

# Characterized Control Valve with Rotary Actuators



*Technical Databook*

Ver.2

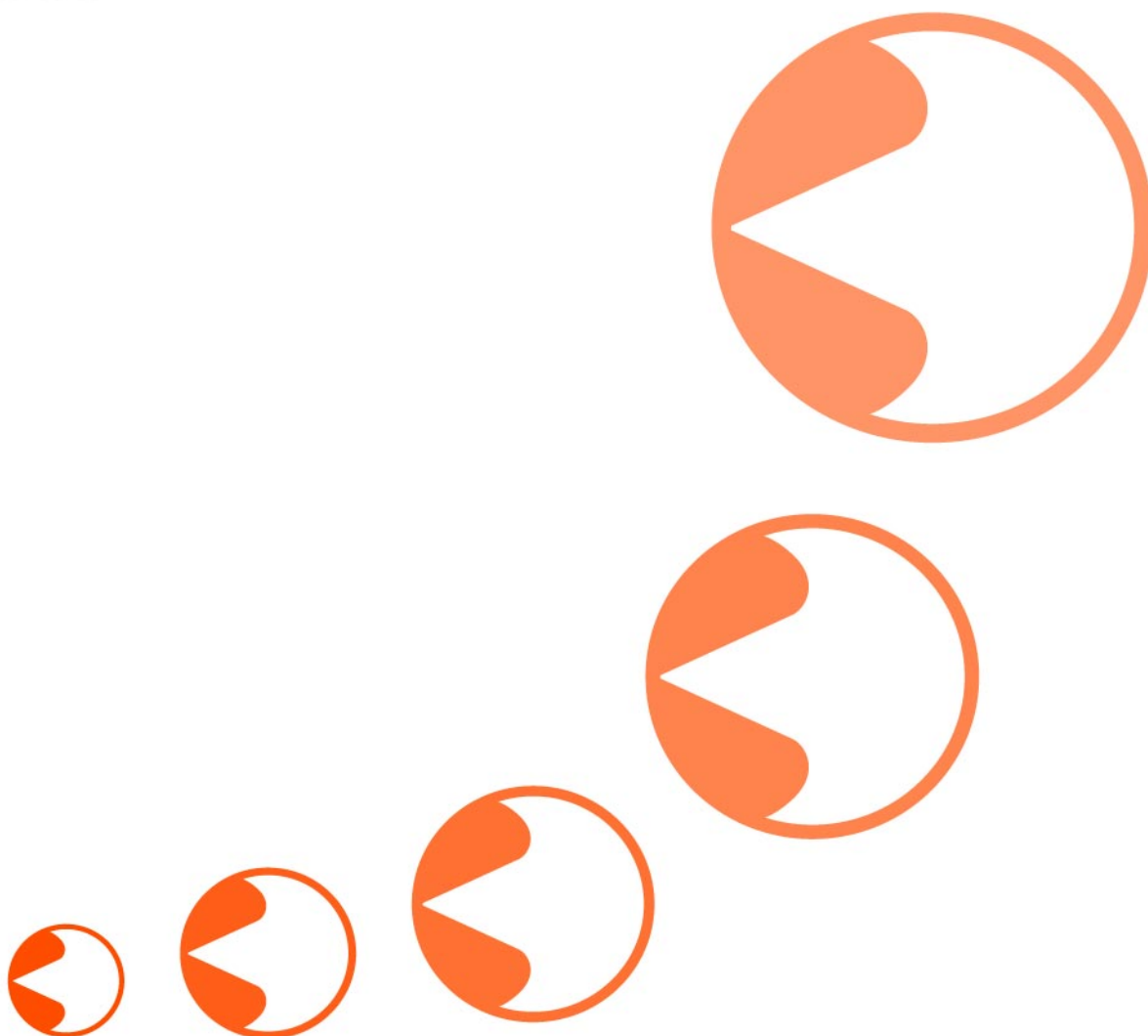
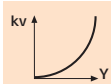


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## Characterized control valves and rotary actuators for modulating control



### Flow characteristics of characterized control valves

Characteristic: equal percentage

For more technical data: refer to pages 6, 9, 12

Rated pressure: 4140 kPa (DN15...32)  
2760 kPa (DN32...50)  
1600 kPa (DN65...150)



Connection	Internal thread																	
Kvs [m <sup>3</sup> /h]	0.63	1	1.6	2.5	4	6.3	4	6.3	8.6	6.3	10	16	10	16	16	25	25	40
DN [mm]	15	15	15	15	15	15	20	20	20	25	25	25	32	32	40	40	50	50
2-way	R209	R210	R211	R212	R213	R214	R217	R218	R219	R222	R223	R224	R229	R231	R238	R239	R248	R249
3-way	R309	R310	R311	R312	R313	-	R317	R318	-	R322	R323	-	R329	R331	R338	-	R348	-

### Suitable non-spring return rotary actuators, modulating, DC 0...10 V

TR24-SR	AC/DC 24 V	LRU24-SR	AC/DC 24 V	NRU24-SR	AC/DC 24 V	SRU24-SR
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### Suitable spring return rotary actuators, modulating, DC 0...10 V


TRF24-SR	AC/DC 24 V	LF24-SR	AC/DC 24 V	AFR24-SR	AC/DC 24 V
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### Suitable non-spring return rotary actuators, 3-point

TR24	AC/DC 24 V	LRU24(-S)	AC/DC 24 V	NRU24(-S)	AC/DC 24 V	SRU24(-S)
TR230-3	AC 230 V	LRU230(-S)	AC 100...240 V	NRU230(-S)	AC 100...240 V	SRU230(-S)

### Suitable spring return rotary actuators, 3-point

TRF24-2	AC/DC 24 V	LF24-3	AC/DC 24 V	AFR24-3(-S) US	AC/DC 24 V
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Connection	Flange PN 16										
Kvs [m³/h]	65	95	80	110		63		100	140	230	320
DN [mm]	65	65	80	80		65		80	100	125	150
2-way 	R662A	R663A	R678A	R679A		*R664AC		*R679AC	R6099AC	R6124AC	R6149AC

### Suitable non-spring return rotary actuators, modulating, DC 0...10 V

SRU24-SR	AC/DC 24 V	GRU24-SR	AC/DC 24 V
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### Suitable spring return rotary actuators, modulating, DC 0...10 V

AFR24-SR	AC/DC 24 V
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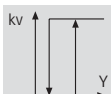
### Suitable non-spring return rotary actuators, 3-point

SRU24(-S)	AC/DC 24 V	GRU24	AC/DC 24 V
SRU230(-S)	AC 100...240 V	GRU230	AC 100...240 V

### Suitable spring return rotary actuators, 3-point

AFR24-3(-S) US	AC/DC 24 V
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

## Open-close ball valves and rotary actuators for shut-off or change-over functions



### Flow characteristics of open-close ball valves

For more technical data: refer to page 10...12

Rated pressure: 4140 kPa (DN15...32)  
2760 kPa (DN32...50)  
1600 kPa (DN65...80)

Connection	Internal thread							Flange PN 16			
Kvs [m³/h]	8.6	21	26	16	32	32	49	180	145	120	180
DN [mm]	15	20	25	32	32	40	50	65	80	65	80
2-way 	R215	R220	R225	R230	R232	R240	R250	R665A	R680A	*R665AC	*R680AC
3-way 	R315	R320	R325	R330	R332	R340	R350	-	-	-	-

### Suitable non-spring return rotary actuators, Open/Close

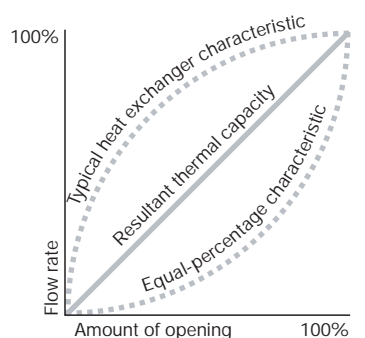
TR24	LRU24(-S)	NRU24(-S)	SRU24(-S)
TR230-3	LRU230(-S)	NRU230(-S)	SRU230(-S)

### Suitable spring return rotary actuators, Open/Close

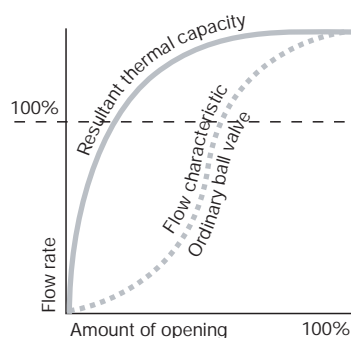
TRF24(-S)	LF24; LFM24-S2	AFR24(-S)
TRF230(-S)	LF230; LFM230-S2	AFR230(-S)

\* DN65, DN80 super compact CCV will be available in the fourth quarter 2006.

## An ordinary ball valve is unsuitable as a control device



Characteristic of an ideal control valve



Characteristic of an ordinary ball valve

In order to ensure good stability of control, a control valve must have a flow characteristic that complements the nonlinear characteristic of the heat exchanger in the HVAC system.

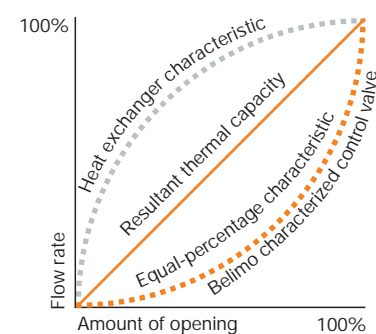
An equal-percentage valve characteristic is desirable in order to produce a linear relationship between the thermal output and the amount of opening of the control device. This means that the flow rate increases slowly as the valve begins to open. Characteristic in ordinary ball valves is severely distorted.

The reason for this is that an ordinary ball valve has an extremely high flow coefficient (Kvs value) compared with its nominal size, several times that of a comparable globe valve.

Therefore, an ordinary ball valve is not very suitable for performing control functions:

- Quick-opening flow characteristic
- Flow coefficient excessive due to the design
- Flow control inadequate in the part-load range

## Belimo has added "control" to the ball valve

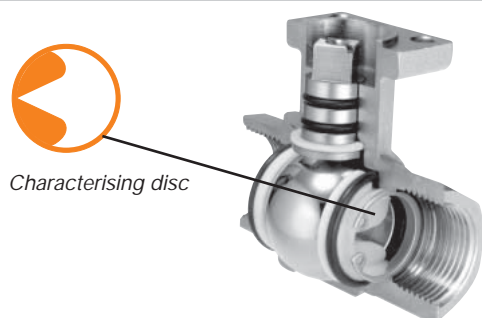


Characteristic of the Belimo CCV

Belimo has succeeded in solving the problem of the distorted flow characteristic of ordinary ball valves. A so-called "characterising disc" in the inlet of the characterized control valve converts the valve's characteristic to the equal-percentage kind. The side of the characterizing disc facing the ball is concave and is in contact with the surface of the ball. Thus, the actual flow is regulated by the hole in the ball and by the V-shaped aperture in the characterizing disc.

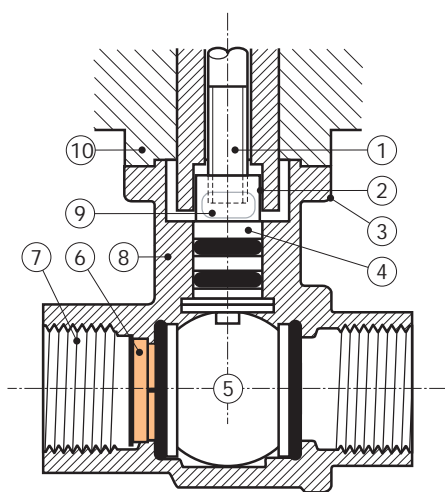
The Kvs value is reduced and corresponds approximately to that of a globe valve of comparable size. In order to avoid having to fit pipe reducers in the majority of cases, each size of valve is also available with wide choices of different Kvs values.

## Advantages of the Belimo Characterized Control Valve



- Equal-percentage characteristic
- No initial jump in flow on opening
- Excellent stability of control thanks to the characterizing disc
- Kvs values comparable with those of globe valves of comparable size
- Fewer pipe reducers needed
- High rangeability
- High close-off pressure
- Tight-sealing

## The elements of the Characterized Control Valve



- ① Simple direct attachment with a central screw
- ② Square spindle head for form-fit attachment of the rotary actuator
- ③ Identical mounting flange for all sizes
- ④ Spindle with two O-rings for long service life
- ⑤ Ball and spindle made of stainless steel
- ⑥ Characterizing disc produces equal-percentage flow characteristic
- ⑦ Internal screw connection (ISO7/1) for DN15...50; Flange (ISO7005-2) for DN65...150
- ⑧ Forged fitting, nickel-plated brass body
- ⑨ Vent part to prevent the accumulation of condensation
- ⑩ Thermal decoupling of actuator from valve

## Optimum choice of kvs valves of identical size

- Better controllability
- Lower installation costs

The Belimo range of characterized control valves includes 2-way and 3-way types that are available in a variety of sizes and with a choice of Kvs value. A characterized control valve is normally supplied as a unit complete with a suitable Belimo rotary actuator

## Notes

- The control devices described in this publication are intended for use in the closed water circuits of heating, ventilating and air-conditioning system. Use of the control devices in conjunction with other liquid or gaseous fluids is on request
- Select the characterized control valve according to the valve sizing diagram: page 6
- Please pay attention to the notes on operation, mounting, commissioning, maintenance and project design: page 36,37
- Select the pipe connectors: page 35

## Ordering

Ordering example\* (with NRU24)

- a) NRU24 rotary actuator with R..valve fitted\*\*  
-Order code: R..+NRU24
- b) NRU24 rotary actuator and R.. valve supplied separately  
-Order code: R../NRU24
- c) NRU24 rotary actuator packed loose  
-Order code: NRU24

\* An order for a R..valve usually includes an actuator

\*\* Except for the DN65 and above sizes

## Sizing diagram for characterized control valves

### Legend

—  $\Delta p_{\max}$   
Maximum permitted pressure difference for long service life across control path A-AB referred to the whole range of opening

- - -  $\Delta p_{\max}$  for low-noise operation

$\Delta p_{v100}$   
Pressure difference with ball valve fully open

$\dot{V}_{100}$  Nominal flow rate at  $\Delta p_{v100}$

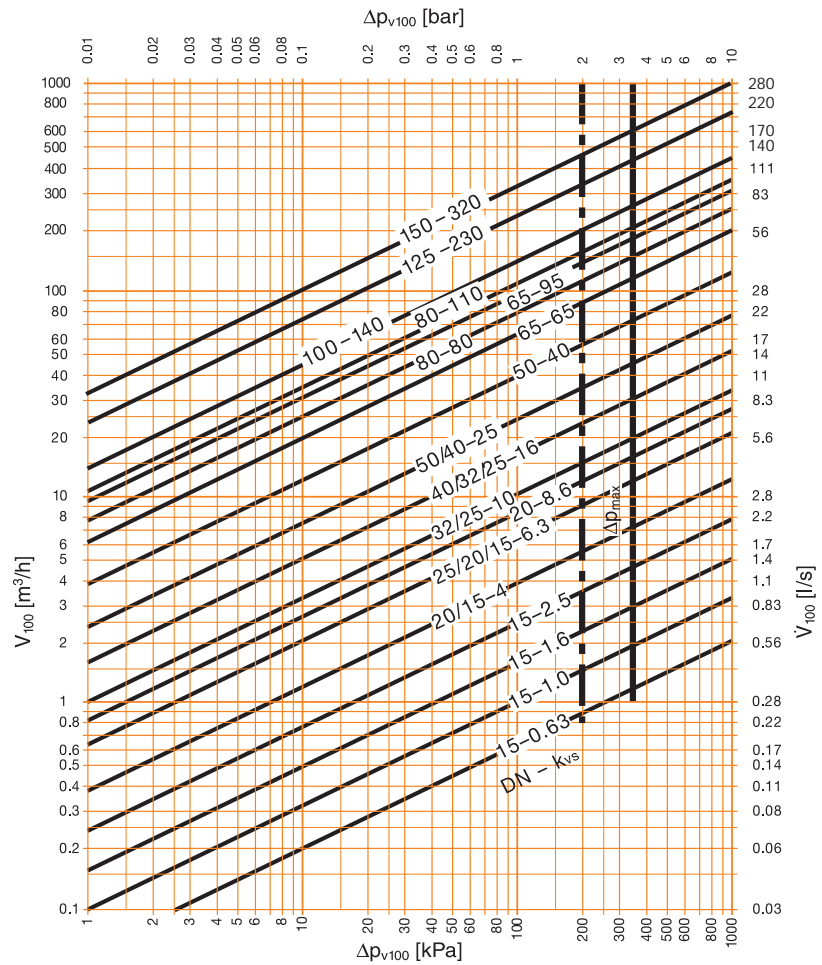
### Formula for $k_{vs}$

$$k_{vs} = \sqrt{\frac{\dot{V}_{100}}{\Delta p_{v100} / 100}}$$

$\dot{V}_{100}$  [m<sup>3</sup>/h]  
 $\Delta p_{v100}$  [kPa]

### Definition of $\Delta p_s$ (Pg. 6...9)

Differential pressure at which the actuator can still seal the valve tightly allowing for the appropriate leakage rate



## Sizing table for characterized control valves

Kvs [m <sup>3</sup> /h]	0.63	1	1.6	2.5	4	4	6.3	6.3	6.3	8.6	10	10	16	16	16	25	25	40
DN [mm]	15	15	15	15	15	20	15	20	25	20	25	32	25	32	40	40	50	50
2-way	R209	R210	R211	R212	R213	R217	R214	R218	R222	R219	R223	R229	R224	R231	R238	R239	R248	R249
3-way	R309	R310	R311	R312	R313	R317	-	R318	R322	-	R323	R329	-	R331	R338	-	R348	-
Kvs [m <sup>3</sup> /h]	65	95	80	110		63		100	140	230	320							
DN [mm]	65	65	80	80		65		80	100	125	150							
2-way	R662A	R663A	R678A	R679A		*R664AC		*R679AC	R6099AC	R6124AC	R6149AC							

## Sizing table for Open/Close ball valves

Differential pressure $\Delta p_{v100}$ [kPa]	0.1	1	3	10	Kvs [m <sup>3</sup> /h]	DN [mm]	2-way	3-way
	0.27	0.86	1.49	2.72	8.6	15	R215	R315
	0.66	2.1	3.6	6.6	21	20	R220	R320
	0.82	2.6	4.5	8.2	26	25	R225	R325
	0.51	1.6	2.77	5.06	16	32	R230	R330
	1.01	3.2	5.54	10.12	32	32	R232	R332
	1.01	3.2	5.54	10.12	32	40	R240	R340
	1.55	4.9	8.49	15.5	49	50	R250	R350
	5.70	18	31.2	56.9	180	65	R665A	-
	4.60	14.5	25.1	45.9	145	80	R680A	-
	3.79	12	20.8	37.9	120	65	*R665AC	-
	5.70	18	31.2	56.9	180	80	*R680AC	-

\* DN65, DN80 super compact CCV will be available in the fourth quarter 2006.

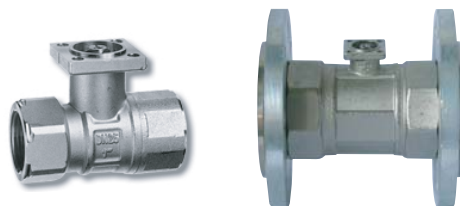


**2-way characterized control valves**  
DN 15...80



**Equal-percentage characteristics for modulating control of cold and hot water**

- Applications**
- Water-side control of air handling unit in air conditioning systems
  - Water-side control in heating systems



## Technical data

Flow medium	Cold and hot water, water with max. 50% volume of glycol	
Temperature of medium	-5°C...100°C	
Rated pressure Ps	DN15...32	4140 kPa
	DN32...50	2760 kPa
	DN65...80	1600 kPa
Flow characteristic	Control path A-AB	equal percentage
	DN15*	n(ep)=3.2, optimized in opening range
	DN20...80**	n(ep)=3.9, optimized in opening range
Rangeability	DN15*	Sv > 50
	DN20...80**	Sv > 100
Leakage rate	Air bubble-tight (DIN 3230 Part 3)	
Pipe connector	DN15...50	Internal thread to ISO7/1
	DN65...80	Flanged ISO7005-2 PN16
Differential pressure Δpmax	350 kPa (200 kPa for low-noise operation)	
Closing pressure Δps	DN15...50	1400 kPa
	DN65...80	700 kPa
Angle of rotation	90° (Operation range12.5°...90°)	
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
<b>Materials</b>		
Body	Forged, nickel-plated brass body	
Ball	Stainless steel	
Seat	PTFE	
Stem	Stainless steel	
O-ring	EPDM	
Characterizing disk	TEFZEL	

\*= Kvs up to 2.5 ;

\*\*= DN15 Kvs ≥ 4

## Product features

- Mode of operation** The characterized control valve is operated by a rotary actuator. The actuator is controlled by a standard modulating or 3-point control system and drive the ball of the valve - the throttling device - to the opening position dictated by the control signal.
- Equal-percentage characteristic** Equal-percentage characteristic of the flow rate ensured by the integral characterizing disc
- Manual operation** Please refer to page 13...34. Manual operation is not possible for TRF.., LF.. and AFR.. actuators



**2-way characterized control valves**  
DN 65...150 \*



**Equal-percentage characteristics for modulating control of cold and hot water**

- Applications**
- Water-side control of air handling unit in air conditioning systems
  - Water-side control in heating systems



## Technical data

Flow medium	Cold and hot water, water with max. 50% volume of glycol	
Temperature of medium	-5°C...100°C	
Rated pressure Ps	1600 kPa	
Flow characteristic	Control path A-AB    equal percentage n(ep)=3.9, optimized in opening range	
Rangeability	DN65...80 DN100...150	Sv > 100 Sv > 150
Leakage rate	0-0.01% of Kvs (ANSI Class IV)	
Pipe connector	Flanged ISO7005-2 PN16	
Differential pressure Δpmax	350 kPa (200 kPa for low-noise operation)	
Closing pressure Δps	DN65...125 DN150	700 kPa 500 kPa
Angle of rotation	90° (Operation range 12.5°...90°)	
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
<b>Materials</b>		
Body	GG25, Polyester coated	
Ball	Stainless steel	
Seat	RPTFE	
Stem	Stainless steel	
O-ring	EPDM	
Characterizing disk	Stainless steel	

## Product features

<b>Mode of operation</b>	The characterized control valve is operated by a rotary actuator. The actuator is controlled by a standard modulating or 3-point control system and drive the ball of the valve - the throttling device - to the opening position dictated by the control signal.
<b>Equal-percentage characteristic</b>	Equal-percentage characteristic of the flow rate ensured by the integral characterizing disc
<b>Manual operation</b>	Please refer to page 13...34. Manual operation is not possible for TRF.., LF.. and AFR.. actuators <ul style="list-style-type: none"> <li>• Slim valve body mounting on the pipe simplify installation procedure</li> <li>• Light weight comparing with same DN size valves</li> <li>• Anti-corrosion treatment inside of the valve</li> <li>• Solid linkage in insulation design</li> </ul>

\* DN65, DN80 super compact CCV will be available in the fourth quarter 2006.





**3-way characterized control valves**  
DN 15...50



**Equal-percentage characteristics for modulating control of cold and hot water**

- Applications**
- Water-side control of air handling unit in air conditioning systems
  - Water-side control in heating systems



## Technical data

Flow medium	Cold and hot water, water with max. 50% volume of glycol	
Temperature of medium	-5°C...100°C	
Rated pressure Ps	DN15...32	4140 kPa
	DN32...50	2760 kPa
Flow characteristic	Control path A-AB DN15* DN20...50** Bypass B-AB	equal percentage n(ep)=3.2, optimized in opening range n(ep)=3.9, optimized in opening range Linear, flow rate is 70% of Kvs value
Rangeability	DN15*	Sv>50
	DN20...50**	Sv>100
Leakage rate	Control path A-AB	Air bubble-tight (DIN 3230 Part 3)
	Bypass B-AB	Approx. 1...2% of Kvs value
Pipe connector	Internal thread to ISO7/1	
Differential pressure Δpmax	350 kPa (200 kPa for low-noise operation)	
Closing pressure Δps	1400 kPa	
Angle of rotation	90° (Operation range - Control pass A-AB 12.5°...90° - Bypass B-AB 12.5°...70°)	
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
<b>Materials</b>		
Body	Forged, nickel-plated brass body	
Ball	Stainless steel	
Seat	PTFE	
Stem	Stainless steel	
Stem seal	EPDM	
Characterizing disk	TEFZEL	

\*= Kvs up to 2.5;

\*\*= DN15 Kvs  $\geq$  4

## Product features

**Mode of operation** The characterized control valve is operated by a rotary actuator. The actuator is controlled by a standard modulating or 3-point control system and drive the ball of the valve - the throttling device - to the opening position dictated by the control signal.

**Equal-percentage characteristic** Equal-percentage characteristic of the flow rate ensured by the integral characterizing disc

**Manual operation** Please refer to page 13...34. Manual operation is not possible for TRF.., LF.. and AFR.. actuators

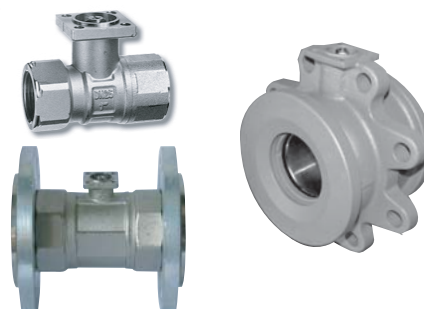


2-way open-close ball valves  
DN 15...80 \*

Shut-off function and 2-point control  
in cold and hot water circuits

## Applications

For shutting off cold and hot water circuits in heating and ventilation systems on the water side or for 2-point control of these circuits



## R2../R6..A Technical data

Flow medium	Cold and hot water, water with max. 50% volume of glycol	
Temperature of medium	-5°C...100°C	
Rated pressure Ps	DN15...32	4140 kPa
	DN32...50	2760 kPa
	DN65...80	1600 kPa
Leakage rate	0-0.01% of Kvs (ANSI Class IV)	
Pipe connector	DN15...50	Internal thread to ISO7/1
	DN65...80	Flanged ISO7005-2 PN16
Differential pressure Δpmax	1000 kPa (200 kPa for low-noise operation)	
Closing pressure Δps	DN15...50	1400 kPa
	DN65...80	700 kPa
Angle of rotation	90°	
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
<b>Materials</b>		
Body	Forged, nickel-plated brass body	
Ball	Stainless steel	
Seat	PTFE	
Stem	Stainless steel	
O-ring	EPDM	

## \* R6..AC Technical data (Just for DN65, DN80)

Flow medium	Cold and hot water, water with max. 50% volume of glycol
Temperature of medium	-5°C...100°C
Rated pressure Ps	1600 kPa
Leakage rate	0-0.01% of Kvs (ANSI Class IV)
Pipe connector	Flanged ISO7005-2 PN16
Differential pressure $\Delta p_{max}$	1000 kPa(200 kPa for low-noise operation)
Closing pressure $\Delta p_s$	700 kPa
Angle of rotation	90°
Installation position	Upright to horizontal (in relation to the stem)
Maintenance	Maintenance-free
<b>Materials</b>	
Body	GG25,Polyester coated
Ball	Stainless steel
Seat	RPTFE
Stem	Stainless steel
O-ring	EPDM

## Product features

<b>Mode of operation</b>	The open-close ball valve is operated by a rotary actuator. The rotary actuator is controlled by an open-close signal.
<b>Manual operation</b>	Please refer to page 13...34. Manual operation is not possible for TRF., LF., and AFR.. actuators
<b>R6..AC</b>	<ul style="list-style-type: none"> <li>• Slim valve body mounting on the pipe simplify installation procedure</li> <li>• Light weight comparing with same DN size valves</li> <li>• Anti-corrosion treatment inside of the valve</li> <li>• Solid linkage in insulation design</li> </ul>

\* R665AC, R680AC will be available in the fourth quarter 2006. If you want to use DN100...150 Open-Close ball valves, please contact your local agency.

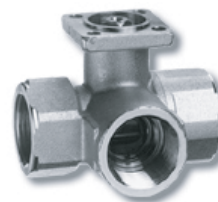


**3-way open-close ball valves**  
DN 15...50

**Change-over function and 2-point controls**  
in cold and hot water circuits

#### Applications

For changing over cold and hot water circuits in heating and ventilation systems on the water side or for 2-point control of these circuits.



#### Technical data

Flow medium	Cold and hot water, water with max. 50% volume of glycol	
Temperature of medium	-5°C...100°C	
Rated pressure Ps	DN15...32	4140 kPa
	DN32...50	2760 kPa
Flow rate	Bypass B-AB	Approx. 50% of Kvs
Leakage rate	Control path A-AB	Air bubble-tight (DIN 3230 Part 3)
	Bypass B-AB	1% of Kvs
Pipe connector	Internal thread to ISO7/1	
Differential pressure Δpmax	1000 kPa (200 kPa for low-noise operation)	
Closing pressure Δps	1400 kPa	
Angle of rotation	90°	
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
<b>Materials</b>		
Body	Forged, nickel-plated brass body	
Ball	Stainless steel	
Seat	PTFE	
Stem	Stainless steel	
Stem seal	EPDM	

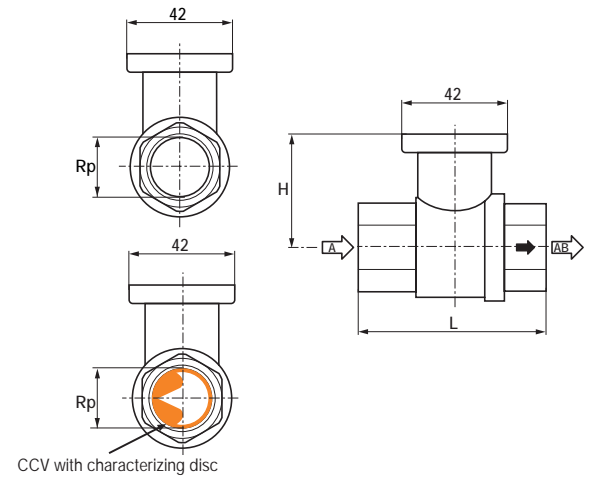
#### Product features

<b>Mode of operation</b>	The open-close ball valve is operated by a rotary actuator. The rotary actuator is controlled by an open-close signal.
<b>Manual operation</b>	Please refer to page 13...34. Manual operation is not possible for TRF.., LF... and AFR.. actuators.

## Dimensions

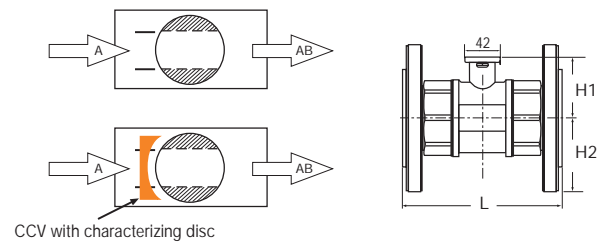
### R2.. 2-way ball valves

Valve type	DN		Dimensions [mm]		Thread	Max. screwing depth [mm]	Weight [kg]
	mm	Imp.	L	H	Rp		
R209...R215	15	1/2"	67	45	1/2"	13	0.4
R217...R220	20	3/4"	76	47.5	3/4"	13	0.55
R222...R225	25	1"	87	47.5	1"	17	0.7
R229, R230	32	1 1/4"	102	47.5	1 1/4"	19	0.9
R231, R232	32	1 1/4"	113	52	1 1/4"	19	1.15
R238...R240	40	1 1/2"	113	52	1 1/2"	19	1.15
R248...R250	50	2"	127	58	2"	22	1.9



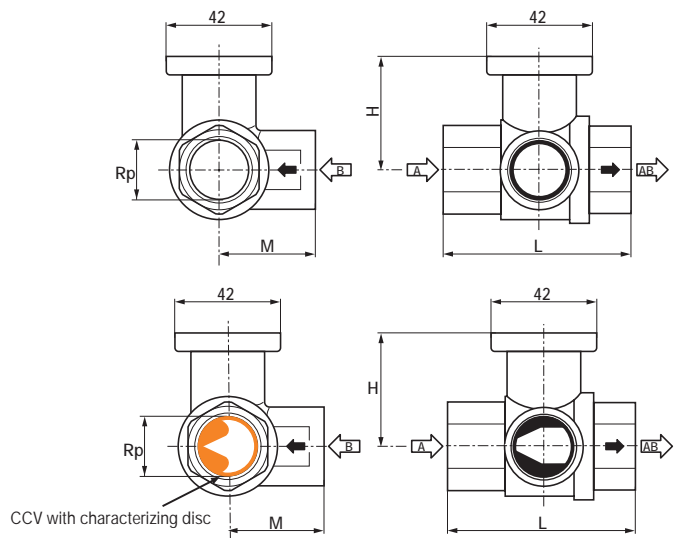
### R6..A 2-way ball valves

Valve type	DN		Dimensions [mm]			Weight [Kg]
	mm	Imp.	L	H1	H2	
R662A, R663A	65	2.5"	188.4	69.45	92.5	10.63
R678A, R679A	80	3"	199.5	69.45	100	12.86



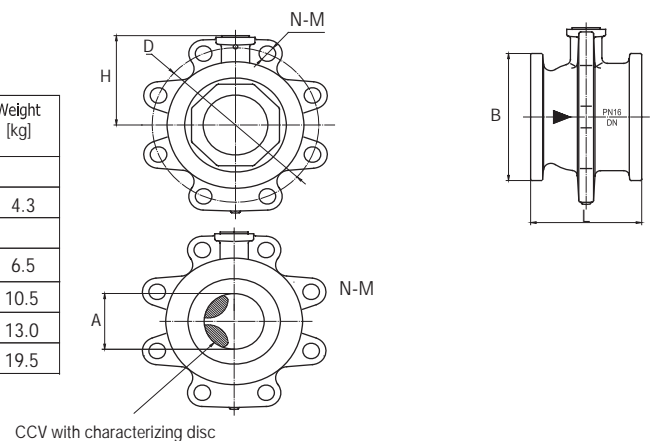
### R3.. 3-way ball valves

Valve type	DN		Dimensions [mm]			Thread	Max. screwing depth [mm]	Weight [kg]
	mm	Imp.	L	H	M	Rp		
R309...R315	15	1/2"	67	45	34	1/2"	13	0.45
R317...R320	20	3/4"	76	47.5	38.5	3/4"	13	0.6
R322...R325	25	1"	87	47.5	43.5	1"	17	0.9
R329, R330	32	1 1/4"	102	47.5	51	1 1/4"	19	1.2
R331, R332	32	1 1/4"	113	52	56.5	1 1/4"	19	1.5
R338, R340	40	1 1/2"	113	52	56.5	1 1/2"	19	1.5
R348, R350	50	2"	127	58	63.5	2"	22	2.4



### R6..AC 2-way ball valves

Valve type	DN		Dimensions [mm]							Weight [kg]
	mm	Imp.	A	B	D	L	H	N	M	
R664AC	65	2.5"	ø44	ø101	ø145	93	86	4	ø18	4.3
R679AC	80	3"	ø55	ø125	ø160	108	94.5	8	ø18	6.5
R6099AC	100	4"	ø64	ø148	ø180	120	104	8	ø18	10.5
R6124AC	125	5"	ø77	ø174	ø210	142	118	8	ø18	13.0
R6149AC	150	6"	ø96	ø204	ø240	170	136.5	8	ø22	19.5



- Non-spring return rotary actuators: For ball valves DN 15...20
- Torque: 2 Nm
- Modulating control TR24-SR (AC/DC 24 V)
- Open/Close and floating control TR24 (AC/DC 24 V)  
TR230-3 (AC 230 V)



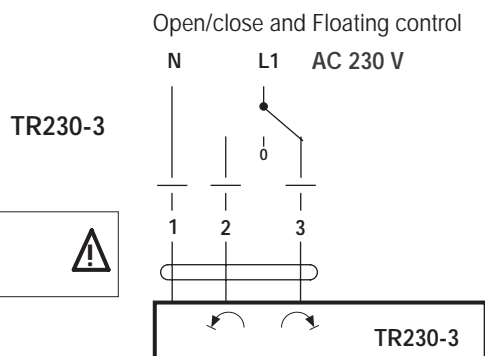
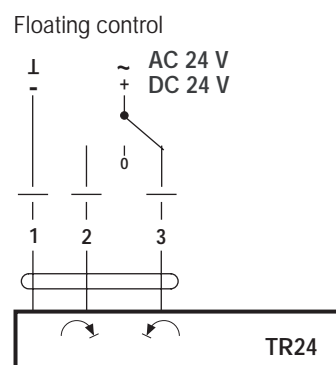
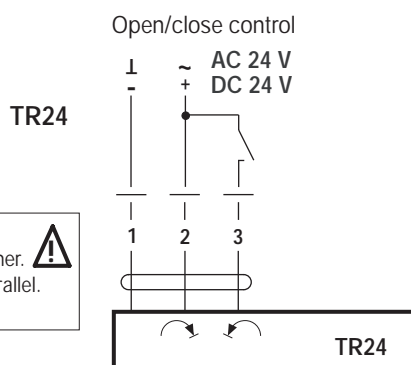
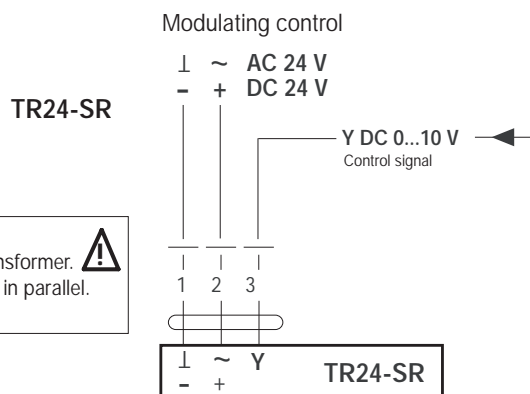
## Technical data

<b>Basic technical data</b>	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	2 Nm
	Angle of rotation	95°
	Sound power level	35 dB (A)
	Degree of protection	IP40
	EMC	CE according to 89/336/EEC
	Ambient temperature	-5 ... +50°C
	Non-operating temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	To EN 60730-1
	Maintenance	Maintenance-free
<b>TR24-SR</b>	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	1.0 W
	Transformer sizing	1.0 VA
	Control signal	0...10 VDC @ 100 kΩ input impedance
	Operating range	2...10 VDC
	Protection class	III (safety low voltage)
	Running time	90 s
	Weight	0.3 Kg
<b>TR24</b>	Power supply range	AC 19.2... 22.8 V / DC 21.6...22.8 V
	Power consumption	0.5 W
	Transformer sizing	0.5 VA
	Protection class	III (safety low voltage)
	Running time	100 s
	Weight	0.3 Kg
<b>TR230-3</b>	Power supply range	AC 198 ... 264 V
	Power consumption	1.0 W
	Transformer sizing	1.0 VA
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated)
	Running time	105 s
	Weight	0.3 Kg

## Product features

- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** Manual operation by lever (the gearing latch remains disengaged as long as the self-resetting lever is pressed).




## Wirings



- Non-spring return rotary actuators: For ball valves DN25...32
- Torque 5 Nm
- Modulating control LRU24-SR (AC/DC 24 V)
- Open/Close and floating control LRU24(-S) (AC/DC 24 V)  
LRU230(-S) (AC 100...240 V)



## Technical data

Basic Technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	5 Nm
	Angle of rotation	90°
	Running time	90 s
	Sound power level	Max. 35 dB (A)
	Position indication	Mechanical
	Direction of rotation	Selectable by switch (covered): Factory preset  change to  to reverse the direction of rotation
	Degree of protection	IP54 in any direction
	EMC	CE according to 89/336/EEC
	Ambient temperature range	-5 ... +50°C
	Non-operation temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	EN 60730-1
	Maintenance	Maintenance free
LRU24-SR	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	1.5 W @running / 0.4 W @ holding
	Transformer sizing	3 VA
	Control Signal	0...10 VDC (input impedance 100kΩ)
	Operating range	2...10 VDC
	Measurement Voltage	2...10 VDC, Max. 1mA
	Protection class	III (safety low voltage)
	Weight	0.55 kg
LRU24(-S)	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	1.5 W @running / 0.2 W @ holding
	Transformer sizing	2 VA
	Protection class	III (safety low voltage)
	Auxiliary switch (LRU24-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	0.55 kg
LRU230(-S)	Nominal voltage range	AC 85 ... 265 V
	Power consumption	2.0 W @ running / 0.5 W @ holding
	Transformer sizing	4 VA
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) 
	Auxiliary switch (LRU230-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	0.60 kg

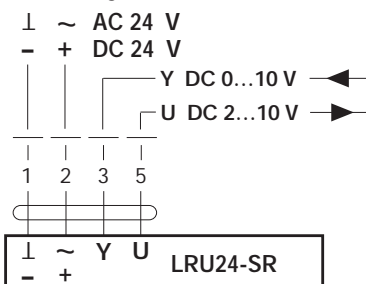
## Product features

- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** Manual operation by pushbutton when necessary.
- High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wirings

### LRU24-SR

#### Modulating control

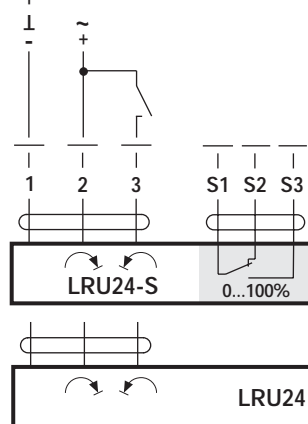


#### Notes:

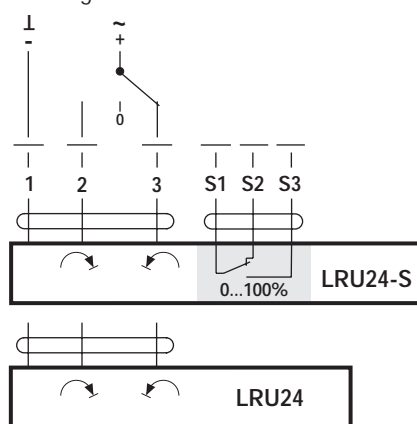
- Connection via safety isolating transformer.
  - Other actuators can be connected in parallel.
- Please note the performance data.

### LRU24(-S)

#### Open/close control



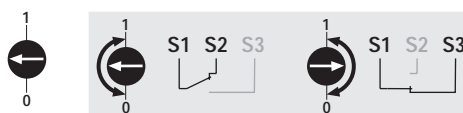
#### Floating control



#### Notes:

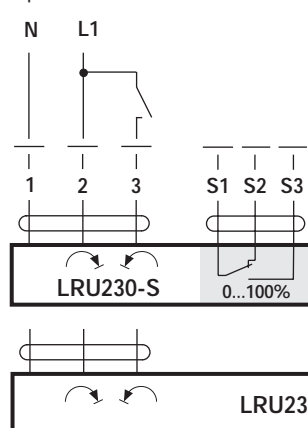
- Connection via safety isolating transformer.
  - Other actuators can be connected in parallel.
- Please note the performance data.

#### Auxiliary switch

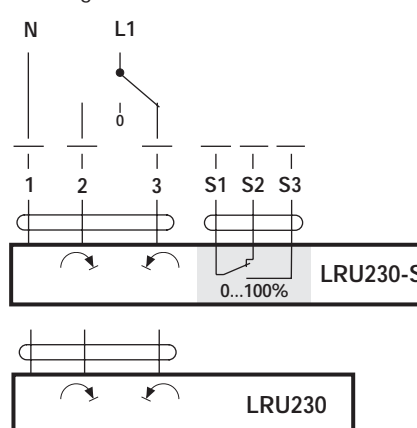


### LRU230(-S)

#### Open/close control



#### Floating control



#### Notes:

- Caution: Power supply voltage.
  - Other actuators can be connected in parallel.
- Please note the performance data.

#### Auxiliary switch








- Non-spring return rotary actuators: For ball valves DN32...50
- Torque 10 Nm
- Modulating control                      NRU24-SR (AC/DC 24 V)
- Open/Close and floating control      NRU24(-S) (AC/DC 24 V)  
NRU230(-S) (AC 100...240 V)



## Technical data

Basic Technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	10 Nm
	Angle of rotation	90°
	Running time	90 s
	Sound power level	Max. 45 dB (A)
	Position indication	Mechanical
	Direction of rotation	Selectable by switch (covered): Factory preset  change to  to reverse the direction of rotation
	Degree of protection	IP54 in any direction
	EMC	CE according to 89/336/EEC
	Ambient temperature range	-5 ... +50°C
	Non-operation temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	EN 60730-1
	Maintenance	Maintenance free
NRU24-SR	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	2.5 W @ running / 0.4 W @ holding
	Transformer sizing	5 VA
	Control Signal	0...10 VDC (input impedance 100kΩ)
	Operating range	2...10 VDC
	Measurement Voltage	2...10 VDC, Max. 1mA
	Protection class	III (safety low voltage)
	Weight	0.85 kg
NRU24(-S)	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	2.0 W @ running / 0.2 W @ holding
	Transformer sizing	4 VA
	Protection class	III (safety low voltage)
	Auxiliary switch (NRU24-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	0.85 kg
NRU230(-S)	Nominal voltage range	AC 85 ... 265 V
	Power consumption	3.0 W @ running / 0.6 W @ holding
	Transformer sizing	7 VA
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) 
	Auxiliary switch (NRU230-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	0.90 kg

## Product features

- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** Manual operation pushbutton when necessary.
- High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wirings

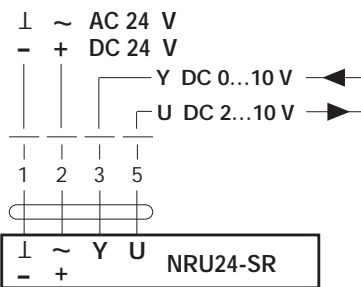
### NRU24-SR

#### Notes:

- Connection via safety isolating transformer.
- Other actuators can be connected in parallel.
- Please note the performance data.



#### Modulating control



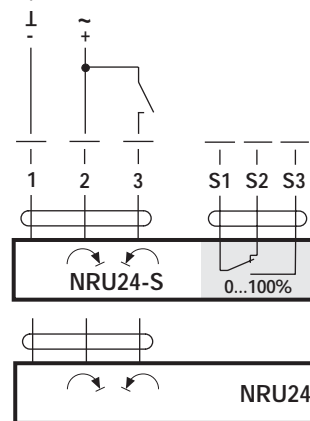
### NRU24(-S)

#### Notes:

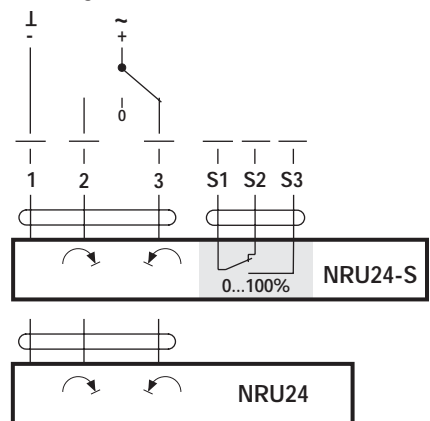
- Connection via safety isolating transformer.
- Other actuators can be connected in parallel.
- Please note the performance data.



#### Open/close control



#### Floating control



#### Auxiliary switch



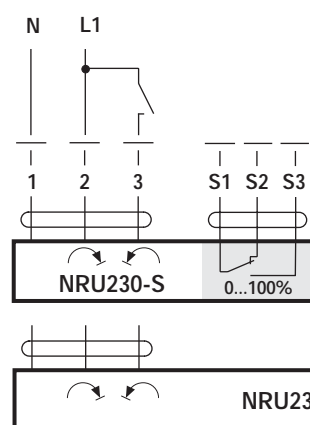
### NRU230(-S)

#### Notes:

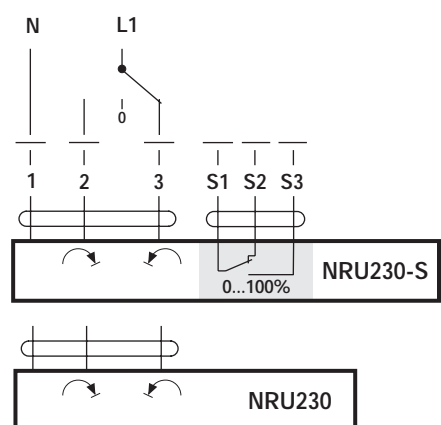
- Caution: Power supply voltage.
- Other actuators can be connected in parallel.
- Please note the performance data.



#### Open/close control



#### Floating control






#### Auxiliary switch



- Non-spring return rotary actuators: for ball valves DN50...80
- Torque 20 Nm
- Modulating control SRU24-SR (AC/DC 24 V)
- Open/Close and floating control SRU24(-S) (AC/DC 24 V)  
SRU230(-S) (AC 100...240 V)



## Technical data

Basic Technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	20 Nm
	Angle of rotation	90°
	Running time	90 s
	Sound power level	Max. 45 dB (A)
	Position indication	Mechanical
	Direction of rotation	Selectable by switch (covered): Factory preset  change to  to reverse the direction of rotation
	Degree of protection	IP54 in any direction
	EMC	CE according to 89/336/EEC
	Ambient temperature range	-5 ... +50°C
	Non-operation temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	EN 60730-1
	Maintenance	Maintenance free
SU24-SR	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	2.5 W @ running / 0.4 W @ holding
	Transformer sizing	5 VA
	Control Signal	0...10 VDC (input impedance 100kΩ)
	Operating range	2...10 VDC
	Measurement Voltage	2...10 VDC, Max. 1mA
	Protection class	III (safety low voltage)
SRU24(-S)	Weight	1.0 kg
	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	2.5 W @ running / 0.2 W @ holding
	Transformer sizing	5.5 VA
	Protection class	III (safety low voltage)
	Auxiliary switch (SRU24-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	1.0 kg
SRU230(-S)	Nominal voltage range	AC 85 ... 265 V
	Power consumption	3.0 W @ running / 0.6 W @ holding
	Transformer sizing	7 VA
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) 
	Auxiliary switch (SRU230-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V 0... 100% adjustable
	Weight	1.05 kg

## Product features

- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** Manual operation by pushbutton when necessary.
- High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wirings

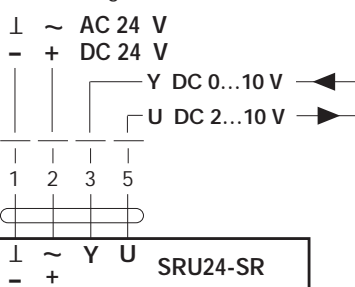
### SRU24-SR

#### Notes:

- Connection via safety isolating transformer.
- Other actuators can be connected in parallel. Please note the performance data.



#### Modulating control



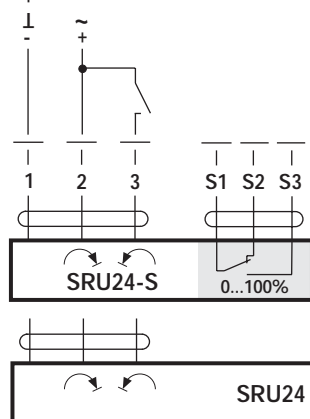
### SRU24(-S)

#### Notes:

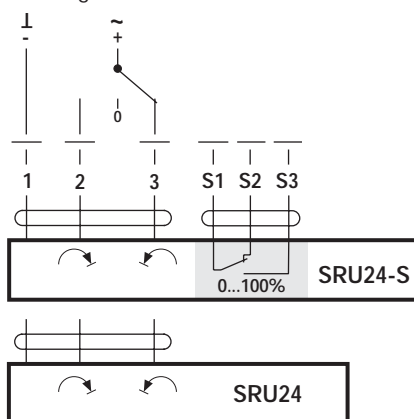
- Connection via safety isolating transformer.
- Other actuators can be connected in parallel. Please note the performance data.



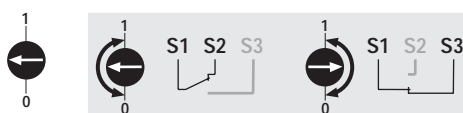
#### Open/close control



#### Floating control



#### Auxiliary switch



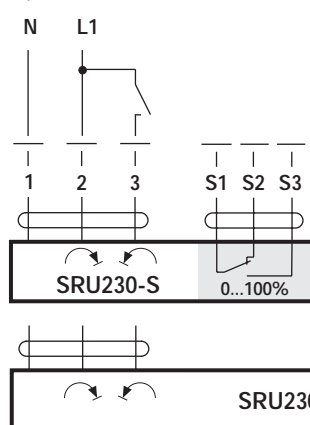
### SRU230(-S)

#### Notes:

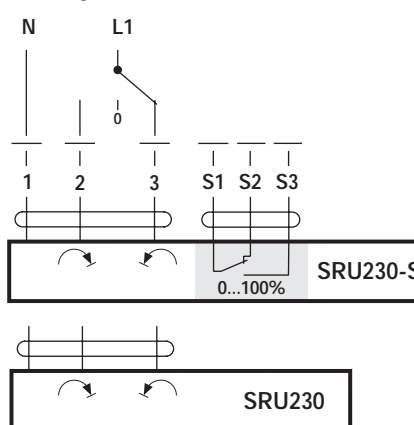
- Caution: Power supply voltage.
- Other actuators can be connected in parallel. Please note the performance data.



#### Open/close control



#### Floating control






#### Auxiliary switch



- Non-spring return rotary actuators: For ball valves DN100...150
- Torque 40 Nm
- Modulating control GRU24-SR (AC/DC 24 V)
- Open/Close and floating control GRU24 (AC/DC 24 V)  
GRU230 (AC 100...240 V)



## Technical data

Basic Technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	40 Nm
	Angle of rotation	90°
	Running time	150 s
	Sound power level	Max. 45 dB (A)
	Position indication	Mechanical
	Direction of rotation	Selectable by switch (covered): Factory preset  change to  to reverse the direction of rotation
	Degree of protection	IP54 in any direction
	EMC	CE according to 89/336/EEC
	Ambient temperature range	-5 ... +50°C
	Non-operation temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	EN 60730-1
	Maintenance	Maintenance free
GRU24-SR	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	4.5 W @ running / 2 W @ holding
	Transformer sizing	6.5 VA
	Control Signal	0...10 VDC (input impedance 100kΩ)
	Operating range	2...10 VDC
	Measurement Voltage	2...10 VDC, Max. 1mA
	Protection class	III (safety low voltage)
GRU24	Weight	2.0 kg
	Nominal voltage range	AC/DC 19.2... 28.8 V
	Power consumption	4 W @ running / 2 W @ holding
	Transformer sizing	6 VA
	Protection class	III (safety low voltage)
GRU230	Weight	2.0 kg
	Nominal voltage range	AC 85 ... 265 V
	Power consumption	4 W @ running / 2 W @ holding
	Transformer sizing	7 VA
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) 
	Weight	2.05 kg

## Product features

- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** Manual operation by pushbutton when necessary.
- High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wirings

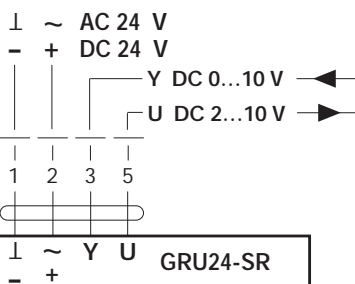
### GRU24-SR

#### Notes:

- Connection via safety isolating transformer.
  - Other actuators can be connected in parallel.
- Please note the performance data.



#### Modulating control



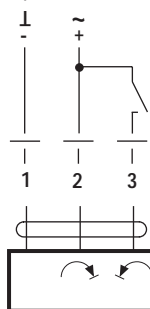
### GRU24

#### Notes:

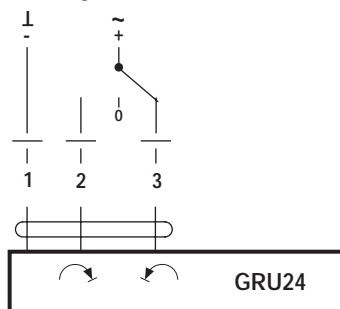
- Connection via safety isolating transformer.
  - Other actuators can be connected in parallel.
- Please note the performance data.



#### Open/close control



#### Floating control



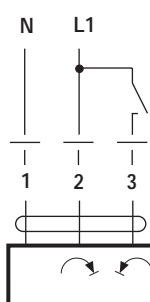
### GRU230

#### Notes:

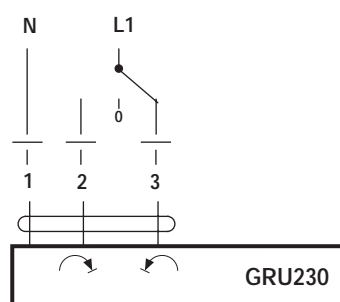
- Caution: Power supply voltage.
  - Other actuators can be connected in parallel.
- Please note the performance data.



#### Open/close control

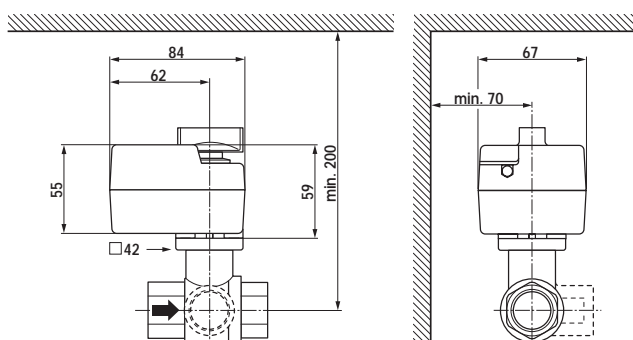


#### Floating control



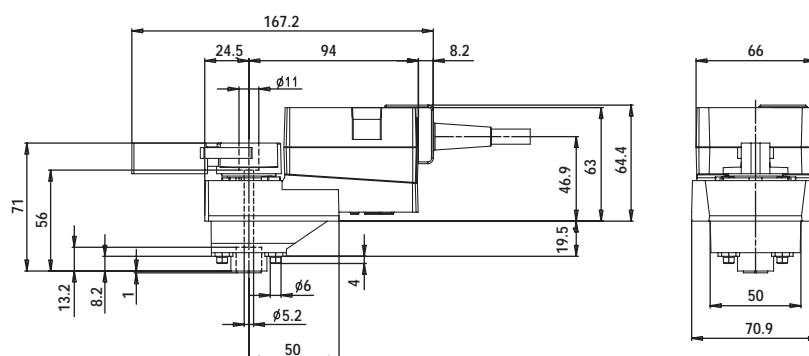
## Dimensions: TR..

Measurement [mm]



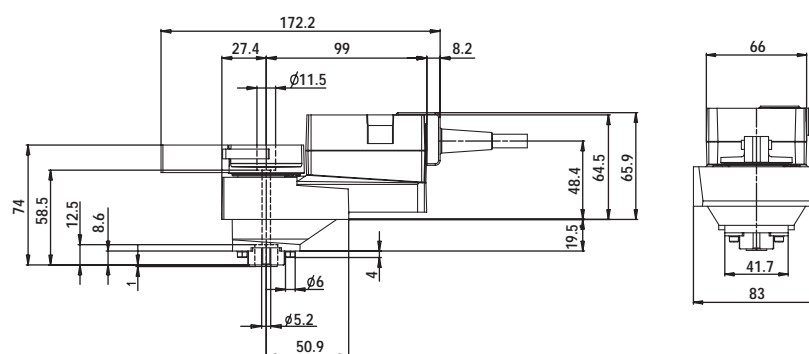
## Dimensions: LRU..

Measurement [mm]



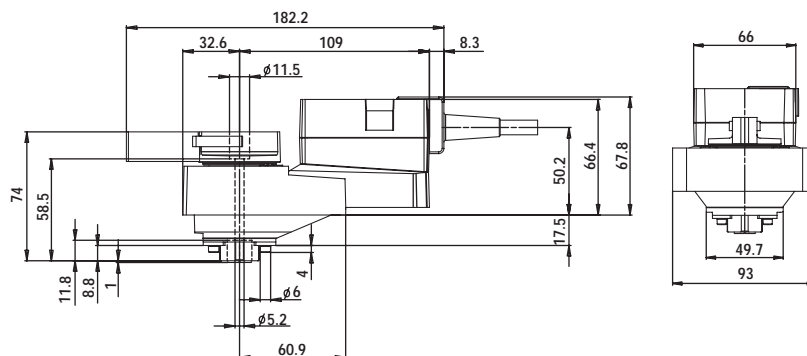
## Dimensions: NRU..

Measurement [mm]



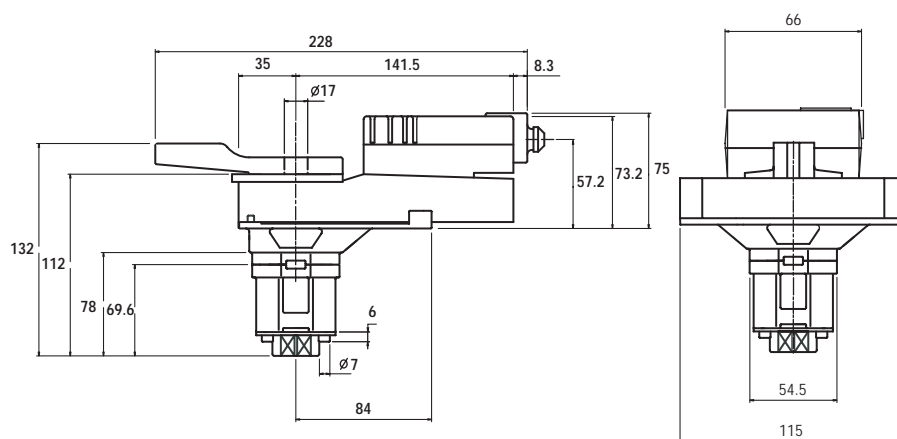
## Dimensions: SRU..

Measurement [mm]



## Dimensions: GRU..

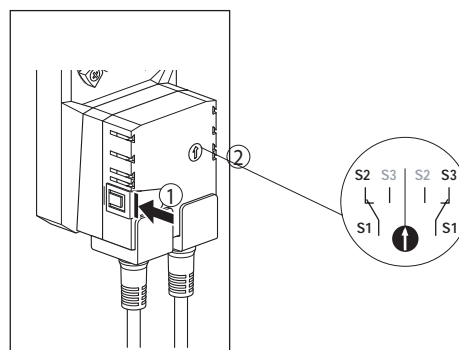
Measurement [mm]



## Auxiliary switch adjustment: LRU../NRU../SRU.. -S

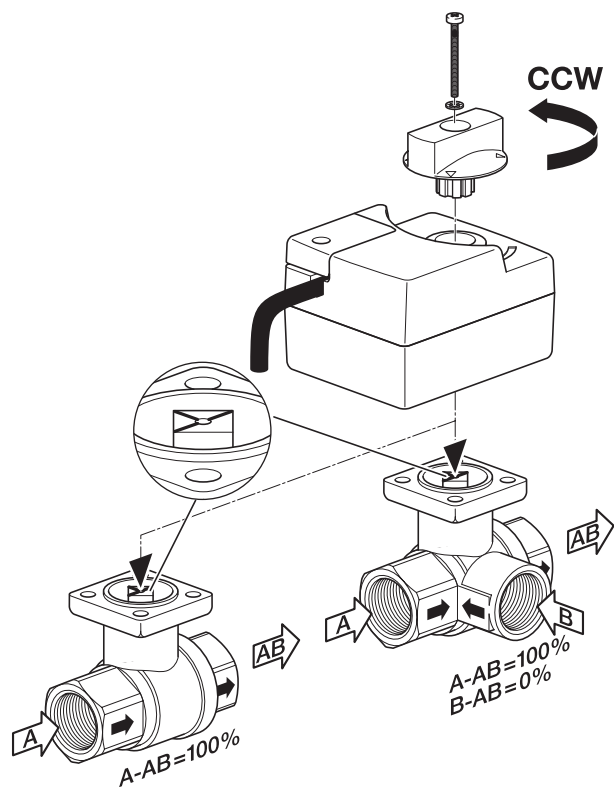
1. Press the pushbutton, manually operate the universal clamp to desired switch position.
2. Turn switch pointer to the middle line.
3. When actuator moves clockwise(counter-clockwise) to switch position, switch indicator passes counter-clockwise(clockwise) the middle line, the contact between S1 and S3 is broken (made) and the contact between S1 and S2 is made (broken).

Note: The switching point should be about 5° from the mechanical end stops (1 short step on the scale).

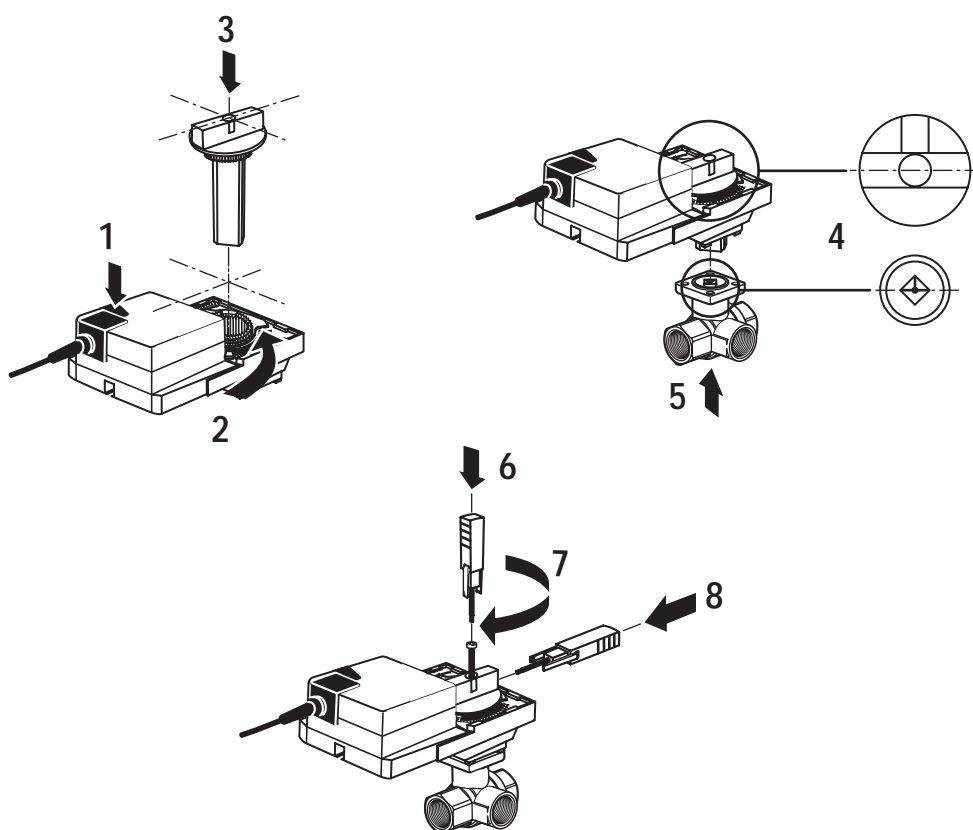




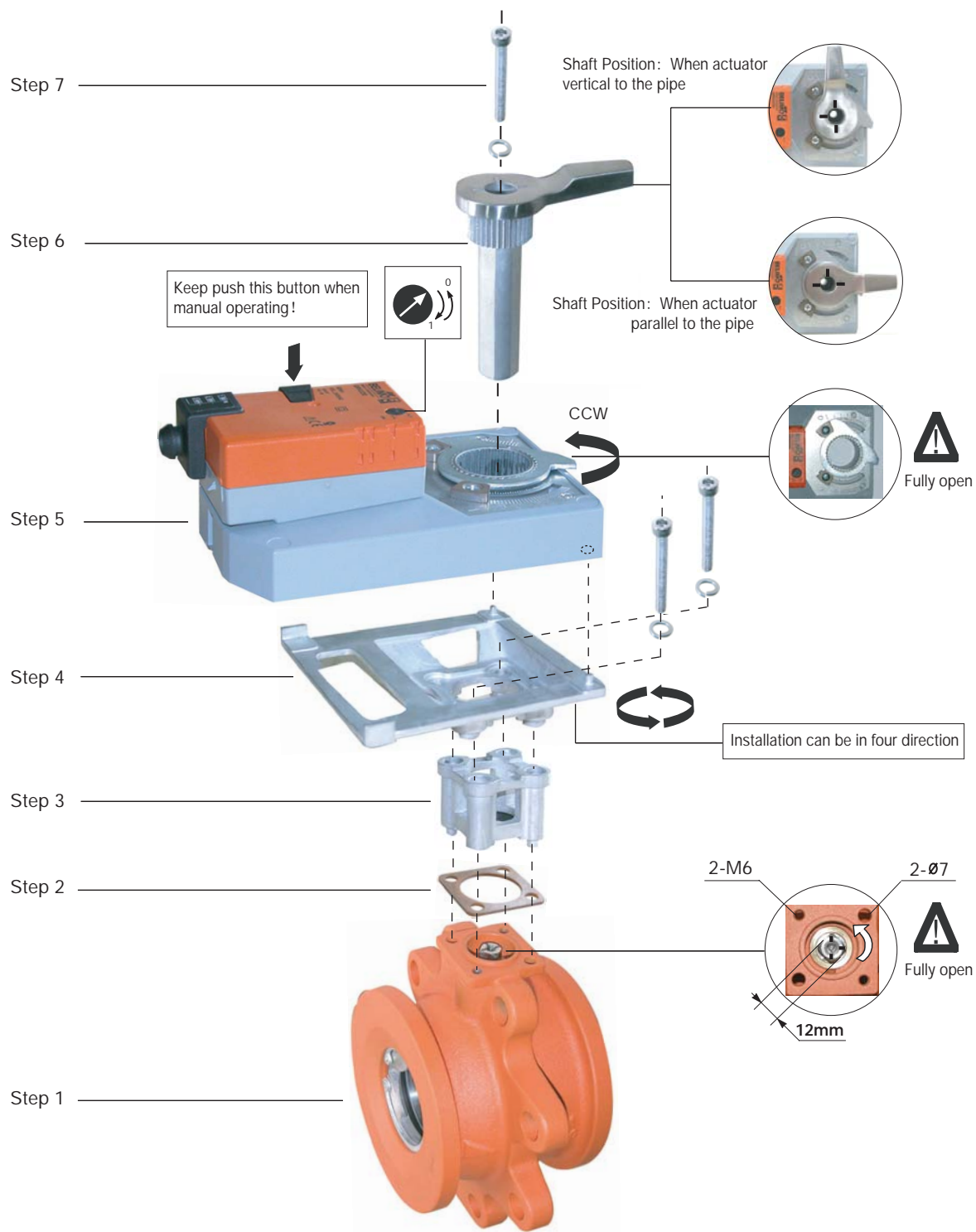
Installation procedures: TR..



Installation procedures: LRU../NRU../SRU..




## Installation procedures: GRU..



- Spring return rotary actuators: For ball valves DN 15...20
- Torque: 2 Nm
- Modulating control TRF24-SR (AC/DC 24 V)
- Floating (3-point) control TRF24-2 (AC/DC 24 V)
- Open/Close control TRF24(-S) (AC/DC 24 V)  
TRF230(-S) (AC 100...240 V)



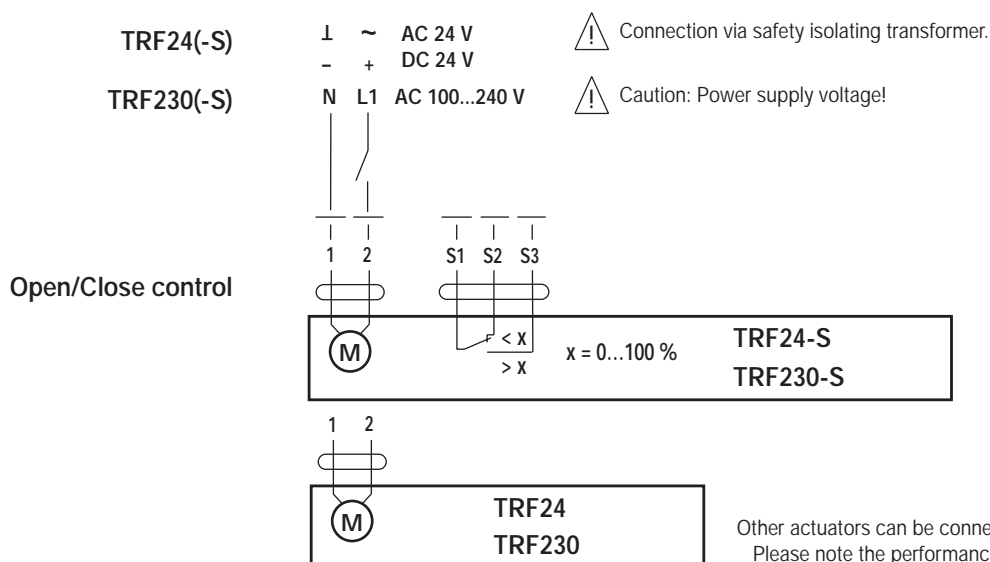
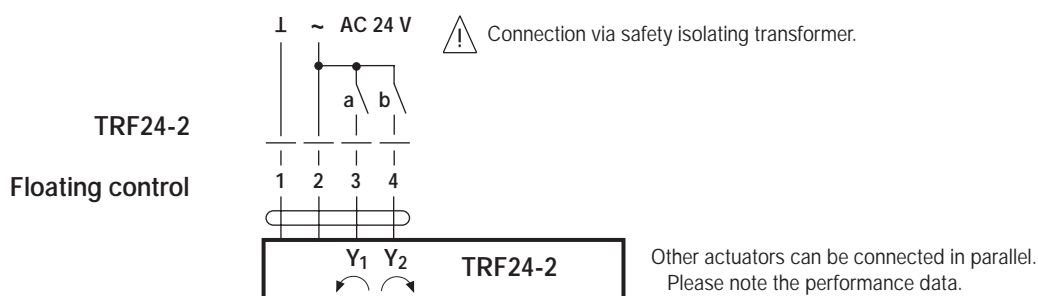
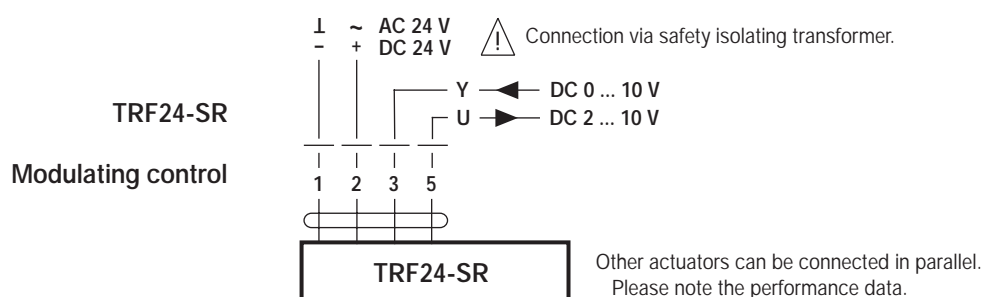
## Technical data

Basic technical data	Connection	1 m, 0.75 mm <sup>2</sup>
	Torque	Motor: 2 Nm; Spring return: 2 Nm
	Angle of rotation	95°
	Sound power level	Motor: Max. 50 dB (A), Spring return: 62 dB (A)
	Position indication	Mechanical
	Degree of protection	IP42
	EMC	CE according to 89/336/EEC
	Ambient temperature	-5 ... +50°C
	Non-operating temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	To EN 60730-1
	Maintenance	Maintenance-free
TRF24-SR	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	2.5 W @ running / 1 W @ holding
	Transformer sizing	4 VA
	Control signal	0...10 VDC @ 100 kΩ input impedance
	Operating range	2...10 VDC
	Position feedback	2...10 VDC
	Direction of rotation	Motor: Reversible with L/R switch; Spring return: reversible by mounting L/R
	Protection class	III (safety low voltage)
TRF24-2	Running time	Motor: < 150 s; spring return: < 25 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	0.6 Kg
	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	2.5 W @ running / 1 W @ holding
	Transformer sizing	4 VA
TRF24(-S)	Direction of rotation	Motor: Reversible with L/R switch; Spring return: reversible by mounting L/R
	Protection class	III (safety low voltage)
	Running time	Motor: 40... 75 s; spring return: < 25 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	0.6 Kg
	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
TRF230(-S)	Power consumption	2.5 W @ running / 1.5 W @ holding
	Transformer sizing	5 VA
	Direction of rotation	Spring return reversible by mounting L/R
	Auxiliary switch (TRF24-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V, 0... 100% adjustable
	Protection class	III (safety low voltage)
	Running time	Motor: 40... 75 s; spring return: < 25 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	0.6 Kg
	Power supply range	AC 85 ... 265 V
TRF230(-S)	Power consumption	2.5 W @ running / 1.5 W @ holding
	Transformer sizing	5 VA
	Direction of rotation	Spring return reversible by mounting L/R
	Low voltage directive	CE according to 73/23/EEC
	Auxiliary switch (TRF230-S)	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V, 0... 100% adjustable
	Protection class	II (Totally insulated) 
	Running time	Motor: 40... 75 s; spring return: < 25 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	0.6 Kg

## Product features

<b>Simple direct mounting</b>	Simple direct mounting on the ball valve using only one screw.
<b>Manual operation</b>	No manual operation.
<b>High function reliability</b>	The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wiring



- Spring return rotary actuators: For ball valve DN 15...32
- Torque: 4 Nm
- Modulating control LF24-SR (AC/DC 24 V)
- Floating control LF24-3 (AC/DC 24 V)
- Open/Close control LF24, LFM24-S2 (AC/DC 24 V)  
LF230, LFM230-S2 (AC 230 V)



## Technical data

Basic technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	Motor: 4 Nm; Spring return: 4 Nm
	Angle of rotation	95°
	Sound power level	Motor: Max. 50 dB (A), Spring return: 62 dB (A)
	Position indication	Mechanical
	Degree of protection	IP54
	EMC	CE according to 89/336/EEC
	Ambient temperature	-5 ... +50°C
	Non-operating temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	To EN 60730-1
	Maintenance	Maintenance-free
LF24-SR	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	2.5 W @ running / 1 W @ holding
	Transformer sizing	5 VA
	Control signal	0...10 VDC @ 100kΩ input impedance
	Operating range	2...10 VDC
	Position feedback	2...10 VDC
	Direction of rotation	Motor: Reversible by L/R switch; Spring return: reversible by mounting L/R
	Protection class	III (safety low voltage)
	Running time	Motor: < 150 s; spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	1.4 Kg
LF24-3	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	2.5 W @ running / 1 W @ holding
	Transformer sizing	5 VA
	Direction of rotation	Motor: Reversible by L/R switch; Spring return: reversible by mounting L/R
	Protection class	III (safety low voltage)
	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
LF24, LFM24-S2	Weight	1.4 Kg
	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	5 W @ running / 2.5 W @ holding
	Transformer sizing	7 VA
	Direction of rotation	Spring return: reversible by mounting L/R
	Auxiliary switch (LFM24-S2)	2 X SPDT, 1 mA ...3(0.5) A, AC 250 V
	Protection class	III (safety low voltage)
	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
LF230, LFM230-S2	Weight	1.4 ... 1.54 Kg
	Power supply range	AC 198 ... 264 V
	Power consumption	5 W @ running / 3 W @ holding
	Transformer sizing	7 VA
	Direction of rotation	Spring return: reversible by mounting L/R
	Auxiliary switch (LFM230-S2)	2 X SPDT, 1 mA ...3(0.5) A, AC 250 V
	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) <input type="checkbox"/>
	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	1.55 ... 1.68 Kg

## Product features

**Simple direct mounting** Simple direct mounting on the ball valve using only one screw.

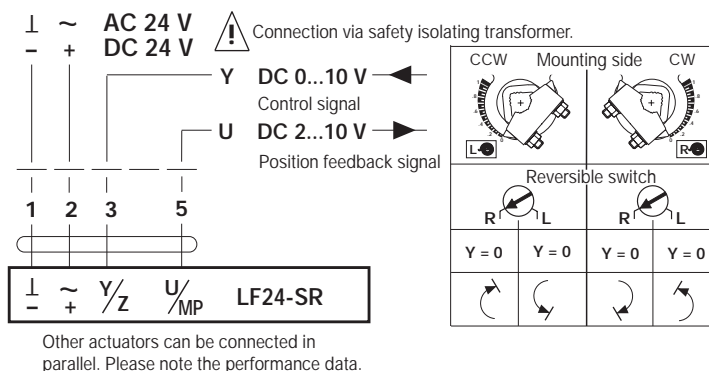
**Manual operation** Only LFM24-S2 and LFM230-S2 have manual operation with integral position stop.

**High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

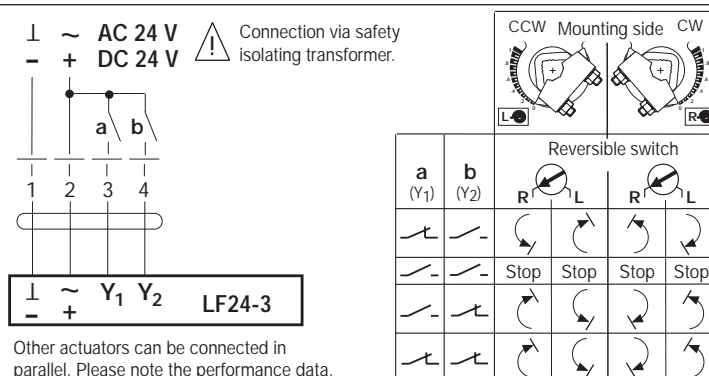
## Wiring

LF24-SR

Modulating control

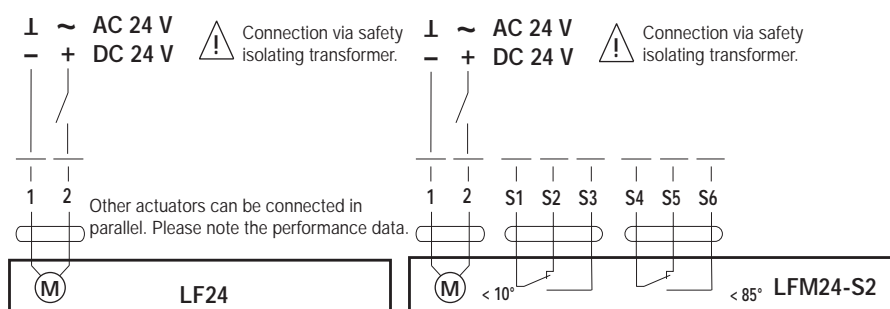


LF24-3  
Floating control



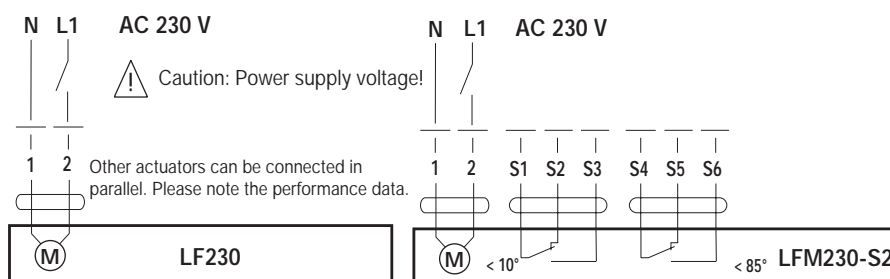
LF24, LFM24-S2

Open/close control



LF230, LFM230-S2


## Open/close control



- Spring return rotary actuators: For ball valve DN 15...80
- Torque: 15 Nm
- Modulating control      AFR24-SR (AC/DC 24 V)
- Floating control          AFR24-3(-S) US (AC/DC 24 V)
- Open/Close control      AFR24(-S) (AC/DC 24 V)  
AFR230(-S) (AC 230 V)



## Technical data

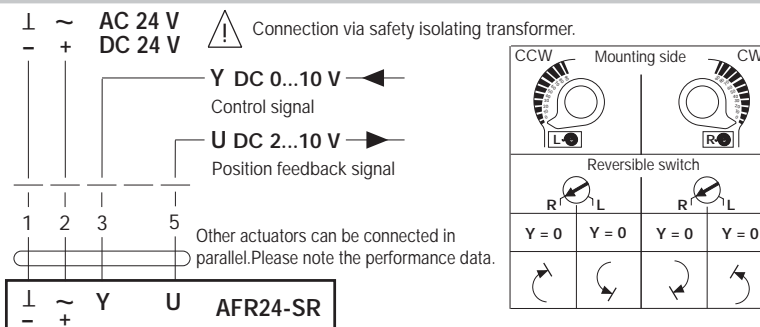
Basic technical data	Connection cable	1 m, 0.75 mm <sup>2</sup>
	Torque	Motor: 15 Nm; Spring return: 15 Nm
	Angle of rotation	95°
	Sound power level	Motor: Max. 45 dB (A), Spring return: 62 dB (A)
	Position indication	Mechanical
	Degree of protection	IP54
	EMC	CE according to 89/336/EEC
	Ambient temperature	-5 ... +50°C
	Non-operating temperature	-5 ... +80°C
	Temperature of medium	-5 ... +100°C
	Humidity test	To EN 60730-1
	Maintenance	Maintenance-free
AFR24-SR	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	6 W @ running / 2.5 W @ holding
	Transformer sizing	10 VA
	Control signal	0...10 VDC @ 100kΩ input impedance
	Operating range	2...10 VDC
	Position feedback	2...10 VDC
	Direction of rotation	Motor: Reversible by L/R switch; Spring return: reversible by mounting L/R
	Protection class	III (safety low voltage)
	Running time	Motor: ~ 150 s; spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
	Power supply range	2.7 Kg
AFR24-3(-S) US	Power consumption	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Weight	5 W @ running / 1.5 W @ holding
	Transformer sizing	10 VA
	Direction of rotation	Motor: Reversible by L/R switch; Spring return: reversible by mounting L/R
	Auxiliary switch AFR24-3-S US	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V0... 100% adjustable
	Protection class	III (safety low voltage)
	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
AFR24(-S)	Weight	3 Kg
	Power supply range	AC 19.2... 28.8 V; DC 21.6... 28.8 V
	Power consumption	5 W @ running / 1.5 W @ holding
	Transformer sizing	10 VA
	Direction of rotation	Spring return: reversible by mounting L/R
	Auxiliary switch AFR24-S	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V0... 100% adjustable
	Protection class	III (safety low voltage)
AFR230(-S)	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	3 Kg
	Power supply range	AC 198 ... 264 V
	Power consumption	6.5 W @ running / 2.5 W @ holding
	Transformer sizing	11 VA
	Direction of rotation	Spring return: reversible by mounting L/R
	Auxiliary switch AFR230-S	1 X SPDT, 1 mA ...3(0.5) A, AC 250 V0... 100% adjustable
AFR230(-S)	Low voltage directive	CE according to 73/23/EEC
	Protection class	II (Totally insulated) 
	Running time	Motor: 40... 75 s; Spring return: ~ 20 s (-5... +50°C) / Max. 60 s (-30°C)
	Weight	3 Kg

## Product features

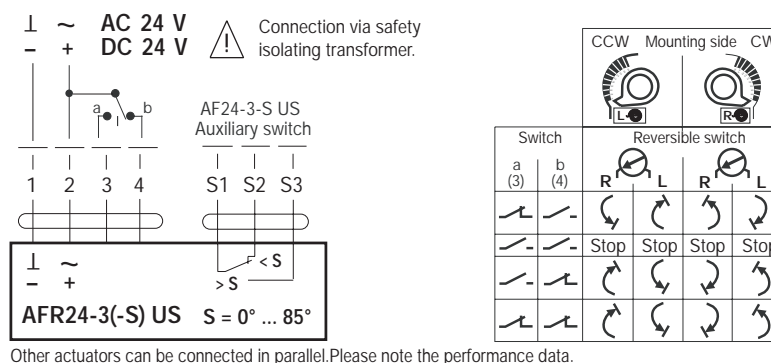
- Simple direct mounting** Simple direct mounting on the ball valve using only one screw.
- Manual operation** No manual operation.
- High function reliability** The actuator is overload-proof, needs no limit switches, stops automatically at the end stops.

## Wiring

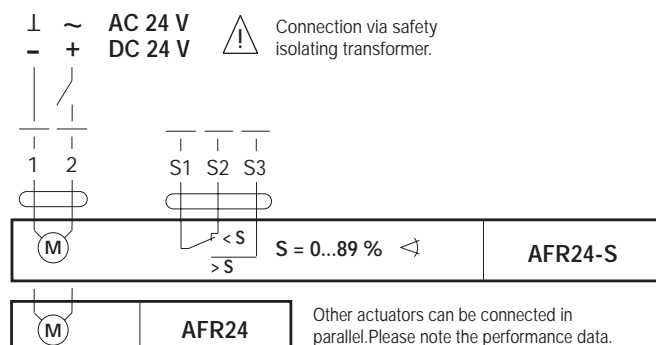
### AFR24-SR Modulating control



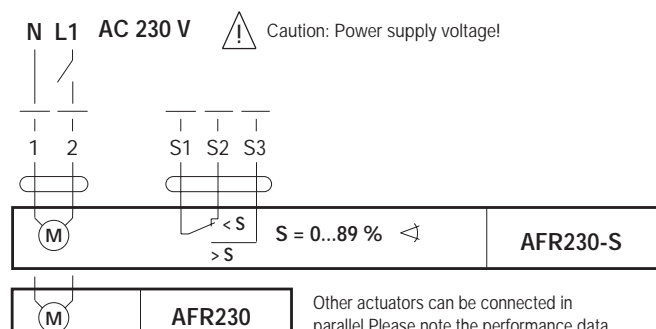
### AFR24-3(-S) US Floating control



### AFR24(-S) Open/close control



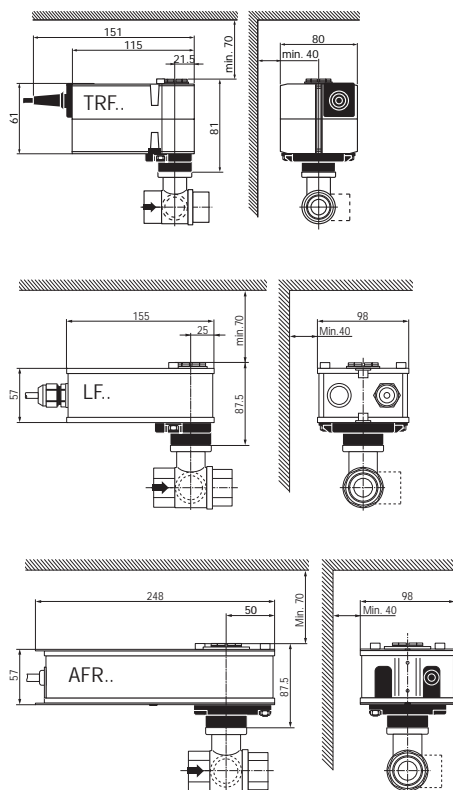
### AFR230(-S) Open/close control





Dimensions

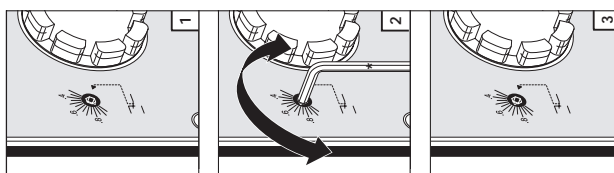
Measurement [mm]



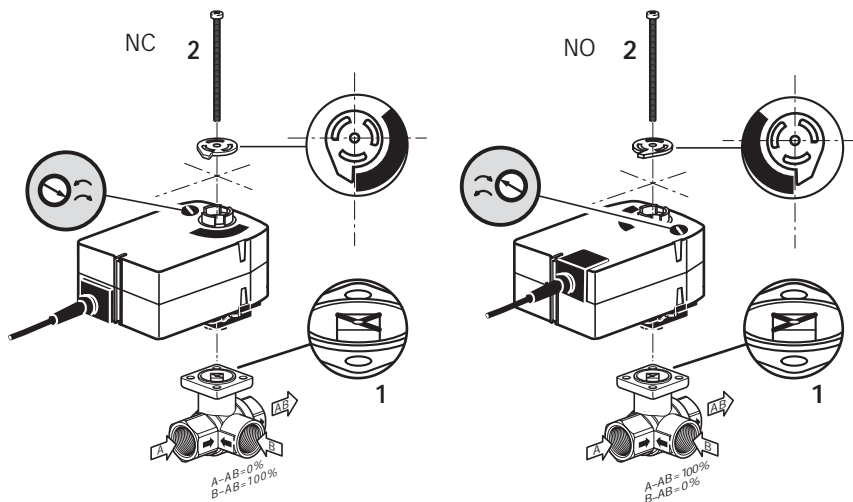
Adjusting AFR.. -S auxiliary switches

Initial situation: Actuator in safety position

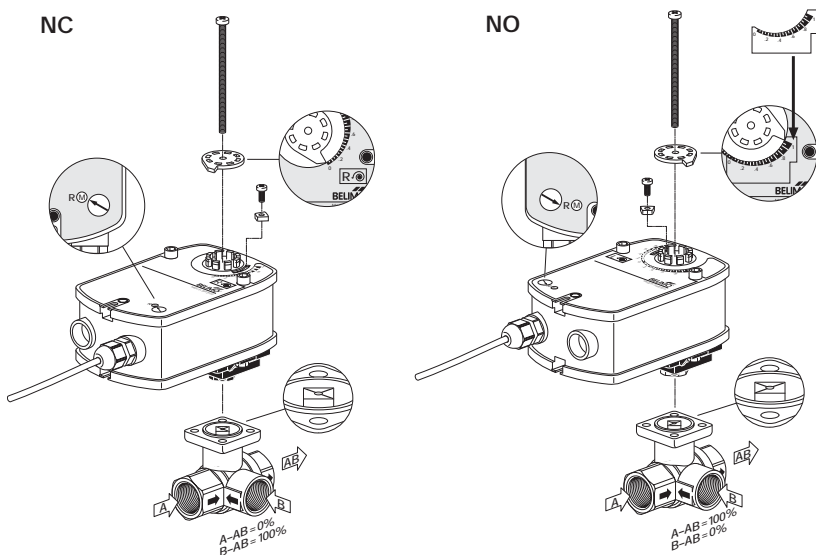
3 mm (1/8") hexagonal key not included with the actuator



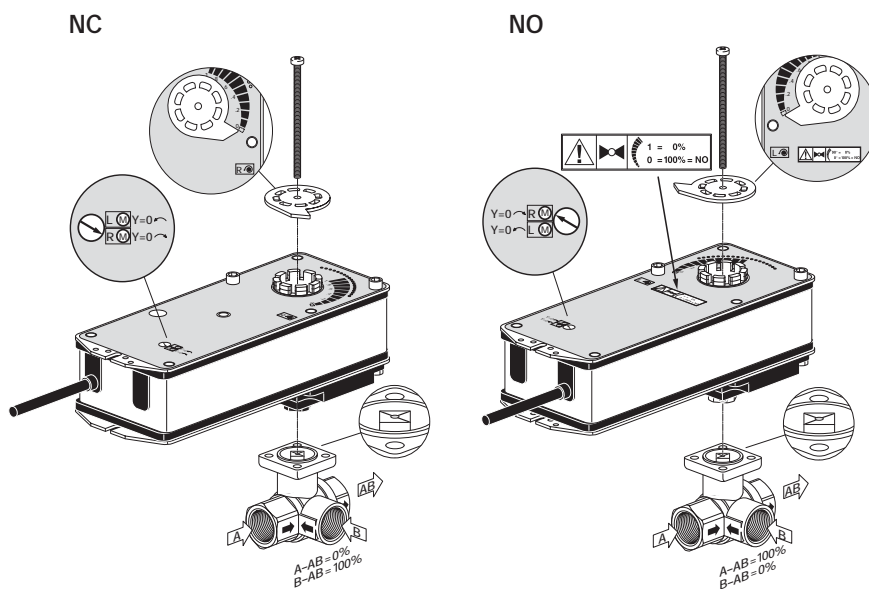
## Installation procedures: TRF..



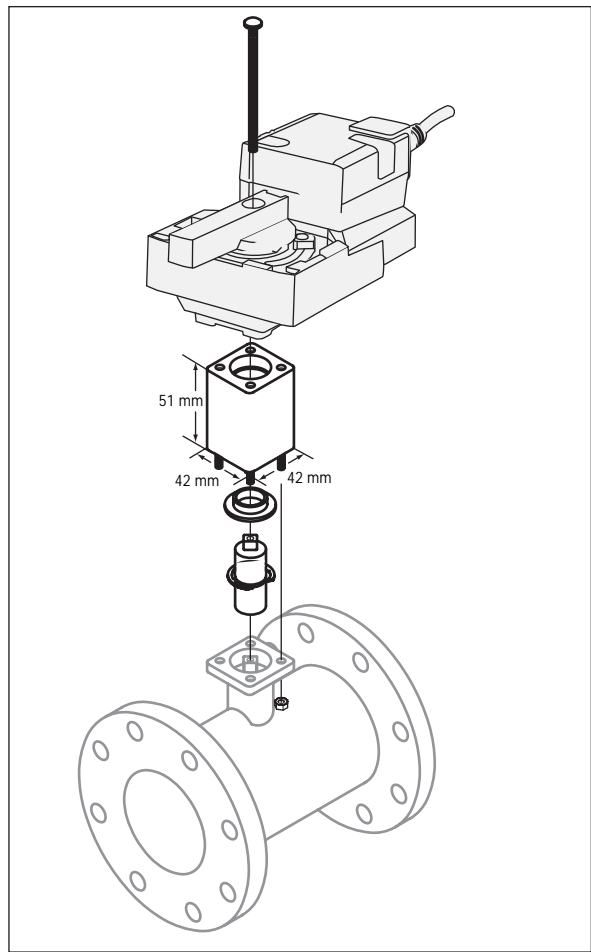
## Installation procedures: LF..



## Installation procedures: AFR..



CCV-EXT-KIT valve neck extension kit

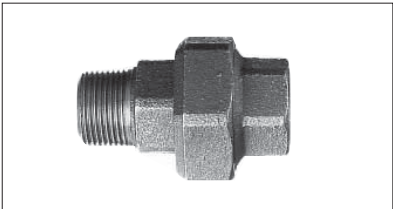
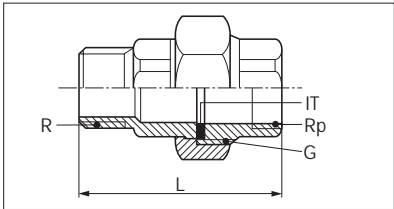


**Application:**  
CCV-EXT-KIT provides an extra 50 mm gap between the valve mounting flange and the actuator for better insulation installation  
**Note:**  
CCV-EXE-KIT can't be mounted onto DN100...150 CCV

Technical data	
Extension height	50 mm
Weight	320 g
Material	
Extension housing	Aluminum - anodized
Shaft	Stainless steel
Threaded hardware	Stainless steel
Bearing	Oil light bearing
Retaining clip	Stainless steel

Pipe connectors

Type	ZR2315	ZR2320	ZR2325	ZR2332	ZR2340	ZR2350
DN [mm]	15	20	25	32	40	50
Weight [kg]	0.2	0.35	0.45	0.8	0.9	1.4
Dim. L [mm]	66	72	80	90	95	107



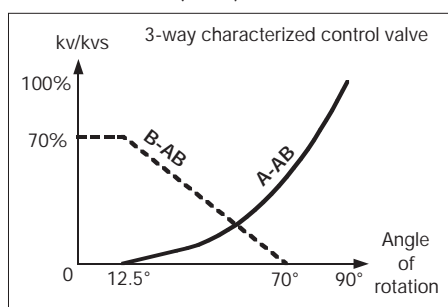
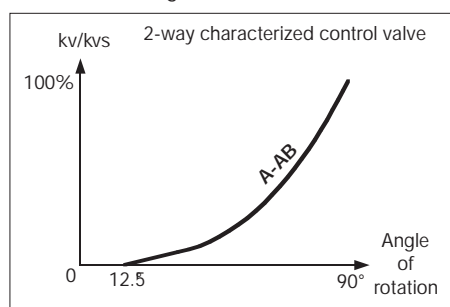
Included in scope of delivery of ZR23.. : R-thread male part, G-thread union nut, Rp-thread female part, IT flat gasket

## Standard directions of flow

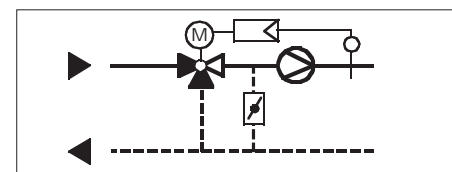
 characterized control valves	 A-AB open	 A-AB closed	2-way R2.., R6..A, R6..AC
	 A-AB open	 A-AB closed	3-way R3..
 Open/Close ball valves	 A-AB open	 A-AB closed	2-way R2.., R6..A, R6..AC
	 A-AB open	 A-AB closed	3-way R3..
Spindle position for corresponding valve flow			For 2-way and 3-way ball valves
Actuator position corresponding to ball valve flow direction			

## Flow characteristics of characterized control valves

Between 0° and 12.5° angle of rotation, 2-way and function as regulating devices. In the case of the 3-way characterized control valve, the bypass flow rate (B-AB) is 70% of the tight-sealing shut-off devices (A-AB). Between the 12.5° and 90° angle of rotation, control ball valves nominal flow rate (A-AB).



**Note:**  
Due to its spherical design, the 3-way characterized control valve is of only limited application for conventional supply temperature control systems. Therefore, it is recommended that supply temperature control systems be of the double-mixing circuit type (see diagram below). There are no restrictions when using mixing-type circuits for air preheaters and for injection circuits.



## Mounting, installation and commissioning

### Separate supply

When ball valve and rotary actuator are supplied separately, they can be assembled on-site.

No special tools are needed for assembly, and instructions will be found packed with the valve and actuator.

**Commissioning** must not be carried out until the ball valve and rotary actuator have been assembled in accordance with the instructions.

### Recommended mounting positions

The ball valves may be mounted either vertical (Fig. 1) or horizontal (Fig. 2). However, mounting the ball valves with the spindle pointing downwards, i.e. upside down (Fig.3), is not recommended.

Fig. 1

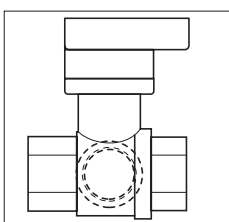


Fig. 2

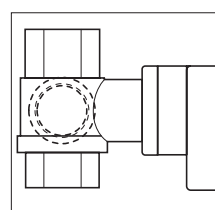
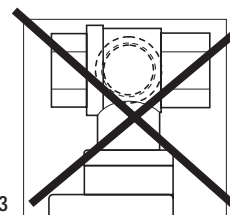


Fig. 3



## Maintenance

- Ball valves and rotary actuators are both maintenance free.
- Before any kind of service work is carried out on control devices of this type, it is essential to isolate the actuator from the power supply (by unplugging the power lead). Any pumps in the particular part of the piping system concerned must also be switched off and the appropriate isolating fittings closed (also allow everything

to cool down first if necessary and reduce the pressure in the system to atmospheric).

- The systems must not be returned to service until the ball valve and the actuator have been properly re-installed and connected and the pipework has been refilled in the proper manner.

### Subsequent removal

In the case of applications where subsequent removal of a ball valve will be necessary, it is

advisable to make appropriate preparations before hand. A typical example is the provision of extra detachable ZR23.. pipe connectors (page 32).

### Disposal

When a control device (ball valve and actuator) has come to the end of its service life, the two parts must be dismantled and sorted into different materials before being disposed of.

## Project design

### Installing R2../R6.. CCV, 2-way

The R2.. characterized control valve is a throttling device, so must be installed in the return line of systems in order to ensure less thermal stress on the seals of the device. The direction of flow specified must be adhered to.

### Installing R3.. CCV, 3-way

The R3.. characterized control valve is a mixing device. Whatever type of installation is employed, it is essential to adhere to the directions of flow specified. Whether a valve is installed in the supply or the return of a

system depends on the type of hydraulic circuit being employed. No balancing valve is needed in the bypass line of a diverting circuit because of the reduced flow in the bypass.

### Water quality requirements

The water quality requirements specified in VDI 2035 must be adhered to.

### Dirt filters recommended

Characterized control valves are relatively sensitive control devices, and in order to ensure that they give long service life, the fitting of dirt filters is recommended.

### Sufficient isolating valves

It is essential to ensure that sufficient isolating valves are provided.

### Correct rating and sizing

In order to ensure that the control device (characterized control valve and rotary actuator) achieves a long service life, it is essential for the valve to be rated for the correct differential pressure  $\Delta p_{V100}$  across the valve, i.e. with adequate valve authority ( $P_v > 0.5$ ). The differential pressure  $\Delta p_{V100}$  depends on the type of hydraulic circuit in which the valve is being used.

## Differential pressures $\Delta p_{V100}$ with characterized control valves full open

$\Delta p_{v100}$ R2../R6.. characterized control valves, 2-way		$\Delta p_{v100}$ R3.. characterized control valves, 3-way			
Geographic presentation	<b>Throttling circuit</b> $\Delta p_{v100} > \Delta p_{VR} / 2$ Typical values: $15 \text{ kPa} < \Delta p_{v100} < 150 \text{ kPa}$	<b>Injection circuit with throttling device</b> $\Delta p_{v100} > \Delta p_{VR} / 2$ Typical values: $10 \text{ kPa} < \Delta p_{v100} < 100 \text{ kPa}$	<b>Diverter circuit</b> $\Delta p_{v100} > \Delta p_{MV}$ Typical values: $5 \text{ kPa} < \Delta p_{v100} < 50 \text{ kPa}$	<b>Mixing circuit</b> $\Delta p_{v100} > \Delta p_{MV}$ Typical values: $\Delta p_{v100} > 3 \text{ kPa}$ (unpressurised manifold). For other mixing circuits: $3 \text{ kPa} < \Delta p_{v100} < 30 \text{ kPa}$	<b>Injection circuit with 3-way characterized control valve</b> $\Delta p_{MV1} + \Delta p_{MV2} \approx 0$ Typical values: $\Delta p_{v100} > 3 \text{ kPa}$
Synoptic presentation					

### Legend

Characterized control valve, 2-way with rotary actuator	Characterized control valve, 3-way with rotary actuator	Pump	Non-return damper	Balancing throttle	VL — Supply RL... Return
$\Delta p_{VR}$ Differential pressure across specified section at rated load		$\Delta p_{MV}$ Differential pressure across variable-flow section at rated load (e.g. heat exchanger)		<b>Note:</b> Dirt traps and isolating fittings are not shown.	