acvatix

Modulating control valves PN16 with magnetic actuators   MVF461H...

with position control and position feedback signal
for hot water, hight temperature hot water and steam

- **Short positioning time (<2 s), high resolution (1 : 1000)**
- **Selectable valve characteristic: Equal-percentage or linear**
- **High rangeability**
- **Selectable standard interface DC 0/2...10 V or DC 0/4... 20 mA**
- **Phase-cut signal input for Staefa controllers**
- **Position control and position feedback signal**
- **Wear-free inductive stroke measurement**
- **Spring return facility: A → AB closed when deenergized**
- **Low friction, robust and maintenance-free**

Use

The MVF461H...valve types are through-port control valves with fitted magnetic actuator. The actuator is equipped with connecting electronics for positioning control and position feedback. When deenergized, the valve is closed.

The short positioning time, high resolution and high rangeability make these valves ideal for proportional control of district heating stations and heating plant using HTHW and steam.

Type summary

Type reference	DN	k_{VS}	Δp_{max}	Δp_S	S_{NA}	P_{med}	I_N	Wire cross-section [mm²]		
								4- wire connection		
							Fuse	1.5	2.5	4.0
		[m³/h]	[kPa]	[kPa]	[VA]	[W]	[A]	Max. cable length L [m]		
MVF461H15-0.6	15	0.6	1000	1000	33	15	3.15	60	100	160
MVF461H15-1.5	15	1.5	1000	1000	33	15	3.15	60	100	160
MVF461H15-3	15	3	1000	1000	33	15	3.15	60	100	160
MVF461H20-5	20	5	1000	1000	33	15	3.15	60	100	160
MVF461H25-8	25	8	1000	1000	33	15	3.15	60	100	160
MVF461H32-12	32	12	1000	1000	43	20	4	40	70	120
MVF461H40-20	40	20	1000	1000	65	20	6.3	30	50	80
MVF461H50-30	50	30	1000	1000	65	26	6.3	30	50	80

Δp_{max} = max. permissible differential pressure across the valve's control path, valid for the entire actuating range of the motorised valve (maximum recommended operating differential pressure)

Δp_S = max. permissible differential pressure at which the motorised valve will close securely against the pressure (close off pressure)

S_{NA} = nominal apparent power for selecting the transformer

P_{med} = average true power

I_N = slow fuse (mandatory)

k_{VS} = nominal flow rate of cold water (5 to 30 °C) through the fully openend valve (H_{100}) at a differential pressure of 100 kPa (1 bar)

L = max. cable length; with 4-wire connections, the max. permissible length of the separate 1.5 mm² copper positioning signal cable is 200 m

Ordering

When ordering, please give quantity, product name and type reference.
Valve body and magnetic actuator form one assembly and cannot be separated.

Example: **1 valve MVF461H15-0.6**

Technical and mechanical design

For a detailed description of operation, refer to Data Sheet CA1N4028E.

Automatic control

The electronics module converts the positioning signal to a phase-cut power signal which generates a magnetic field in the coil. This causes the armature to change its position in accordance with the interacting forces (magnetic field, counterspring, hydraulics, etc.). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the valve plug, enabling fast changes in load to be corrected quickly and accurately.

The valve's position is measured continuously. Any disturbance in the system is rapidly corrected by the internal positioning controller, which ensures that the positioning signal and the valve stroke are exactly proportional, and also delivers the position feedback signal.
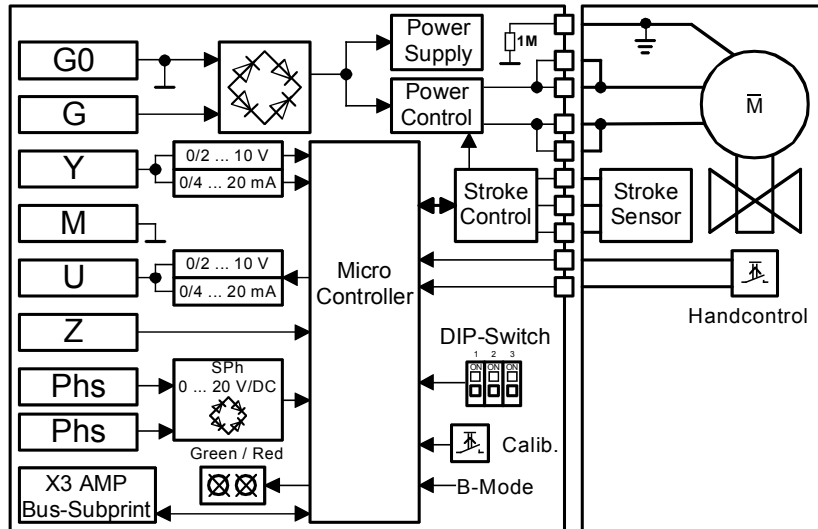
Control

The magnetic actuator can be driven by a Siemens controller or a controller of other manufacture that deliver a DC 0/2 ...10 V or DC 0/4 ... 20 mA output signal.
To achieve optimum control performance, it is recommended to use a 4-wire connection for the valve. **In case of DC power supply, a 4-wire connection is mandatory!**
The controller's signal ground terminal M must be connected to the valve's terminal M. Terminals M and GO have the same potential and are internally interconnected in the valve's electronics.

Basic diagram

Spring return facility

If the positioning signal is interrupted, or in the event of a power failure, the valve's return spring will automatically close control path A → AB.

Indication of operating state

| LED	Indication	Operating state, function	Remarks, troubleshooting
Green	Lit	Control mode	Normal operation; everything o.k.
	Flashing	Calibration	Wait until calibration is finished (green or red LED will be lit)
		In manual control	Hand wheel in Man or Off position
Red	Lit	Calibration error Internal error	Recalibrate (bridge contacts behind the calibration slot) Replace electronics module
	Flashing	Mains fault DC Supply - / +	Check mains network (outside the frequency or voltage range); DC supply + / - connection rectify
Both	Dark	No power supply Electronics faulty	Check mains network, check wiring Replace electronics module

Manual control

By pressing (**a**) and turning (**b**) the hand wheel
• in clockwise (CW) direction, control path A → AB can be mechanically opened to between 80 and 90 %
• in counterclockwise (CCW) direction, the actuator will be switched off and the valve closed

As soon as the hand wheel is pressed and turned, neither the forced control signal Z nor the input signal Y or the phase-cut signal acts on the actuator. The green LED will flash.

For automatic control, the hand wheel must be set to the Auto position. The green LED will be lit.
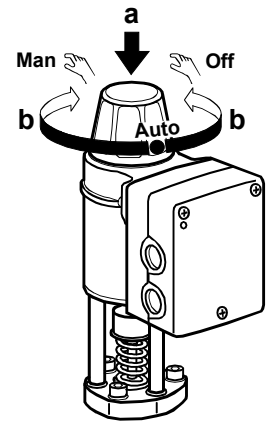

Calibration

If the electronics module is replaced or the actuator turned through 180 °, the valve's electronics must be recalibrated. For that, the hand wheel must be set to Auto.

The printed circuit board has a slot. Calibration is made by bridging the contacts located behind the slot using a screwdriver. The valve will then travel across the full stroke to store the end positions.
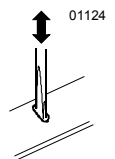
While calibration is in progress, the green LED will flash for about 10 seconds (also refer to «Indication of operating state»).

Configuration
DIP switches

2 ... 10 V
4 ... 20 mA
[mA] — V̇lin

ON
OFF

[V] — V̇log
0 ... 10 V
0 ... 20 mA
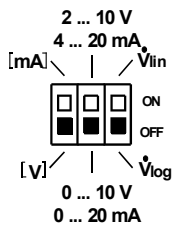
	DIP	Function	OFF (default)	ON	Remarks
1	ON OFF	Voltage or current input	[V]	[mA]	Assignment of terminal Y: Voltage or current
2	ON OFF	Correcting span Terminals Y and U	0 ... 10 V, 0 ... 20 mA	2 ... 10 V, 4 ... 20 mA	Offset settings of input or output
3	ON OFF	Characteristic	V̇lin (Equal-percentage)	V̇lin (linear)	

Assignment positioning signal Y:
Voltage or current

⍗ Y	ON OFF	ON OFF	
ON OFF	0 ... 10 V	2 ... 10 V	
ON OFF	0 ... 20 mA	4 ... 20 mA	

Assignment of correcting span Y and U:
0 ... 10 V / 0 ... 20 mA oder
2 ... 10 V / 4 ... 20 mA

⍐ U	ON OFF	ON OFF
Ri > 500 Ω	0 ... 10 V	2 ... 10 V
Ri < 500 Ω	0 ... 20 mA	4 ... 20 mA

Output signal U (position feedback signal) is dependent on the load resistance. Above 500 Ω, it is automatically a voltage signal, below 500 Ω a current signal.
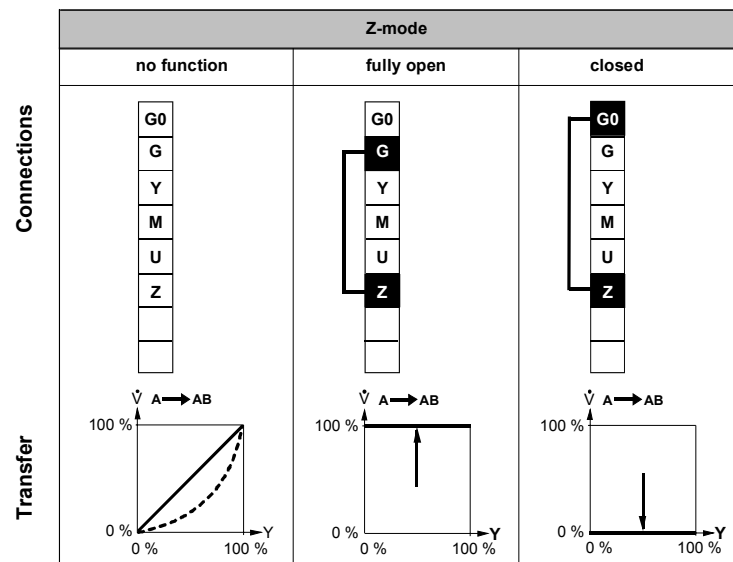
Selection of valve characteristic:

Equal-percentage or linear
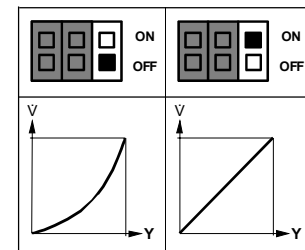
Forced control input

If terminal Z for the forced control input
− is not connected, the valve will follow the Y-signal or the phase-cut signal
− is connected to G, the valve will fully open via control path A → AB
− is connected to G0, the valve will close via control path A → AB

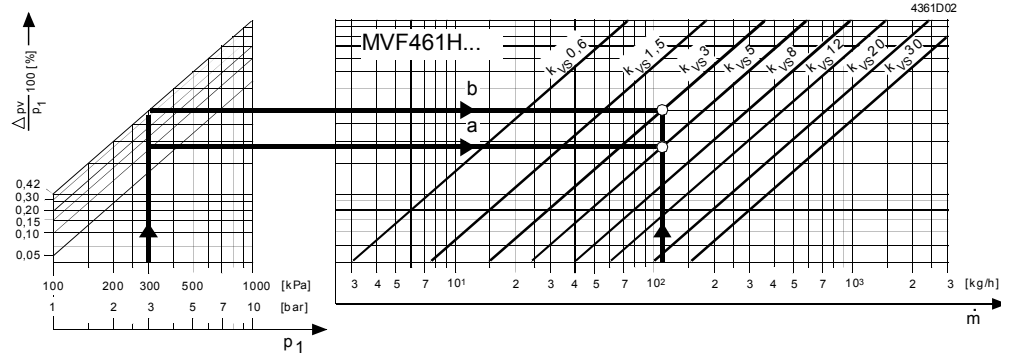|	Z-mode		
	no function	fully open	closed
Connections	G0 G Y M U Z	G0 **G** Y M U **Z**	**G0** G Y M U **Z**
Transfer			

Signal priority

1. Hand wheel position Man or Off
2. Forced control signal Z
3. Phase-cut signal
4. Signal input Y

Dimension

Saturated steam flow chart

p_1 = absolute pressure at inlet side

p_3 = absolute pressure at outlet side

Δp_v = differential pressure across the valve

$\dot{m}$ = volume of steam kg/h

k = factor for superheated steam

$= 1 + 0.0013 \times \Delta T$ superheat (with saturated steam $k = 1$)

Pressure ratio = $\dfrac{p_1 - p_3}{p_1} \cdot 100$ [%]

Pressure ratio < 42 % (below critical press. drop)

Pressure ratio ≥ 42 % (above critical press. drop)

Calculation of k_{vs}

a) At below the critical pressure drop

$$\frac{p_1 - p_3}{p_1} \cdot 100 < 42\ \%$$

$$k_{vs} = 0.042 \cdot \frac{\dot{m}}{\sqrt{p_3 \cdot (p_1 - p_3)}} \cdot k$$

b) At above critical pressure drop

$$\frac{p_1 - p_3}{p_1} \cdot 100 \geqslant 42\ \%$$

$$k_{vs} = 0.084 \cdot \frac{\dot{m}}{p_1} \cdot k$$

Example to a) below critical

Given: Saturated steam = 133.54 [° C]

p_1 = 3.0 [bar] ≙ 300 [kPa]

$\dot{m}$ = 110 [kg/h]

Pressure ratio = 12 %

Required: k_{vs} valve type

Solution:

$$p_3 = p_1 - \frac{12}{100} \cdot p_1$$

$$= 3 - \frac{12}{100} \cdot 3 = 2.64 \text{ [bar]}$$

$$\cong 264 \text{ [kPa]}$$

$$k_{vs} = 0.042 \cdot \frac{110}{\sqrt{2.64\,(3 - 2.64)}} \cdot 1$$

$$= 4.739$$

Selected: $k_{vs} = 5$ ➡ **Typ MVF 461H20-5**

Example to b) above critical

Given: Saturated steam = 133.54 [° C]

p_1 = 3.0 [bar] ≙ 300 [kPa]

$\dot{m}$ = 110 [kg/h]

Pressure ratio: admissible, above critical (≥ 42 %)
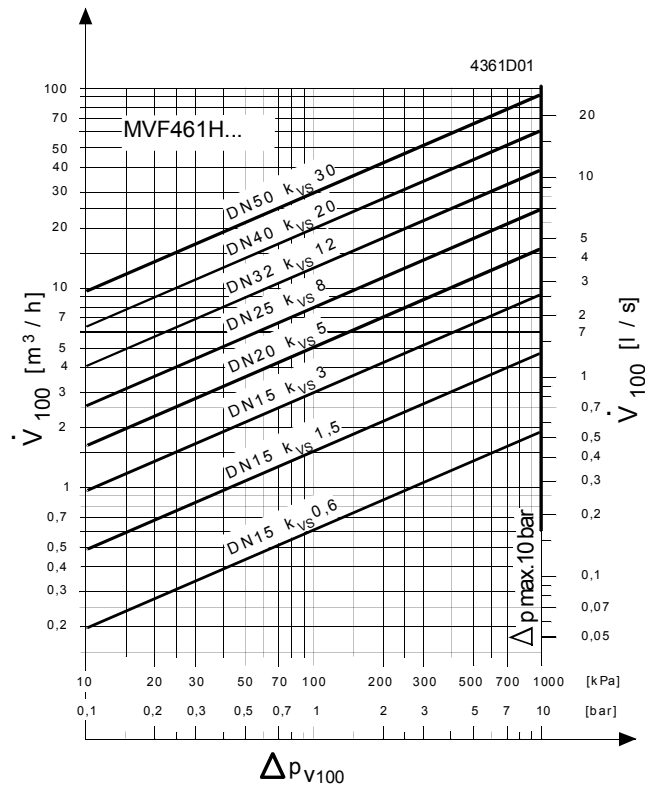
Required: k_{vs} valve type

Solution:

$$k_{vs} = 0.084 \cdot \frac{110}{3} \cdot 1$$

$$= 3.08$$

Selected: $k_{vs} = 3$ ➡ **Typ MVF 461H15-3**

Water flow chart

Δp_{V100} = differential pressure across the fully open valve and the valve's control path by a volume flow $\dot{V}_{100}$

$\dot{V}_{100}$ = volume flow through the fully open valve (H_{100})

Δp_{max} = max. permissible differential pressure across the valve's control path for the entire actuating range of the motorised valve (maximum recommended operating differential pressure)

100 kPa = 1 bar ≈ 10 mWG

1 m^3/h = 0.278 l/s water at 20 °C

Valve characteristic
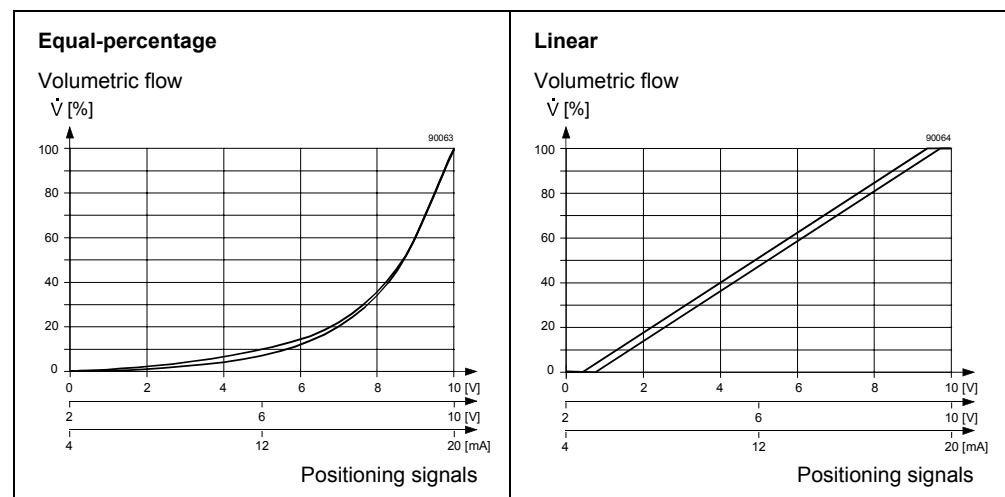
Mounting notes

The valve is supplied complete with Mounting Instructions 74 319 0378 0.

Caution ⚠ **The valve may only be used in flow direction (A – AB).**
Observe the direction of flow!

Mounting position

Installation notes

- The actuator may not be lagged

For electrical installation, refer to «Connection diagrams».
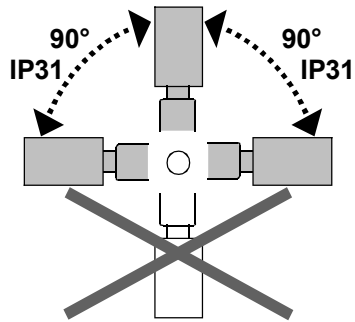
Maintenance notes

The low friction and robust, maintenance-free design makes regular servicing unnecessary and ensure a long service life.
The valve stem is sealed from external influences by a maintenance-free gland.

If the red LED is lit, the electronics must be recalibrated or replaced.

Should the valve electronics prove faulty, the ASE12 electronics module must be replaced (refer to Mounting Instructions 74 319 0404 0).

Caution ⚠ **Always disconnect power before fitting or removing the electronics module.**

After replacing the electronics module, calibration must be triggered in order to optimally match the electronics to the valve (refer to «Calibration»).

Disposal notes

The actuator contains electric and electronic components and may not be disposed of together with household waste.
Local and currently valid legislation must be observed.

Technical data

Power supply	For use with low-voltage only (SELV, PELV)		
• AC 24 V	Operating voltage		AC 24 V +20 / –15 %
	Frequency		45 ... 65 Hz
	Typical power consumption	P_{med}	refer to «Type summary»
		Standby	< 1 W (valve fully closed)
	Nominal apparent power S_{NA}		refer to «Type summary»
	Suitable fuse		slow (refer to «Type summary»)
• DC 24 V	Operating voltage		DC 20 ... 30 V
Functional data of actuator			
• Input	Control signal Y		DC 0/2 ... 10 V or DC 0/4 ... 20 mA
			or DC 0 ... 20 V Phs
	Impedance DC 0/2 ... 10 V		100 kΩ // 5nF
	DC 0/4 ... 20 mA		240 Ω // 5nF
	Forced control		
	Impedance		22 kΩ
	Closing the valve (Z connected to G0)		< AC 1 V; < DC 0.8 V
	Opening the valve (Z connected to G)		> AC 6 V; > DC 5 V

			No function (Z not wired up)	phase-cut or control signal Y active

• Output	Position feedback signal	voltage	DC 0/2 ... 10 V; load resistance > 500 Ω
		current	DC 0/4 ... 20 mA; load resistance ≤ 500 Ω
	Stroke measurement		inductive
	Nonlinearity		± 3 % of end value
Functional data of valve	Pressure class		PN16 to EN 1333
	Perm. operating pressure [1]		Water up to 120 °C: 1.6 MPa (16 bar)
			Water above 120 °C: 1.3 MPa (13 bar)
			Saturated steam: 0.9 MPa (9 bar)
	Differential pressure $\Delta p_{max} / \Delta p_s$		1 MPa (10 bar)
	Leakage rate at Δp = 0.1 MPa (1 bar)		A → AB max. 0.05 % k_{VS} (to IEC 534-4)
	Medium temperature		>1 ... 180 °C
	Valve characteristic [2]		equal-percentage or linear,
			optimized near the closing point
			(refer to Data Sheet 4023)
	Stroke resolution $\Delta H / H_{100}$		1 : 1000 (H = stoke)
	Control mode		modulating
	Position when actuator is deenergized		A → AB closed
	Mounting position		upright to horizontal
	Running time		< 2 s
Materials	Valve body		modular cast iron EN-GJS-400-18-LT
	Covering flange		modular cast iron EN-GJS-400-18-LT
	Seat / plug		CrNi-steel
	Valve stem seal		EPDM (O-ring)
Electrical connections	Cable entries		3 x M20 x 1.5 or PG13.5 / G1/2
	Connection terminals		screw terminals for 4 mm^2 wires
	Min. cross-sectional area [3]		0.75 mm^2
	Max. cable length		refer to «Type summary»
	Dimensions		refer to «Dimensions»
	Weight		refer to «Dimensions»

[1] Tested at 1.5 x PN (24 bar), similar to DIN 3230-3
[2] Can be selected via DIP switch
[3] In case of strong vibrations, use high-flex stranded wires

Norms and standards	Degree of protection	IP31 to IEC 529
	Conforming to	**CE**- requirements
		UL to UL 873
		certified to Canadian standard
		C22.2 No. 24
		C-Tick N 474
		PED 97/23/EC:
		pressure-carrying parts
		Par. 1, section. 2.1.4 / Par. 3, section 3
		Fluid group 2
	AC + DC: Immunity	Industrial IEC 61000-6-2
	AC: Emissions	Residential IEC 61000-6-3
	DC: Emissions	CISPR 22, class B
	Immunity (HF)	IEC 1000-4-3; IEC 1000-4-6 (10 V/m)
	Emissions (HF)	EN 55022, CISPR 22, Klasse B
	Vibration [3]	IEC 68-2-6
		(1 g acceleration, 1 ... 100 Hz, 10 min)

General environmental conditions

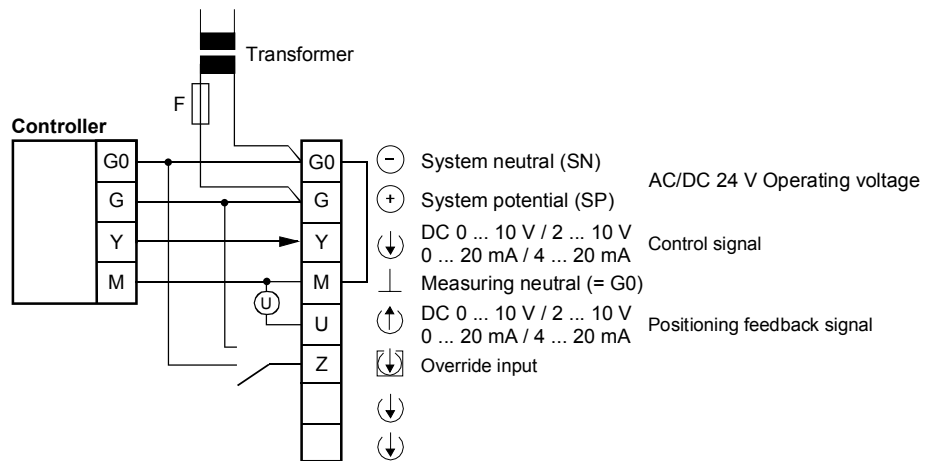|	Operation IEC 721-3-3	Transport IEC 721-3-2	Storage IEC 721-3-1
Climatic conditions	Class 3K5	Class 2K3	Class 1K3
Temperature	–5 ... +45 °C	–25 ... +70 °C	–5 ... +45 °C
Humidity	5 ... 95 %r.F.	5 ... 95 %r.F.	5 ... 95 %r.F.
Mechanical conditions	IEC 721-3-6 Class 3M2		

Connection diagrams

Caution ⚠ **If controller and valve receive their power from separate sources, only one transformer may be earthed on the secondary side.**
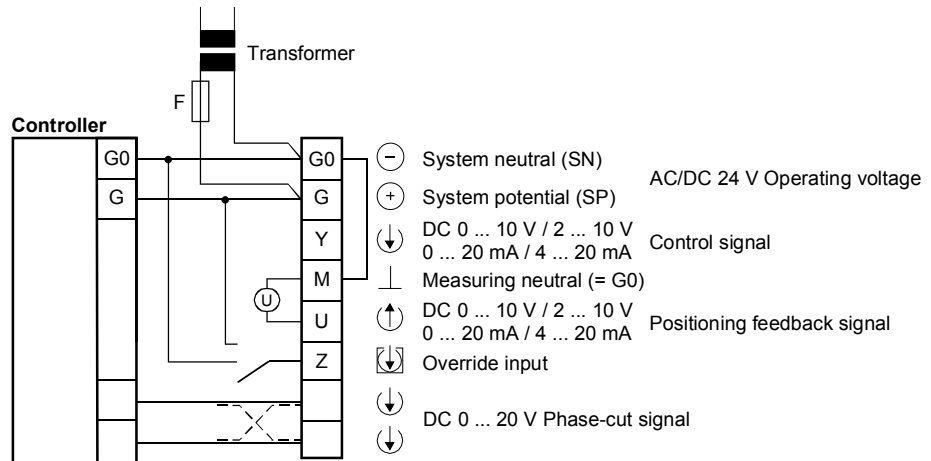
Caution ⚠ **In case of DC power supply, a 4-wire connection is <u>mandatory</u>!**

Controllers with control signal
**DC 0 ... 10 V**
DC 2 ... 10 V
DC 0 ... 20 mA
DC 4 ... 20 mA

Transformer

Controller

G0	G0	(−) System neutral (SN)
G	G	(+) System potential (SP)
Y	Y	DC 0 ... 10 V / 2 ... 10 V 0 ... 20 mA / 4 ... 20 mA Control signal
M	M	⊥ Measuring neutral (= G0)
	U	DC 0 ... 10 V / 2 ... 10 V 0 ... 20 mA / 4 ... 20 mA Positioning feedback signal
	Z	Override input

AC/DC 24 V Operating voltage

Controllers with phasecut signal
DC 0 ... 20 V

Transformer

Controller

G0	G0	(−) System neutral (SN)
G	G	(+) System potential (SP)
	Y	DC 0 ... 10 V / 2 ... 10 V 0 ... 20 mA / 4 ... 20 mA Control signal
	M	⊥ Measuring neutral (= G0)
	U	DC 0 ... 10 V / 2 ... 10 V 0 ... 20 mA / 4 ... 20 mA Positioning feedback signal
	Z	Override input
		DC 0 ... 20 V Phase-cut signal

AC/DC 24 V Operating voltage

Application examples

The examples shown below are basic diagrams with no installation-specific details.

9H807 A

D

9H808 A

E

9/10
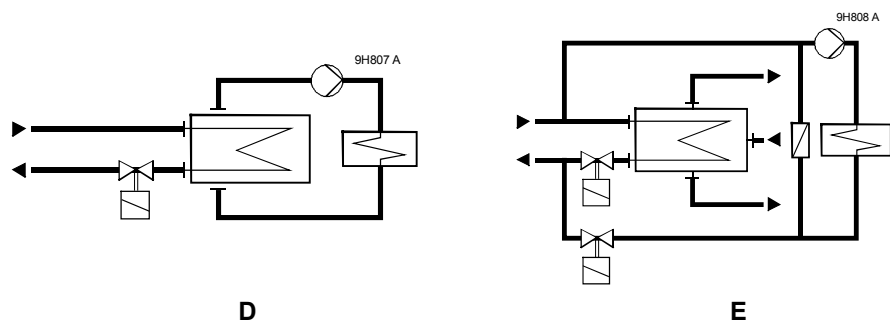
D : District heating (supply heating) system, indirect connection.

E : District heating (supply heating) system, directly connected to water-heating system

Caution ⚠ **The valve may only be used in flow direction (A – AB).. The direction of flow must be observed!**

Dimensions

4361M01
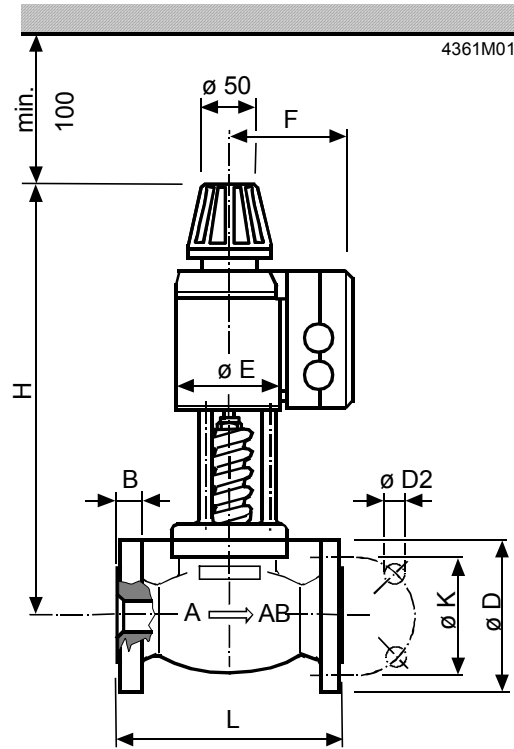
Flange dimensions to DIN2533, PN16

Type reference	DN	L [mm]	ø D [mm]	ø D2 [mm]	B [mm]	ø K [mm]	H [mm]	ø E [mm]	F [mm]	Weight [kg]
MVF461H15-0.6	15	130	95	4x14	14	65	340	80	115	8,3
MVF461H15-1.5	15	130	95	4x14	14	65	340	80	115	8,3
MVF461H15-3	15	130	95	4x14	14	65	340	80	115	8,3
MVF461H20-5	20	150	105	4x14	16	75	339	80	115	8,9
MVF461H25-8	25	160	115	4x14	16	85	346	80	115	10,0
MVF461H32-12	32	180	140	4x18	18	100	384	100	125	15,7
MVF461H40-20	40	200	150	4x18	18	110	401	100	125	17,8
MVF461H50-30	50	230	165	4x18	20	125	449	125	138	27,2

Weight incl. packaging

Subject to alteration