount

Application notes

- Unused water leads to a substantial reduction in temperature spread with partial loads
- The entire water amount is pumped in the generator circuit even with zero and partial load
- Low temperature difference leads to an increased power consumption on the pumps and a reduced efficiency of the generator ("Low Delta-T syndrome")
- Increase in temperature spread and system efficiency via throttling circuit
- The hydronic balancing is performed for the full load operating point

Typical applications

- Air reheater is permissible in the event of temperature stratification in partial-load operation
- Air cooler with dehumidification

Disturbance variables

- Differential pressure changes result in a change in the flow rate → Change in power output
- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Valve position

Bill of material

Belimo type	Description	Quantity	Costs
R3..xx-S.. ²⁾	3-way characterised control valve, internal thread, DN, k_{VS} m^3/h	1	
LR24A-SR, NR24A-SR, SR24A-SR, SR24A-SR-5, GR24A-SR-5 ³⁾	Rotary actuator, Nm, AC/DC 24 V, modulating	1	
–	Balancing valve DN	1	
–	Work time required: hydronic balancing	½ h	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	3	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	3	
01DTS-10..	Frost protection thermostat	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
LF24, NF24A, SF24A, EF24A ¹⁰⁾	Rotary actuator with emergency control function, Nm, <6 m ² , AC/DC 24 V, open-close	2	
LM24A-SR, NM24A-SR, SM24A-SR ¹⁰⁾	Rotary actuator, Nm, <4 m ² , AC/DC 24 V, modulating	1	
LM24A, NM24A, SM24A ¹⁰⁾	Rotary actuator, Nm, <4 m ² , AC/DC 24 V, open-close	2 per zone	

²⁾ Also available with external thread (R5..) or flange (R7..Rxx-B..)

³⁾ Other available actuator variants:

- AC/DC 24 V and AC 230 V
- Open-close or 3-point control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch

⁶⁾ Also available with active output signal

⁷⁾ Also available as strap-on temperature sensor

⁹⁾ Also available with display

¹⁰⁾ Other available actuator variants:

- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

3-way characterised control valve from Belimo

Supply and installation of a 3-way valve with high resistance to soiling. Equal-percentage characteristic curve and tight-closing control path A-AB.

With integrated characterising disk for water-side modulating control of air-handling and heating systems.

Design:	mixing valve 3-way, DN 15 ... DN 50
Connection:	internal thread Rp"
k _{VS} value:	0.25...58 m³/h
Media:	cold and warm water with glycol of up to max. 50% vol.
Leakage rate control path A-AB:	leakage rate A, tight (EN 12266-1)
Leakage rate bypass B-AB:	1...2% of the highest possible k _{VS} value of the nominal diameter (DN) used
Characteristic curve control path A-AB:	equal percentage (VDI/VDE 2178), optimised in the opening range
Characteristic curve bypass B-AB:	linear (VDI/VDE 2178)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa
Differential pressure dpmax:	350 kPa

Housing:	brass body nickel-plated
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM
Valve seat:	PTFE, O-ring EPDM
Characterising disk:	TEFZEL (R3040-25-S4, R3050-40-S4, R3050-58-S4: stainless steel)

Manufacture:	Belimo
Type:	R3..xx-S..

Other versions available: external thread or flange connection

Rotary actuator from Belimo

(example LR24A-SR for CCV up to DN 25)

Rotary actuator for the modulating adjustment of 2-way, 3-way and 6-way characterised control valves. Direct mounting on the ball valve with central screw. The assembly tool is integrated in the add-on position indication. Overload protected and without end switch, current reduction in rest position.

Torque:	5 Nm
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V
Operating range:	DC 2...10V
Position feedback:	DC 2...10 V
Power consumption:	- in operation: 1.5 W - for rest position: 0.4 W - for wire sizing: 3 VA
Connection:	cable 1 m, 4 x 0.75 mm²
Manual override:	gear disengagement with pushbutton
Running time:	90 s / 90°
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC

Manufacture:	Belimo
Type:	LR24A-SR

10 Nm to DN 40:	NR24A-SR
20 Nm to DN 50:	SR24A-SR
20 Nm for DN 65 and DN 80:	SR24A-SR-5
40 Nm for DN 65...150:	GR24A-SR-5



- Other actuator variants:
- AC 230 V
 - Various bus communication protocols
 - Open-close, 3-point
 - Modulating 0.5...10 V
 - Fast runner
 - Emergency control function

Including electrical and mechanical accessories

5 year warranty

Belimo – features and benefits

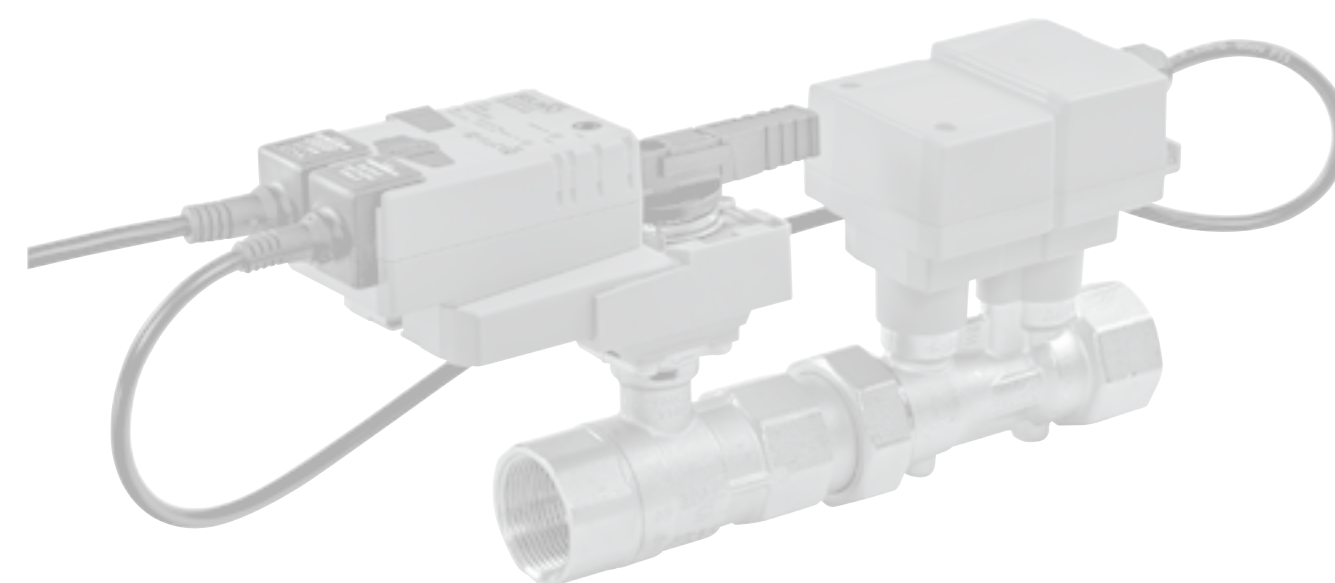
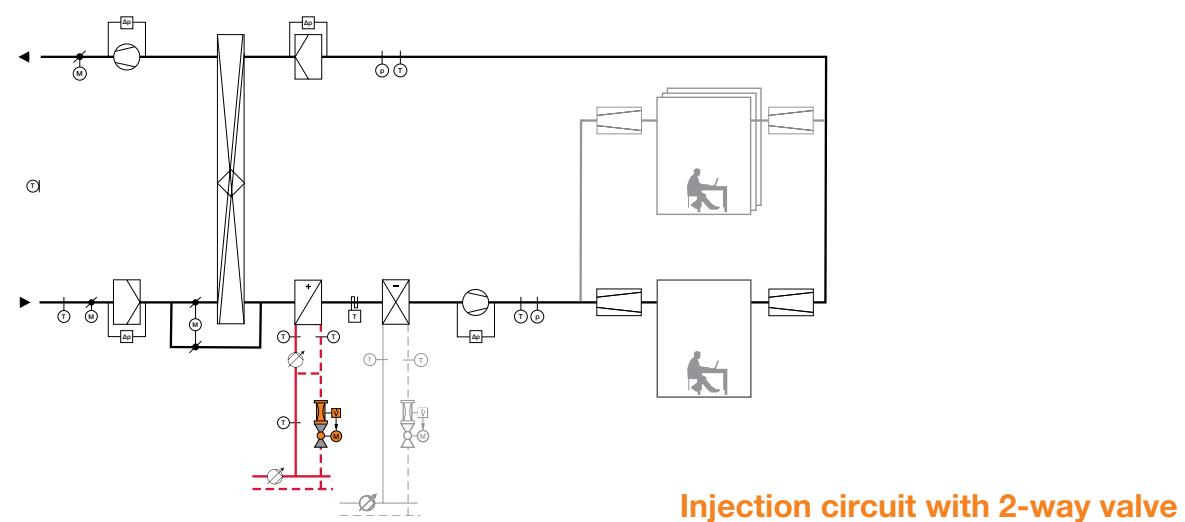
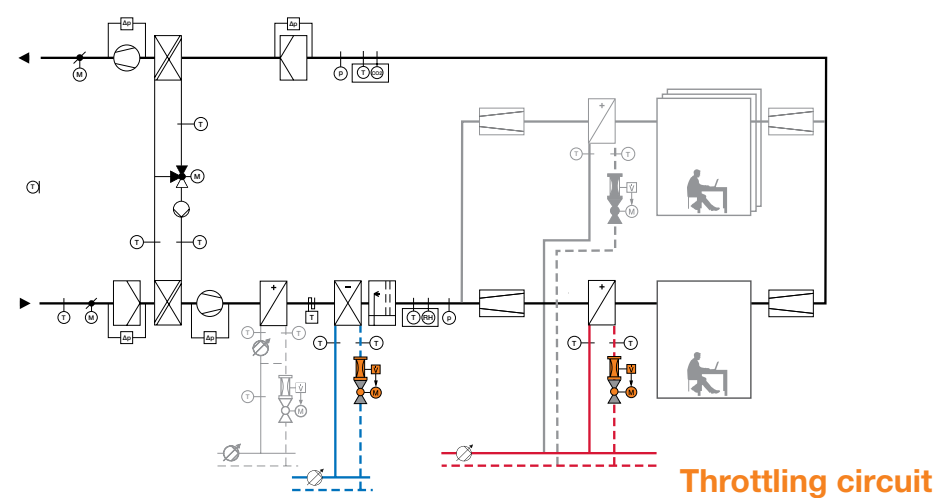
Water applications

Feature	Benefit
Equal-percentage flow characteristic (A-AB) due to characterising disk	Very good control stability throughout the entire flow range
No inlet jump	Good controllability of low outputs
Air bubble tight-closing characterised control valve	No activation losses with zero load
3-way characterised control valve with reduced bypass	No balancing valve required in the bypass line
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
Compact dimensions	Great flexibility in planning and design
5 year warranty	Long-term safety

2

Electronic pressure-independent flow control

Electronic pressure-independent flow control	2.1 Throttling circuit	28
	2.2 Injection circuit with 2-way valve	32



2.1 Throttling circuit

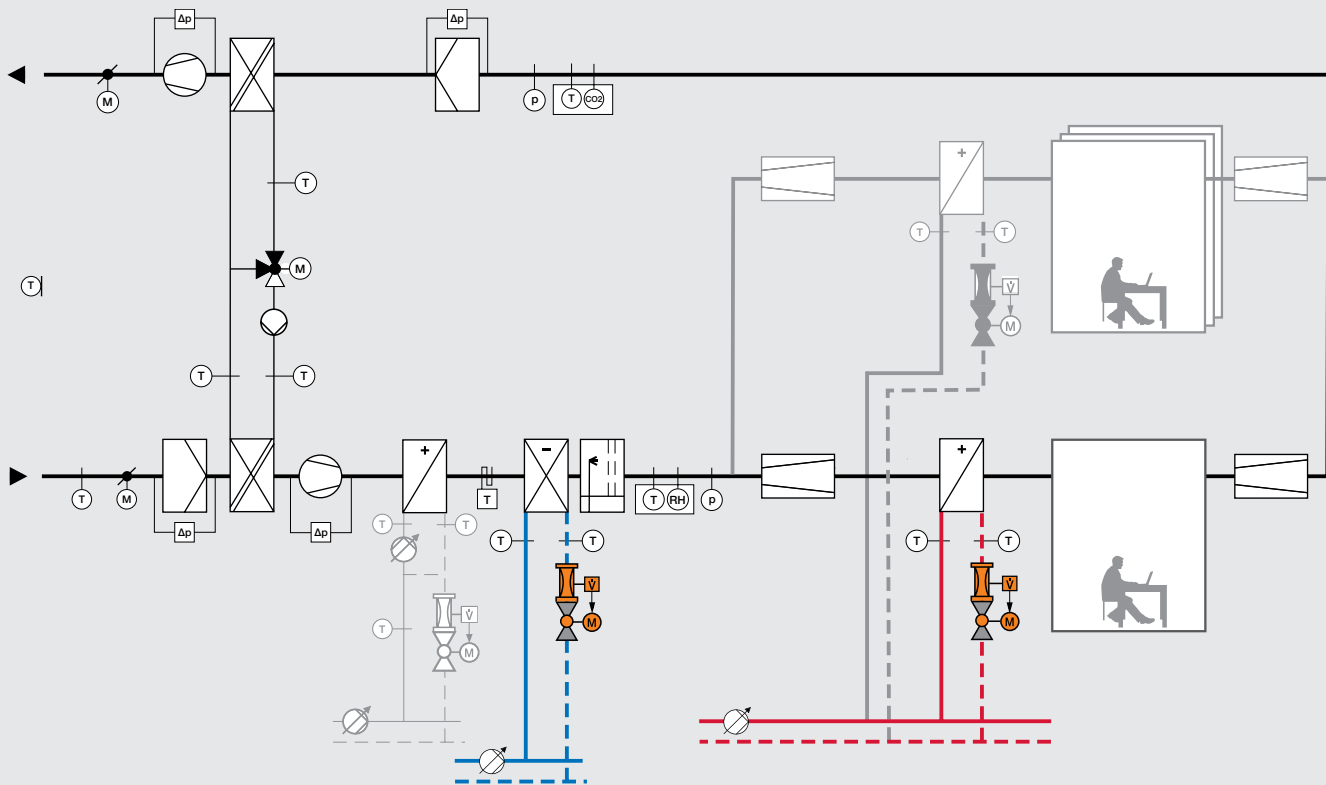


Illustration example

Application description

- Changed requirement at the valve causes the change in the volumetric flow in both the generator and the consumer circuits
- The power output at the heat exchanger is regulated by volumetric flow change
- Flow at heat generator / cooling machine: quantity-variable
- Flow at heat / cooling consumer: quantity-variable
- Pressure ratio at the manifold: pressurised
- Dynamic balancing by the electronic pressure-independent characterised control valve (EPIV) ensures the correct amount of water at full and partial load operating points
- System transparency (volumetric flow)

Application notes

- Reciprocal influence with several consumers is eliminated due to the dynamic balancing
- Dynamic balancing is carried out automatically at each operating point
- Substantially reduced "Low Delta-T syndrome" risk due to the correct amount of water
- Constant pump optimisation is possible due to the feedback signal regarding valve position
- When starting, take into account dead time induced by cooling; use circulation bypass to avoid this if necessary.
- To avoid overheating with valve closed, equip with variable speed pumps

Typical applications

- Air reheater is permissible in the event of temperature stratification in partial-load operation
- Air cooler with dehumidification

Disturbance variables

- Thanks to dynamic balancing, → changes in differential pressure do **not** cause any changes in the rate of flow
- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Real-time flow measurement
- Valve position

List of materials

Belimo type	Description	Quantity	Costs
EP..R+MP (DN 15...50) ⁴⁾	Electronic pressure-independent characterised control valve (EPIV),	1	
P6..W..E-MP (DN 65...150) ⁴⁾	DN, V _{nom} l/s	+ 1 per zone	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	1	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	5 + 2 per zone	
01DTS-10..	Frost protection thermostat	1	
22DTH-1.. ⁸⁾	Humidity and temperature duct sensor DC 0...5/10 V	1	
22DTC-1.. ⁸⁾	CO ₂ and temperature duct sensor DC 0...5/10 V	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
NF24A, SF24A, EF24A, GK24A ¹⁰⁾	Rotary actuator with emergency control function Nm, <8 m ² , AC/DC 24 V, open-close	2	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

⁴⁾ Also available with Modbus or electrical emergency control function
New designation for P6..W..E-.. as from Q3/2017: EP..F+..

⁶⁾ Also available with active output signal

⁷⁾ Also available as strap-on temperature sensor

⁸⁾ Also available with output signal 4...20 mA

⁹⁾ Also available with display

¹⁰⁾ Other available actuator variants:

- AC/DC 24 V and AC 230 V

- 3-point or modulating control

- Communication-ready (MP-Bus®, LON, Modbus, KNX)

- With or without emergency control function

- With or without auxiliary switch



Tender specification

Communication-capable characterised control valve with sensor-operated flow control (EPIV) from Belimo

Supply and installation of a tight-closing, electronic pressure-independent 2-way valve with switchable characteristic curve (equal percentage/linear) and high resistance to soiling.

For water-side modulating control of air-handling and heating systems. Consisting of characterised control valve with actuator and measuring pipe with volumetric flow sensor.
Communication via Belimo MP-Bus® or conventional control. Conversion of active sensor signals and switching contacts. Parameterisable via ZTH EU or service tool MFT-P from Belimo.

Construction type:	straight-through valve 2-way, DN 15...150
Connection:	internal thread Rp" (DN 15...50) flange PN 16 (DN 65...150)
Flow V _{nom} :	0.35...45 l/s
Flow V _{max} :	0.11...45 l/s, adjustable
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V / communicative
Operating range:	DC 2...10 V, variable
Position feedback:	DC 2...10 V, variable
Power consumption:	- in operation: 3.5 W (DN 15...25) - in rest position: 1.3 W (DN 15...25) - for wire sizing: 6 VA (DN 15...25)
Connection:	cable 1 m, 4 x 0.75 mm ²
Manual override:	gear disengagement with pushbutton
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC
Media:	cold and warm water, water with glycol up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in opening range (switchable to linear)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
Differential pressure dpmax:	350 kPa (DN 65...150: 340 kPa)
Theoretical k _{vs} value:	2.9...270 m ³ /h
Measuring principle:	ultrasonic volumetric flow measurement
Measuring accuracy:	+/- 6% (25...100% V _{nom})
Control precision:	+/- 10% (25...100% V _{nom})
Min. flow measurement:	1% of V _{nom}
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM (DN 65...150: EPDM Perox)
Valve seat:	PTFE, O-ring EPDM (DN 65...150: PTFE, O-ring Viton)
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
Measuring pipe:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Manufacture:	Belimo
Type:	EP..R+MP (DN 15...50)
Type:	P6..W..E-MP (DN 65...150)

Also available with Modbus or electrical emergency control function

Including electrical and mechanical accessories

5-year warranty



Belimo – features and benefits

Water applications

Properties	Benefit
Simple design for maximum volumetric flow	Time-saving and simple valve selection
All-in-One solution	4 functions: measuring, controlling, dynamic balancing and shutting
Pressure-independent flow rate due to dynamic balancing	Extremely simplified commissioning
	Securing the correct amount of water with differential pressure changes and with partial load
	Excellent control stability across the entire flow range
Flow measurement	Real-time information water quantity
Air bubble tight-closing characterised control valve	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
5-year warranty	Long-term safety

2.2 Injection circuit with 2-way valve

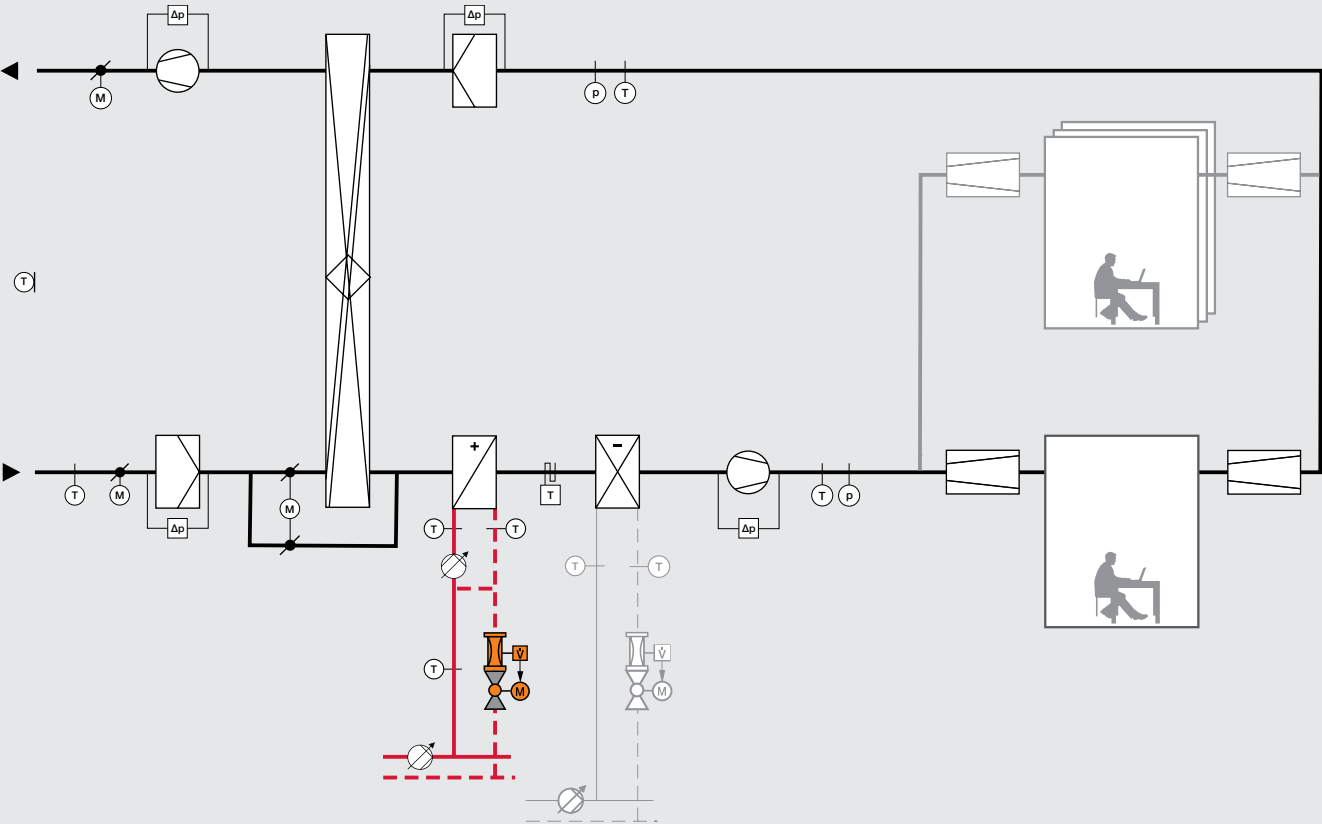


Illustration example

Application description

- Valve requirement determines the amount of supply water injected into the consumer circuit
- Regulation of power output on heat exchanger by changing the temperature
- Flow at heat generator: quantity-variable
- Flow at heat consumer: quantity-constant
- Pressure ratio at the manifold: pressurised
- Dynamic balancing by the electronic pressure-independent characterised control valve (EPIV) ensures the correct amount of water at full and partial load operating points
- System transparency (volumetric flow)

Application notes

- Reciprocal influence with several consumers is eliminated due to the dynamic balancing
- Dynamic balancing is carried out automatically at each operating point
- Constant pump optimisation is possible due to the feedback signal regarding valve position
- To avoid overheating with valve closed, equip with variable speed pumps

Typical applications

- Air preheater with frost hazard
- Air reheater

Disturbance variables

- Thanks to dynamic balancing, → changes in differential pressure do **not** cause any changes in the rate of flow
- Temperature changes result in a change in transfer behaviour → Change in power output

Available measuring values and information

- Real-time flow measurement
- Valve position

List of materials

Belimo type	Description	Quantity	Costs
EP..R+MP (DN 15...50) ⁴⁾ P6..W..E-MP (DN 65...150) ⁴⁾	Electronic pressure-independent characterised control valve (EPIV), DN, V _{nom} l/s	1	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/immersion temperature sensor, passive	3	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	3	
01DTS-10..	Frost protection thermostat	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
LF24, NF24A, SF24A, EF24A ¹⁰⁾	Rotary actuator with emergency control function Nm, <6 m ² , AC/DC 24 V, open-close	2	
LM24A-SR, NM24A-SR, SM24A-SR ¹⁰⁾	Rotary actuator Nm, <4 m ² , AC/DC 24 V, modulating	1	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

⁴⁾ Also available with Modbus or electrical emergency control function
New designation for P6..W..E-.. as from Q3/2017: EP..F+..

⁶⁾ Also available with active output signal

⁷⁾ Also available as strap-on temperature sensor

⁹⁾ Also available with display

¹⁰⁾ Other available actuator variants:

- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

Communication-capable characterised control valve with sensor-operated flow control (EPIV) from Belimo

Supply and installation of a tight-closing, electronic pressure-independent 2-way valve with switchable characteristic curve (equal percentage/linear) and high resistance to soiling.

For water-side modulating control of air-handling and heating systems. Consisting of characterised control valve with actuator and measuring pipe with volumetric flow sensor.
Communication via Belimo MP-Bus® or conventional control. Conversion of active sensor signals and switching contacts. Parameterisable via ZTH EU or service tool MFT-P from Belimo.

Construction type:	straight-through valve 2-way, DN 15...150
Connection:	internal thread Rp" (DN 15...50) flange PN 16 (DN 65...150)
Flow V _{nom} :	0.35...45 l/s
Flow V _{max} :	0.11...45 l/s, adjustable
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V / communicative
Operating range:	DC 2...10 V, variable
Position feedback:	DC 2...10 V, variable
Power consumption:	- in operation: 3.5 W (DN 15...25) - in rest position: 1.3 W (DN 15...25) - for wire sizing: 6 VA (DN 15...25)
Connection:	cable 1 m, 4 x 0.75 mm ²
Manual override:	gear disengagement with pushbutton
Protection class:	III protective extra low voltage
Degree of protection:	IP54
EMC:	CE according to 2004/108/EC
Media:	cold and warm water, water with glycol up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in opening range (switchable to linear)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
Differential pressure dpmax:	350 kPa (DN 65...150: 340 kPa)
Theoretical k _{vs} value:	2.9...270 m³/h
Measuring principle:	ultrasonic volumetric flow measurement
Measuring accuracy:	+/- 6% (25...100% V _{nom})
Control precision:	+/- 10% (25...100% V _{nom})
Min. flow measurement:	1% of V _{nom}
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM (DN 65...150: EPDM Perox)
Valve seat:	PTFE, O-ring EPDM (DN 65...150: PTFE, O-ring Viton)
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
Measuring pipe:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Manufacture:	Belimo
Type:	EP..R+MP (DN 15...50)
Type:	P6..W..E-MP (DN 65...150)

Also available with Modbus or electrical emergency control function

Including electrical and mechanical accessories

5-year warranty



Belimo – features and benefits

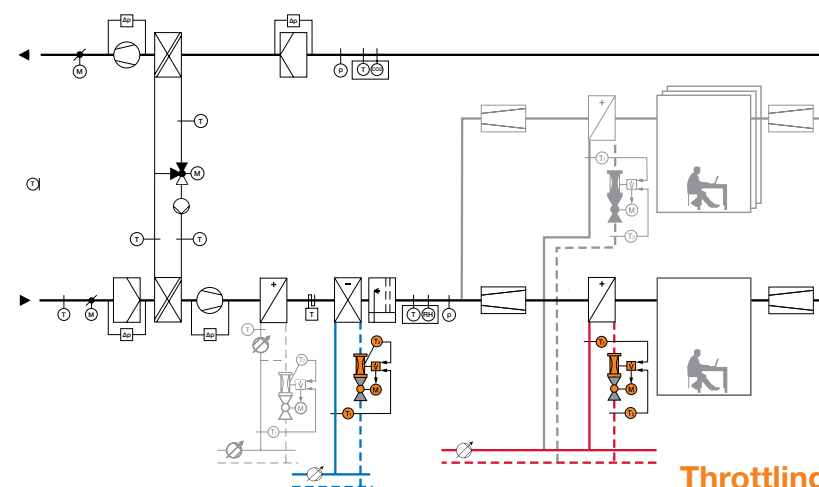
Water applications

Properties	Benefit
Simple design for maximum volumetric flow	Time-saving and simple valve selection
All-in-One solution	4 functions: measuring, controlling, dynamic balancing and shutting
Pressure-independent flow rate due to dynamic balancing	Extremely simplified commissioning
	Securing the correct amount of water with differential pressure changes and with partial load
	Excellent control stability across the entire flow range
Flow measurement	Real-time information water quantity
Air bubble tight-closing characterised control valve	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
5-year warranty	Long-term safety

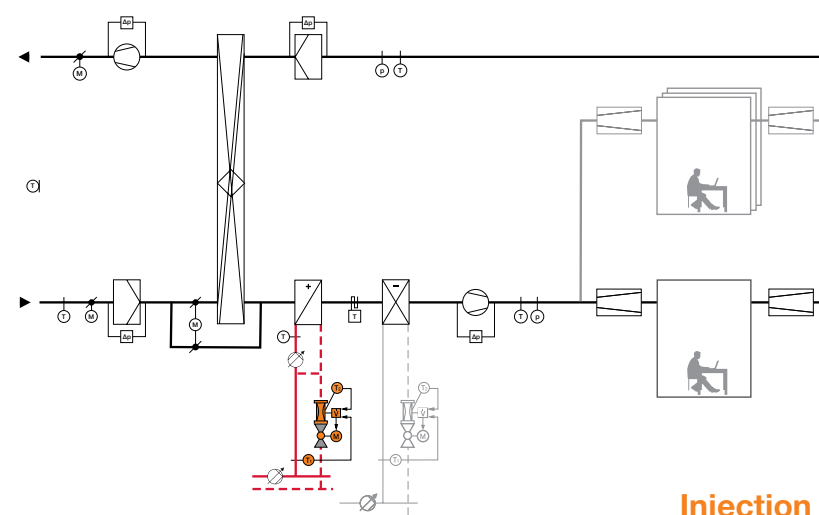
3

Electronic pressure-independent flow control with monitoring function

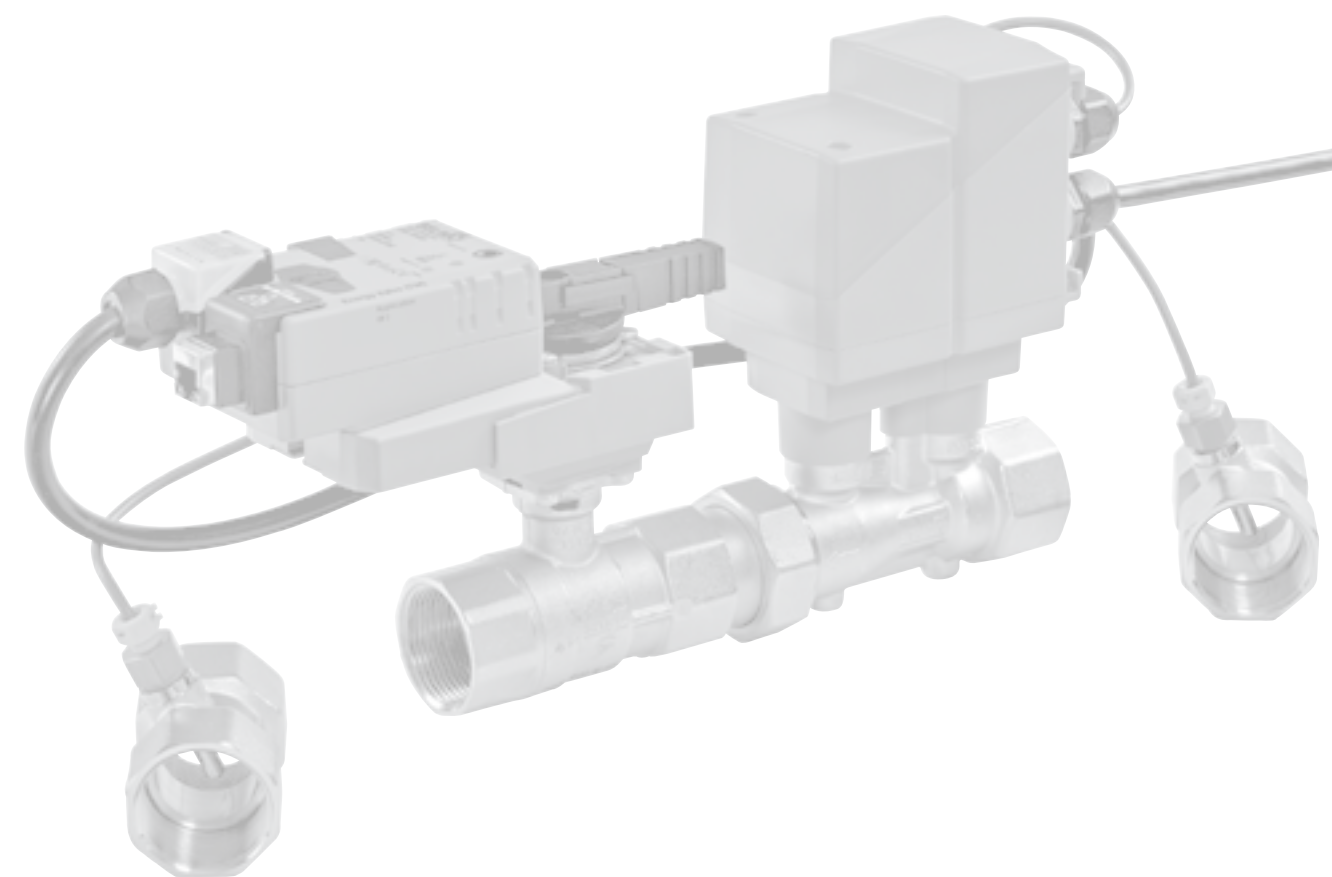
Electronic pressure-independent flow control with monitoring function	3.1 Throttling circuit	38
	3.2 Injection circuit with 2-way valve	42



Throttling circuit



Injection circuit with 2-way valve



3.1 Throttling circuit

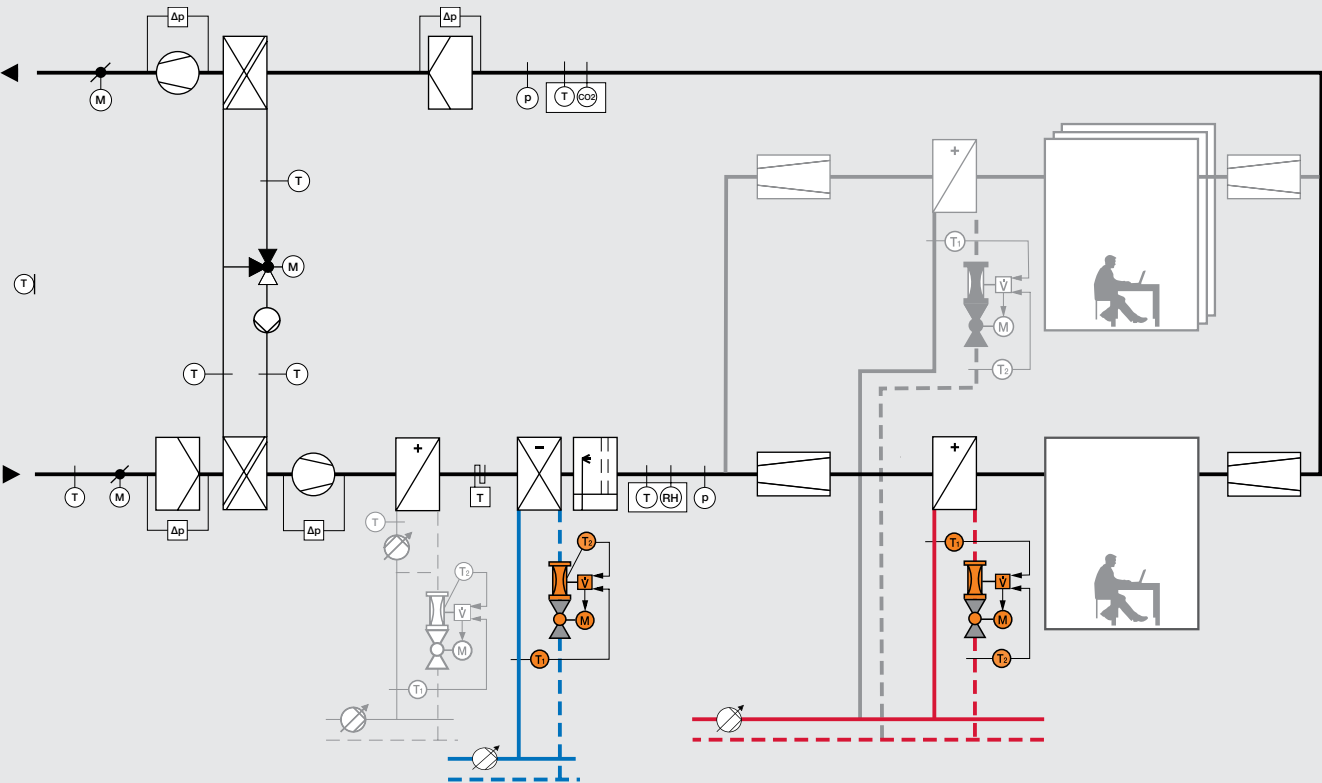


Illustration example

Application description

- Changed requirement at the valve causes the change in the volumetric flow in both the generator and the consumer circuits
- The power output at the heat exchanger is regulated by volumetric flow change
- Flow at heat generator / cooling machine: quantity-variable
- Flow at heat / cooling consumer: quantity-variable
- Pressure ratio at the manifold: pressurised
- Dynamic balancing by the Belimo Energy Valve™ ensures the correct amount of water at full and partial load
- Power control ensures the required heating or cooling output at any time
- Full system transparency (volumetric flow, temperatures, cooling / heating output, ...) with data recording and Belimo Cloud connection

Application notes

- Reciprocal influence with several consumers is eliminated due to the dynamic balancing
- Dynamic balancing is carried out automatically at each operating point
- Efficient avoidance of the "Low Delta-T syndrome" due to pressure-independent flow control and the unique Delta-T manager
- Constant pump optimisation is possible due to the feedback signal regarding valve position
- Dead time at the time of starting that has resulted from cooling should be taken into account and avoided if necessary via circulation bypass; controlled bypass is possible using the extractable temperature measurement value of the Belimo Energy Valve™
- To avoid overheating with valve closed, equip with variable speed pumps

Typical applications

- Air reheater is permissible in the event of temperature stratification in partial-load operation
- Air cooler with dehumidification

Disturbance variables

- Thanks to dynamic balancing, → changes in differential pressure do **not** cause any changes in the rate of flow
- A changed transfer behaviour due to temperature changes is balanced automatically⁽¹⁾ → **no** change in power output

⁽¹⁾ in operating mode 'Power control'

Available measuring values and information

- Real-time flow measurement
- Flow and return temperature
- Temperature difference "Delta-T"
- Current power output
- Heating and/or cooling energy
- Characteristics of the heat exchanger
- Change in the system characteristics
- Valve position

List of materials

Belimo type	Description	Quantity	Costs
EV..R+BAC (DN 15...50) ⁵⁾	Belimo Energy Valve™, electronic pressure-independent characterised control valve with energy monitoring, DN, V _{nom} l/s	1 + 1 per zone	
01UT-1.. ⁶⁾	Outdoor temperature sensor, passive	1	
01DT-1.. ⁶⁾	Duct/temperature sensor, passive	1	
01DT-1.. / A-22P-A.. ^{6) 7)}	Duct/immersion temperature sensor, passive with immersion pocket	3	
01DTS-10..	Frost protection thermostat	1	
22DTH-1.. ⁸⁾	Humidity and temperature duct sensor DC 0...5/10 V	1	
22DTC-1.. ⁸⁾	CO ₂ and temperature duct sensor DC 0...5/10 V	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
NF24A, SF24A, EF24A, GK24A ¹⁰⁾	Rotary actuator with emergency control function Nm, <8 m ² , AC/DC 24 V, open-close	2	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

⁵⁾ Also available with electric emergency control function
New designation for P6..W..EV-.. as from Q3/2017: EV..F+..
⁶⁾ Also available with active output signal
⁷⁾ Also available as strap-on temperature sensor
⁸⁾ Also available with output signal 4...20 mA
⁹⁾ Also available with display
¹⁰⁾ Other available actuator variants:
- AC/DC 24 V and AC 230 V
- 3-point or modulating control
- Communication-ready (MP-Bus®, LON, Modbus, KNX)
- With or without emergency control function
- With or without auxiliary switch



Tender specification

Belimo Energy Valve™: Communication-capable, electronic pressure-independent characterised control valve with energy monitoring and sensor-operated flow and power control

Supply and installation of a tight-closing, electronic pressure-independent 2-way valve with switchable characteristic curve (equal percentage / linear), power and energy-monitoring function and high resistance to soiling.

For water-side modulating control of air-handling and heating systems. Consisting of characterised control valve with actuator and measuring pipe with volumetric flow sensor and temperature sensors. Communication via BACnet IP, BACnet MS/TP, Modbus RTU, Modbus TCP, Belimo MP-Bus® or conventional control. Ethernet 10/100 Mbit/s, TCP/IP with integrated Web server. Parameterisable via integrated Web server or ZTH EU. Connection to the Belimo Cloud.

Construction type:	straight-through valve 2-way, DN 15...150
Connection:	internal thread Rp" (DN 15...50) flange PN 16 (DN 65...150)
Flow V _{nom} :	0.35...45 l/s
Flow V _{max} :	0.11...45 l/s, adjustable
Nominal voltage:	AC 24 V 50/60 Hz, DC 24 V
Control:	modulating DC 0...10 V / communicative
Operating range:	DC 2...10 V, variable
Position feedback:	DC 2...10 V, variable
Power consumption:	- in operation: 4 W (DN 15...25) - in rest position: 3.7 W (DN 15...25) - for wire sizing: 6.5 VA (DN 15...25)
Connection:	cable 1 m, 6 x 0.75 mm ²
Ethernet:	RJ45 socket
Manual override:	gear disengagement with pushbutton
Protection class:	III protective extra low voltage
Degree of protection:	IP54 (for use of protective cap or grommet for RJ45 socket)
EMC:	CE according to 2004/108/EC
Media:	cold and warm water with glycol of up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in opening range (switchable to linear)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
Differential pressure dpmax:	350 kPa (DN 65...150: 340 kPa)
Theoretical k _{vs} value:	2.9...240 m³/h
Measuring principle:	ultrasonic volumetric flow measurement
Measuring accuracy:	+/- 6% (25...100% V _{nom})
Control precision:	+/- 10% (25...100% V _{nom})
Minimum flow measurement:	1% of V _{nom}
Measuring accuracy of absolute temperature:	+/- 0.6 °C @ 60 °C (PT1000 EN60751 Class B)
Measuring accuracy of temperature difference:	+/- 0.23 K @ dT = 20 K
Resolution:	0.05 °C
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
Stem seal:	O-ring EPDM (DN 65...150: EPDM Perox)
Valve seat:	PTFE, O-ring EPDM (DN 65...150: PTFE, O-ring Viton)
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
Measuring pipe:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
T-piece (only DN 15...50):	brass body nickel-plated
Manufacture:	Belimo
Type:	EV..R+BAC (DN 15...50)
Type:	P6..W..EV-BAC (DN 65...150)



Also available with electric emergency control function

Including electrical and mechanical accessories

5-year warranty (7 years if connected to Belimo Cloud)

Belimo – features and benefits

Water applications

Properties	Benefit
Simple design for maximum volumetric flow	Time-saving and simple valve selection
All-in-One solution	5 functions: measuring, controlling, dynamic balancing, shut-ting and monitoring function
Pressure-independent flow rate due to dynamic balancing	Extremely simplified commissioning
	Securing the correct amount of water with differential pressure changes and with partial load
	Excellent control stability across the entire flow range
Flow measurement	Real-time information water quantity
Power control	Temperature and differential pressure-independent operation
Recording of all system data from past 13 months	Full system transparency indicates optimisation potential
	Changes in the system performance are evident
	Helps ensure preservation of value of the entire system
Delta-T manager	Avoidance of "Low Delta-T syndrome"
	No saturation operation of the heat exchanger in the presence of insufficient temperature spread
	Efficient operation of pumps and heat generator or cooling machine
Connection to the Belimo Cloud	Delta-T management by experts from Belimo
	Transparency due to regular performance reports
	Remote maintenance and diagnostics
	Support via Belimo Cloud
	Free software updates
	Data storage over the entire life-cycle
Air bubble tight-closing characterised control valve	Extension of warranty to 7 years
	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
5 or 7-year warranty	Long-term safety

3.2 Injection circuit with 2-way valve

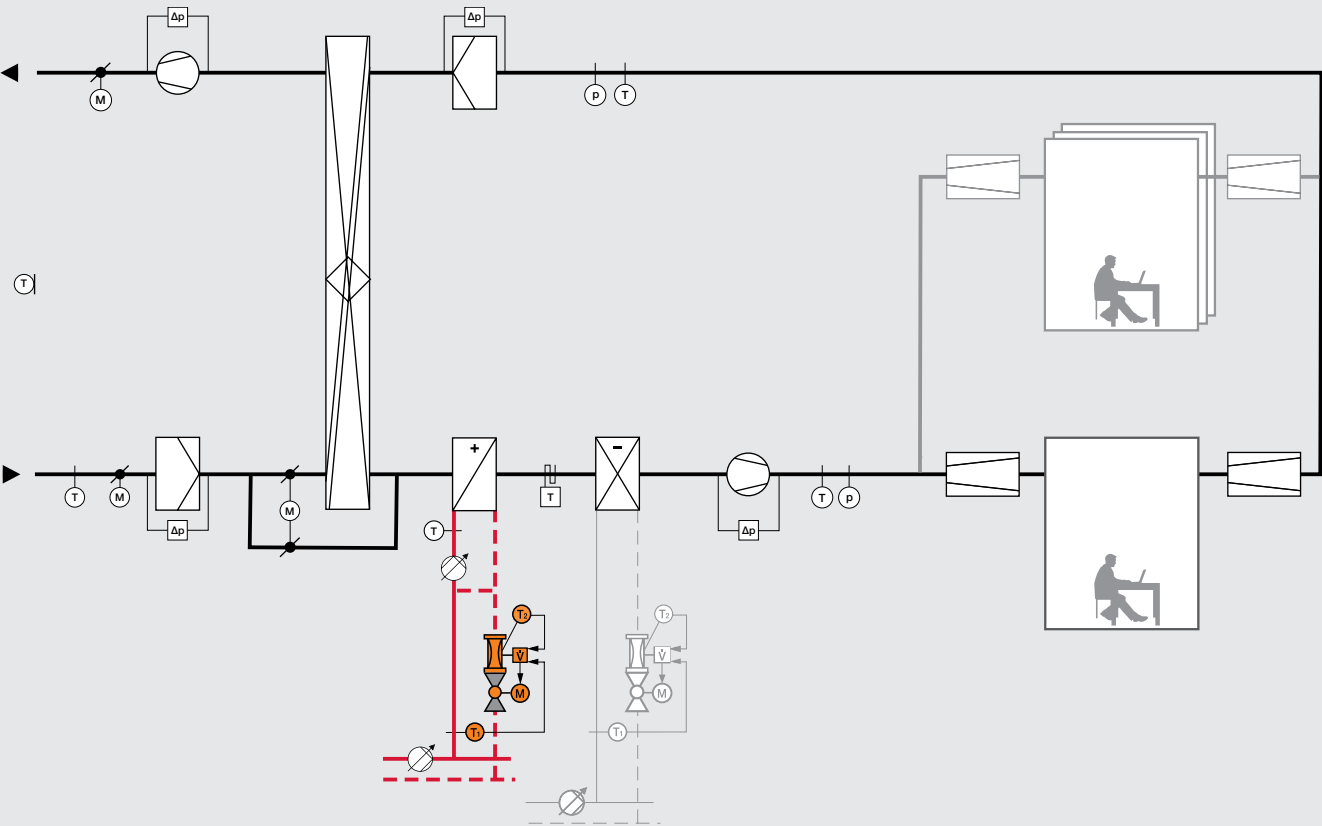


Illustration example

Application description

- Valve requirement determines the amount of supply water injected into the consumer circuit
- Regulation of power output on heat exchanger by changing the temperature
- Flow at heat generator: quantity-variable
- Flow at heat consumer: quantity-constant
- Pressure ratio at the manifold: pressurised
- Dynamic balancing by the Belimo Energy Valve™ ensures the correct amount of water at full and partial load
- Power control ensures the required heating or cooling output at any time
- Full system transparency (volumetric flow, temperatures, cooling / heating output, ...) with data recording and Belimo Cloud connection

Application notes

- Reciprocal influence with several consumers is eliminated due to the dynamic balancing
- Dynamic balancing is carried out automatically at each operating point
- Constant pump optimisation is possible due to the feedback signal regarding valve position
- To avoid overheating with valve closed, equip with variable speed pumps

Typical applications

- Air preheater with frost hazard
- Air reheater

Disturbance variables

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- A changed transfer behaviour due to temperature changes is balanced automatically⁷⁾ → **no** change in power output

⁷⁾ in operating mode 'Power control'

Available measuring values and information

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01DTS-10..	Frost protection thermostat	1	
01APS-10..	Differential pressure switch	4	
22ADP-1.. ⁹⁾	Differential pressure sensor DC 0...5/10 V and 4...20 mA	2	
LF24, NF24A, SF24A, EF24A ¹⁰⁾	Rotary actuator with emergency control function Nm, <6 m², AC/DC 24 V, open-close	2	
LM24A-SR, NM24A-SR, SM24A-SR ¹⁰⁾	Rotary actuator Nm, <4 m², AC/DC 24 V, modulating	1	
LMV-D3-MP, NMV-D3-MP	Volumetric flow controller VAV-Compact for supply air and extract air from zones, suitable for demand-based fan control Note: VAV components obtainable only via the manufacturers of VAV units	2 per zone	

⁵⁾ Also available with electric emergency control function
New designation for P6..W..EV-... as from Q3/2017: EV..F+..

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Operating range:	DC 2...10 V, variable
Position feedback:	DC 2...10 V, variable
Power consumption:	- in operation: 4 W (DN 15...25) - in rest position: 3.7 W (DN 15...25) - for wire sizing: 6.5 VA (DN 15...25)
Connection:	cable 1 m, 6 x 0.75 mm ²
Ethernet:	RJ45 socket
Manual override:	gear disengagement with pushbutton
Protection class:	III protective extra low voltage
Degree of protection:	IP54 (for use of protective cap or grommet for RJ45 socket)
EMC:	CE according to 2004/108/EC
Media:	cold and warm water with glycol of up to max. 50% vol.
Leakage rate control path:	leakage rate A, tight (EN 12266-1)
Characteristic curve:	equal percentage (VDI/VDE 2178), optimised in opening range (switchable to linear)
Medium temperature:	-10...120 °C
Permissible pressure ps:	1600 kPa
Closing pressure dps:	1400 kPa (DN 65...150: 690 kPa)
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Minimum flow measurement:	1% of V _{nom}
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Measuring accuracy of temperature difference:	+/- 0.23 K @ dT = 20 K
Resolution:	0.05 °C
Housing:	brass body nickel-plated (DN 65...150: EN-JL1040 (GG25), with protective paint)
Closing element:	stainless steel
Stem:	stainless steel
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Valve seat:	PTFE, O-ring EPDM (DN 65...150: PTFE, O-ring Viton)
Characterising disk:	TEFZEL (DN 65...150: stainless steel)
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T-piece (only DN 15...50):	brass body nickel-plated
Manufacture:	Belimo
Type:	EV..R+BAC (DN 15...50)
Type:	P6..W..EV-BAC (DN 65...150)



Also available with electric emergency control function

Including electrical and mechanical accessories

5-year warranty (7 years if connected to Belimo Cloud)

Belimo – features and benefits

Water applications

Properties	Benefit
Simple design for maximum volumetric flow	Time-saving and simple valve selection
All-in-One solution	5 functions: measuring, controlling, dynamic balancing, shut-ting and energy monitoring
Pressure-independent flow rate due to dynamic balancing	Extremely simplified commissioning
	Securing the correct amount of water with differential pressure changes and with partial load
	Excellent control stability across the entire flow range
Flow measurement	Real-time information water quantity
Power control	Temperature and differential pressure-independent operation
Recording of all system data from past 13 months	Full system transparency indicates optimisation potential
	Changes in the system performance are evident
	Helps ensure preservation of value of the entire system
Delta-T manager	Avoidance of "Low Delta-T syndrome"
	No saturation operation of the heat exchanger in the presence of insufficient temperature spread
	Efficient operation of pumps and heat generator or cooling machine
Connection to the Belimo Cloud	Delta-T management by experts from Belimo
	Transparency due to regular performance reports
	Remote maintenance and diagnostics
	Support via Belimo Cloud
	Free software updates
	Data storage over the entire life-cycle
Air bubble tight-closing characterised control valve	Extension of warranty to 7 years
	No activation losses with zero load
Low power consumption at the actuator	Small wire cross-section, low investment costs
	Low operating costs
Self-cleaning spherical design prevents sticking	High operating safety
5 or 7-year warranty	Long-term safety

Seamlessly integrated. The new sensors from Belimo.

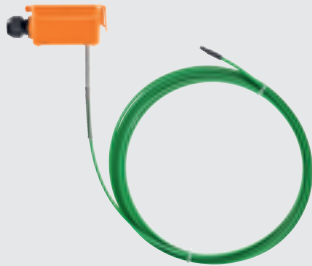


Seamless integration, reliability and intuitive design.
The perfect complement to actuators and valves.

The new range of sensors is the result of Belimo's experience and knowledge in the HVAC industry and our continuous focus on providing added value to our customers. The innovative design offers easy installation and seamless integration to ensure optimal system performance. The sensors from Belimo meet the highest quality and reliability demands.

Properties	Benefits
A variety of output signals 0...10 V, 4...20 mA or ability to communicate via BACnet or Mod-bus	<ul style="list-style-type: none">• Ensure a seamless connection to all major BACS on the market
Snap-on cover	<ul style="list-style-type: none">• First sensor housing on the market offering screwless no-tool design and NEMA 4X / IP65 protection. Due to this the installation becomes not only faster but also more reliable
Mounting plate or mounting clip are supplied	<ul style="list-style-type: none">• Serve as drill template and allow an easy mounting, fastening and installation
Conformity with NEMA 4X / IP65	<ul style="list-style-type: none">• All Belimo sensors with snap-on cover on housing meet these requirements. These sensors are therefore suitable for demanding and outdoor applications including dirt, dust, humidity, condensation, rain and snow
Universal design enclosure	<ul style="list-style-type: none">• Ensures a streamlined product range, which makes the product selection process and installation quick and easy. The simple concept allows to avoid errors during installation and reduces the assembly time
Modular cable glands	<ul style="list-style-type: none">• Suitable for additional wiring options and mounting configurations.
Removable spring loaded terminal block	<ul style="list-style-type: none">• Allow time-saving, no-tool wiring and maximum pull-out force for highest reliability
Reverse polarity protection	<ul style="list-style-type: none">• Reverse-polarity protected to prevent damage caused by incorrect wiring

Temperature sensors



Accurate and reliable temperature readings are essential for optimal building comfort and energy efficiency. Outdoor air, duct and pipe-temperature sensors are designed for easy installation and are compatible with all major BACS

- Variety of output signals ensure seamless connection to all major BACS on the market
- Up to 8 field-selectable providing flexibility
- Sintered moisture protection coating on all duct, immersion, and cable sensors protects against condensation and mechanical stress and vibrations

Humidity sensors



Controlling humidity in buildings is critical to occupant comfort. It is also important to protecting building infrastructure, production processes, stored goods and museum artwork.

- Complementary polymer-capacitance sensor with an accuracy of $\pm 2\%$ relative humidity and long-term drift $\leq \pm 0.25\%$ not affected by high humidity and contaminants
- Multi sensor with selectable output-measurement values: relative humidity, absolute humidity, enthalpy and dew point
- Up to 4 field-selectable temperature measurement ranges provide flexibility in all fields of application

Air Quality sensors



Air quality sensors from Belimo, such as CO₂ and VOC sensors, guarantee optimal indoor air quality with increased comfort and maximised energy savings in buildings. Combinations with temperature and humidity sensors are also available, which helps reduce labour and material costs.

- Dual-channel CO₂ sensor based on NDIR technology
- The additional reference channel allows compensation of the long term drift, providing precise accuracy and long-term stability; the sensor is completely maintenance free
- Dual-channel self-calibration technology (Auto-Zero) allows the use of CO₂ sensors from Belimo in all buildings and applications – including where the ABC method (Automatic Background Calibration) cannot be used

Pressure sensor range



Accurate pressure measurement is important for an optimum HVAC system performance. Pressure sensors from Belimo measure very low to high pressures in air, water and refrigerants.

- The sensors measure pressure, differential pressure and volumetric flow accuracy for a reliable control and monitoring
- Selectable measuring ranges are available for application flexibility

Flow sensors



Reliable measurement of flow plays an important role in maximising HVAC system efficiency and conserving energy. Inline flow sensors from Belimo utilise ultrasonic transit-time technology to provide accurate and repeatable water-flow measurement. Their compact size and insensitivity to dirt make them ideal for use with HVAC chilled water, hot water and water/glycol solutions throughout the entire temperature range.

- The sensor consists of corrosion-resistant materials
- Due to the ultrasonic measurement principle it is insensitive to contamination
- Low power consumption of 0.5 W saves energy and transformer capacity
- $\pm 2\%$ accuracy of reading and $\pm 0.5\%$ repeatability ensure accurate and precise flow measurement

General air solutions



Air treatment, distribution, control and feedback.

The world's most comprehensive range of electrical actuator solutions with or without emergency control function for air dampers of up to 8 m² includes Belimo rotary, linear and full-rotation actuators with a wide-range of motorisation levels and actuating time. The actuators cover almost all power requirements for the control of air flows in air-conditioning plants, from treatment and distribution to feedback and retreatment. The range also includes special actuators for indoor and outdoor use in extreme conditions.

Properties	Benefits
Tested Swiss quality since 40 years	<ul style="list-style-type: none">Reliable and durable products
Comprehensive product range	<ul style="list-style-type: none">The right actuator for every application
Energy-efficient actuator technology	<ul style="list-style-type: none">Reduces operating costs
Low commissioning costs	<ul style="list-style-type: none">Cost-optimised system creation
Maximum system safety	<ul style="list-style-type: none">System availability without restriction

Standard actuators without emergency control function



Belimo offers a comprehensive range of actuators worldwide. The standard actuators without emergency control function include rotary actuators, linear actuators and full-rotation actuators. They are space-saving, robust, energy-saving and durable.

- Rotary actuators**
- Comprehensive range of actuators
 - Customised solutions available ex works
 - Comprehensive electrical and mechanical accessories

- Linear actuators**
- The slimmest actuator of its type
 - Robust compact actuator
 - Simple installation

- Full-rotation actuators**
- Flexible angle of rotation in the application
 - Angle of rotation limitation up to 1800°
 - Can also be used for rotation without limits

Standard actuators with emergency control function



Actuators with emergency control function are essential for the system safety. Difference is made between mechanical and electrical emergency control function.

- Rotary actuators with mechanical emergency control function**
- Comprehensive range of actuators
 - Connection voltage for easy planning and commissioning
 - Closure at voltage interruption in <20 s

- Rotary and linear actuator with electric emergency control function**
- Maximum energy efficiency at rest position
 - Bridging of voltage interruptions of up to 10s
 - Emergency setting position 0...100% adjustable

Special actuators



Belimo is your partner if you need special actuators. The following two options are described in more detail.

- Rotary actuators for extreme conditions**
- The most robust actuator of its type with IP66/67 and NEMA 4
 - With and without emergency control function up to 40 Nm
 - Optional for ambient temperatures up to -40 °C
 - Flexible options for individual customer versions

- Compact actuators with damper blade**
- Four pipe diameter of 100, 125, 150 and 160 mm
 - Suitable for apartment ventilation
 - Extremely quiet and energy-saving

Demand controlled fans



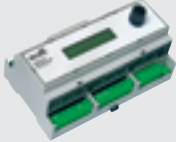
Not as much as possible, but as much as necessary.

An efficient fan control is a vital part of a modern, energy-efficient air handling unit. To this end, the required room volumes are measured by means of presence, temperature and air quality sensors and processed as setpoint value for the local volumetric flow controllers. These in turn generate demand signals for fans of the air handling unit. To regulate fan output, frequency converter-controlled fans are increasingly being joined by directly controlled EC fans.

This is the task and the strength of the Fan Optimiser system: the damper positions of the volumetric flow controller VAV-Compact are detected via the bus system and used as demand signal for the energy-efficient control of the fans. The volume-variable ventilation systems from Belimo are often used in hospitals, hotels, offices, administration and industrial buildings as well increasingly in the energy-efficient residential construction.

Properties	Benefits
Adaptation of the fan performance to the effective demand	<ul style="list-style-type: none">Up to 50% less energy consumption due to considering partial load situations
Open system	<ul style="list-style-type: none">All control functions are possible: CAV, VAV with CO₂, VOC, temperature, presence sensors etc.
Deep primary pressure	<ul style="list-style-type: none">Reduced flow noiseReduced pressure loss in the duct
System finds operating point independently	<ul style="list-style-type: none">Simple commissioningConversion does not require adaptation (provided total air volume is sufficient)No reserves requiredCompensates for some design errors

Fan control



With fan control you will simply increase room comfort. It can be easily connected and addressed to make it ready for operation.

- Efficient commissioning
- Low air duct pressure reduces the flow noise
- Small pressure loss via dampers reduces the energy consumption

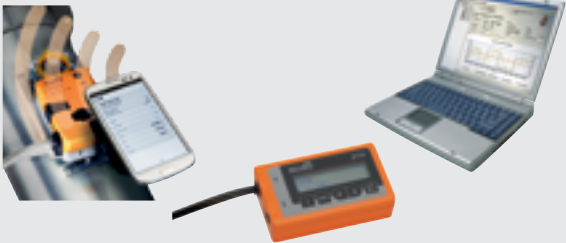
VAV-Compact controllers



The VAV-Compact is a low-cost unit comprising differential pressure sensor, controller and actuator, and has been setting standards in volumetric flow control in rooms and zones since 1990.

- Distribution through damper manufacturers as tested and preset VAV units
- Locally parameterisable with smart phone app, service tool & PC-Tool

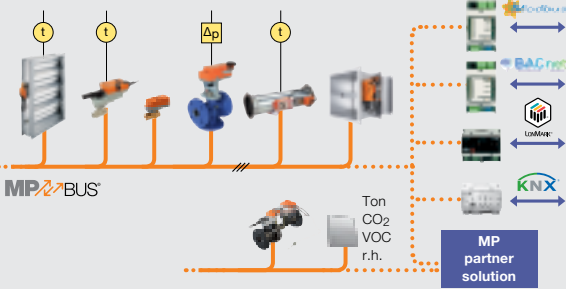
Adjustment and service tools



The setup and service tools from Belimo will facilitate your work.

- The PC tool is used to graphically display all setpoint and actual values as well as control paths. In addition, this is useful for system controls
- With the Belimo Assistant App you can parameterise and configure your Belimo devices via NFC-interface
- The adjustment tool ZTH EU can be used to establish a reliable and proven connection to the tool socket

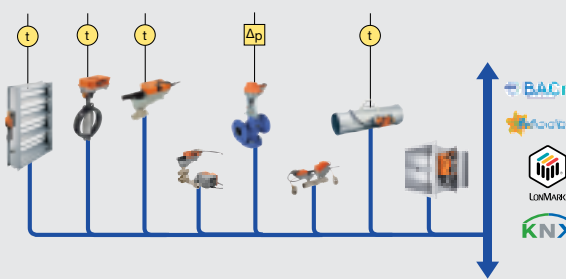
Belimo MP-Bus®



The use of the Belimo MP-Bus® solutions will significantly reduce the space required for installation. This facilitates the installation additionally and reduces the costs.

- Cost-effective, quickly available
- Up to 70% less wiring effort
- No bus connections necessary
- Structured, flexible topology
- The entire product range is suitable for MP-Bus®
- Simple integration in other systems
- Actuator replacement via predefined address

Modbus RTU, LonWorks®, KNX® und BACnet®



In cases where the customer wishes to connect a final controlling element directly to a higher level network, Belimo provides various actuators with an integrated interface.

- This enables a direct connection to field buses commonly used for HVAC without additional hardware, which eliminates additional sources of error
- The system integrators can integrate the actuators easily and using a software environment with which they are familiar

In your vicinity – Everywhere



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