

ACVATIX™

## Modulating control valves with magnetic actuators, PN 16

MXG461K..



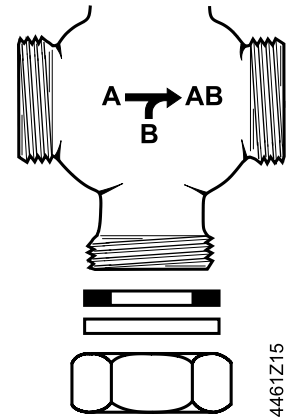
### For cooling water systems

- Permissible media temperature range: -40...130° C
- Pre-mounted stem heater for media temperatures < 0° C (AC / DC 24 V, 10 W)
- Short positioning time (< 2 s), high resolution (1 : 1000)
- Selectable valve characteristic: equal-percentage or linear
- High rangeability
- Operating voltage AC / DC 24 V
- Selectable standard signal inputs DC 0/2...10 V or DC 0/4...20 mA
- DC 0...20 V Phs phase-cut signal input for Staefa controllers
- Indication of operating state, visible from the outside
- Accurate position feedback signal by inductive stroke measurement
- Spring return facility: A to AB closed when deenergized
- Low friction, robust and maintenance-free
- Including fittings

The MXG461K.. valves are mixing or 2-port valves. They are supplied with the magnetic actuator ready fitted, equipped with an electronics module for position control and feedback. When deenergized, the valve's control path A to AB is closed. The short positioning time, high resolution and high rangeability make these valves ideal for modulating control of cooling water systems.

### When used as a 2-port valve

The MXG461K.. valves are supplied as three-port valves, but can also be used as 2-port valves. If used as a 2-port valve, close off port B with the accessories provided (brass nut, Cr-Ni steel cover and flat gasket).



## Functions

### Spring return function

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

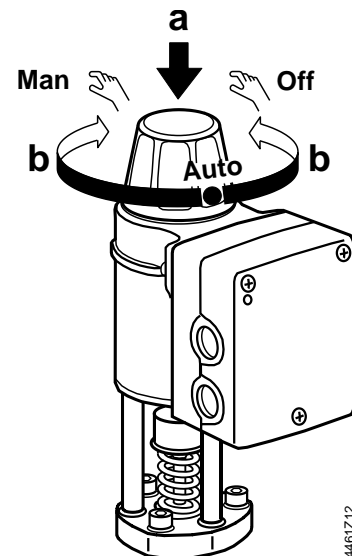
### Manual control

By pressing (a) and turning (b) the hand wheel

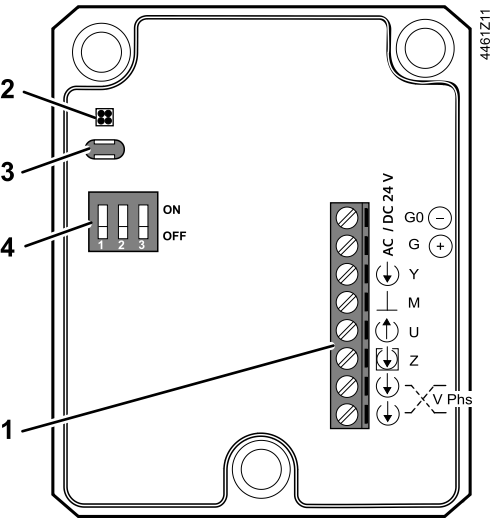
- clockwise (CW), the control path A to AB can be mechanically opened to 80 to 90 %
- counterclockwise (CCW), the actuator will be switched off and the valve closed

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.

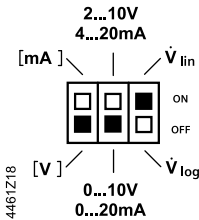
For automatic control, the hand wheel must be set to the Auto position. The green LED will be lit.



Operating and display elements in the electronics housing



- 1 Connection terminals
- 2 LED for indication of operating state
  - green
    - ok
    - calib. / Man
  - red
    - error calib.
    - error
- 3 Slot for autocalibration
- 4 DIL switch for mode controls



DIL switch

Switch	Function	ON/OFF	Description
1 4461Z19 	Positioning signal and range Y	ON	[mA]
		OFF (Factory setting)	[V]
2 4461Z20 	Positioning range Y and U	ON	2...10 V, 4...20 mA
		OFF (Factory setting)	0...10 V, 0...20 mA
3 4461Z21 	Valve characteristic	ON (Factory setting)	$\dot{V}_{lin}$ (linear)
		OFF	$\dot{V}_{log}$ (equal-percentage)

Positioning signal and range Y


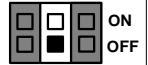

Voltage and current

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

Positioning range Y and U

Output signal U (position feedback signal) is dependent on the load resistance Ri.


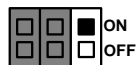
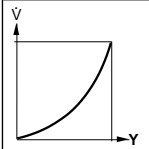
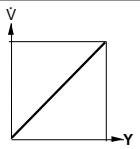
- Ri > 500 Ω, voltage signal
- Ri < 500 Ω, current signal

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

4461Z23

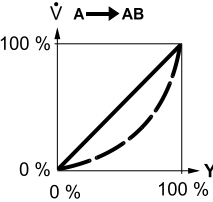
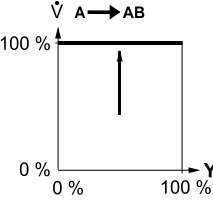
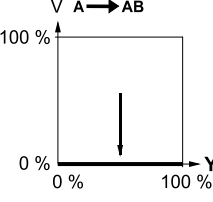
Valve characteristics selection

Equal percentage or linear

4461Z24

## Forced control input Z

Function	Transfer	Connections	Position
Z is not connected The valve will follow the Y-signal or phase-cut signal		<div style="border: 1px solid black; padding: 2px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">G0</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">G</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Y</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">M</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">U</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Z</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Phs</div> <div style="border: 1px solid black; padding: 2px;">Phs</div> </div>	No function
Z connected to G The valve will fully open via control path A to AB		<div style="border: 1px solid black; padding: 2px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">G0</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; background-color: black; color: white;">G</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Y</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">M</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">U</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; background-color: black; color: white;">Z</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Phs</div> <div style="border: 1px solid black; padding: 2px;">Phs</div> </div>	Fully open
Z connected to G0 • The valve will close via control path A to AB		<div style="border: 1px solid black; padding: 2px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; background-color: black; color: white;">G0</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">G</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Y</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">M</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">U</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; background-color: black; color: white;">Z</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Phs</div> <div style="border: 1px solid black; padding: 2px;">Phs</div> </div>	Closed

### Signal priority

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

### Calibration

If the electronics module is replaced or the actuator turned by 180 °, the valve 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.

## Operating state indicators

LED	Indicator	Function	Troubleshoot
Green	LIT	Control mode	Normal operation, everything o.k.
	Flashing	Calibration	Wait until calibration is finished (green or red LED will be lit)
		Manual operation	Hand wheel in Man or Off position
Red	LIT	Calibration error	Recalibrate (bridge contacts behind the calibration slot)
		Internal error	Replace electronics module
	Flashing	Mains fault	Check mains network (outside the frequency or voltage range)
		DC Supply - / +	Connect DC supply + / - correctly
Both	Dark	No power supply	Check mains network, check wiring
		Electronics faulty	Replace electronics module

## Technical design

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. The internal positioning controller balances any disturbance in the system rapidly and delivers the position feedback signal. The valve stroke is proportional to the positioning signal.

The magnetic actuator can be driven by a Siemens controller or a controller of other manufacturers 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. In case of DC power supply, a 4-wire connection is mandatory.

## Type summary

Type	Order number	DN	k <sub>vs</sub> [m <sup>3</sup> /h]	Δp <sub>max</sub> [kPa]	Δp <sub>s</sub> [kPa]	Operating voltage	Positioning signal	Positioning time	Spring return
MXG461K15-0.6	S55308-M100	15	0,6	1000	1000	AC /24 V DC 20...30 V	DC 0...10 V or DC 2...10 V or DC 0...20 mA or DC 4...20 mA	< 2 s	Yes
MXG461K15-1.5	S55308-M101		1,5						
MXG461K15-3	S55308-M102		3						
MXG461K20-5	S55308-M103	20	5	800	800				
MXG461K25-8	S55308-M104	25	8	700	700				
MXG461K32-12	S55308-M105	32	12	600	600				
MXG461K40-20	S55308-M106	40	20						
MXG461K50-30	S55308-M107	50	30						

$\Delta p_{max}$  = max. permissible differential pressure across the valve's control path, valid for the entire actuating range of the motorized valve

$\Delta p_s$  = max. permissible differential pressure (close off pressure) at which the motorized valve will close securely against the pressure (used as 2-port valve)

### Delivery

The valve body and the magnetic actuator form a constructive unit and cannot be separated. The Z366 stem heating element is included in the delivery and always pre-mounted. It should be switched on at medium temperatures < 0° C. It is operated with 24 V AC/DC and has an output of 10 W.

The brass / bronze fittings are included in the delivery.

## Spare parts

Type	Designation
Z366	Stem heating element for media temperatures < 0 °C, AC / DC 24 V, 10 W
ASE12	Replacement electronics module for MXG461B.., MXG461K.. and MVF461H..

## Product documentation

Topic	Title	Document ID
Operation and technical details	Modulating Magnetic Valves	N4028
Mounting	Modulating control valves, PN16, MXG461B.., MXG462S.., MXG461K.. MVF461H.. (M4360)	M4360
EU Conformity	EC declaration of conformity	22131

Related documents such as the environmental declarations, declarations of conformity, etc., can be downloaded from the following Internet address.

<https://www.siemens.com/bt/download>

## Safety

**⚠ CAUTION****National safety regulations**

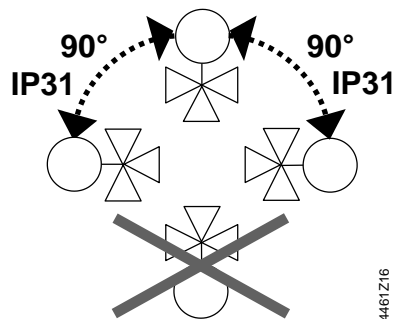
Failure to comply with national safety regulations may result in personal injury and property damage.

- Observe national provisions and comply with the appropriate safety regulations.

## Mounting

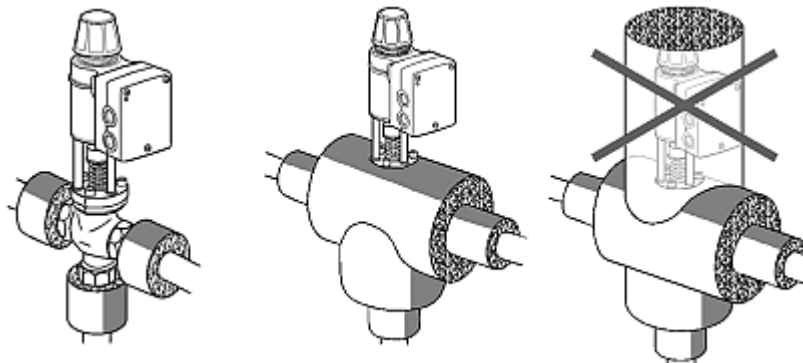
**⚠ CAUTION**

The valve may only be used as a mixing or 2-port valve, not as a diverting valve. Observe the direction of flow.





## Installation

- A strainer should be installed upstream of the valve. This increases the functional reliability of the valve.
- The MXG461K.. valves are flat-faced allowing sealing with the gaskets provided.
- Do not use hemp for sealing the valve body threads.
- The actuator must not be enclosed by the thermal insulation.
- At media temperatures below 0° C, closed-cell insulation, neatly bonded, is required to limit ice formation. See graphic in the middle.





<b>NOTICE</b>	
	In the case of separate supply for controller and valve, only one secondary transformer must be grounded.

<b>NOTICE</b>	
	<b>Damage when used at low media temperature without insulation</b> Damage of the device and loss of warranty <ul style="list-style-type: none"> <li>At media temperatures of -20 degrees and lower, thermal insulation must be installed. Use a closed-cell, neatly bonded insulation, which can be cut to size as needed.</li> </ul>

## Operation

After several weeks of valve operation at media temperatures  $< 0^{\circ}\text{C}$ , there may be a reduction in valve stroke due to ice formation, depending on the operating conditions, such as ambient temperature and humidity.

In case the valve is used as a 2-port valve, this stroke reduction leads to a reduction of the valve's  $k_{vs}$  value. In case the valve is used as a 3-port valve, it leads to leakage on port B, as it cannot be fully closed anymore.

It is important to note that this does not cause any damage to the valve. However, if these effects pose a concern or an issue, it is recommended to defrost and dry down the valve before restarting operation.

## Maintenance

The valves are maintenance-free. The low-friction and robust design eliminates the need for periodic service and ensures a long service life. The valve stem is sealed to the outside by a maintenance-free gland.


## Disposal



This symbol or any other national label indicate that the product, its packaging, and, where applicable, any batteries may not be disposed of as domestic waste. Delete all personal data and dispose of the item(s) at separate collection and recycling facilities in accordance with local and national legislation.  
For additional details, refer to [Siemens information on disposal](#).

## Warranty

Application-specific technical data must be observed. Siemens rejects any and all warranties, if the specified limits are not observed.

<b>NOTICE</b>	
	<b>Damage when used at low media temperature without insulation</b> Damage of the device and loss of warranty <ul style="list-style-type: none"> <li>At media temperatures of -20 degrees and lower, thermal insulation must be installed. Use a closed-cell, neatly bonded insulation, which can be cut to size as needed.</li> </ul>

## Power supply

Power supply	
<b>Extra low-voltage only (SELV, PELV)</b>	
Operating voltage AC 24 V	AC 24 V $\pm 20\%$ (SELV) AC 24 V class 2 (US)
Frequency	45...65 Hz
Typical power consumption Standby	< 1 W (valve closed)
External supply line protection	Fuse slow max. 10 A Circuit breaker max.13 A, characteristic B, C, D as per EN 60898-1 Power source with current limitation of max. 10 A
Operating voltage DC 24 V	DC 20...30 V
Current draw at DC 24 V	0,5 A / 4 A (max.)
<b>Input</b>	
Positioning signal Y	DC 0/2...10 V or DC 0/4...20 mA
Positioning signal Y / Phase cut signal Phs	0...20 V
Impedance DC 0/2...10 V	100 k $\Omega$ // 5nF (load < 0,1 mA)
Impedance DC 0/4...20mA	240 k $\Omega$ // 5nF
<b>Forced control Z</b>	
Impedance	22 k $\Omega$
Close valve (Z connected to G0)	<AC 1 V; <DC 0,8 V
Open valve (Z connected to G)	>AC 6 V; >DC 5 V
No function (Z not wired)	phase-cut- or positioning signal Y active
<b>Output</b>	
Position feedback signal U voltage	DC 0/2...10 V; load resistance > 500 $\Omega$
Position feedback signal U current	DC 0/4...20 mA; load resistance $\leq$ 500 $\Omega$
Stroke measurement	Inductive
Nonlinearity	$\pm 3\%$ of end value

For Typical power consumption  $P_{MED}$ , rated apparent power  $S_{NA}$  and required fuse  $I_F$ , see section **Connection type**

## Functional data

Functional data	
PN class	PN 16 to EN 1333
Permissible operating pressure (Tested at 1,5 x PN (24 bar), similar to EN 12266-1)	1600 kPa (16 bar)
Differential pressure $\Delta p_{\max} / \Delta p_s$	See section <b>Type summary</b>
Leakage rate at $\Delta p = 100 \text{ kPa}$ (1 bar)	A to AB max. 0,05% $k_{vs}$ B to AB <0,2% $k_{vs}$ depending on operating conditions
Valve characteristic (Can be selected via DIL switch)	Equal percentage, $n_{gl} = 3$ to VDI / VDE 2173 or linear, optimized near the closing point
Permissible media	Cooling water, cold water, water with anti-freeze; recommendation: water treatment to VDI 2035
Medium temperature (for media temperatures <0 °C, the Z366 stem heating element must be switched on)	MXG461K...: -40...130° C
Stroke resolution $\Delta H / H_{100}$	1 : 1000 (H = stroke)
Positioning time	< 2 s
Position when deenergized	A to AB closed
Mounting position	upright to horizontal
Mode of operation	Modulating

Materials	
Valve body, covering flange	CC499K (CuSn5Zn5Pb2-C), red brass
Seat / plug	Cr-Ni steel
Valve stem seal	EPDM (O-ring)
Fittings	Bronze / brass

Electrical connections	
Cable entries	2 x 20,5 mm diameter (for M20)
Connection terminals	Screw terminals for 4 mm <sup>2</sup> wires
Min. wire cross-section	0,75 mm <sup>2</sup>
Max. cable length	See section <b>Connection type</b>

## Connection type

Use 4-wire connection. Specifications apply to AC 24 V or DC 24 V.

Type	S <sub>NA</sub>	P <sub>MED</sub>	S <sub>TR</sub>	P <sub>TR</sub>	I <sub>F</sub>	Wire cross section [mm <sup>2</sup> ]		
						1.5	2.5	4.0
	[VA]	[W]	[VA]	[W]	[A]	max. cable length L [m]		
MXG461K 15-0.6	33	15	≥50	≥50	3.15	60	100	160
MXG461K 15-1.5								
MXG461K 15-3								
MXG461K 20-5								
MXG461K 25-8								
MXG461K 32-12	43	20	≥75	≥70	4	40	70	120
MXG461K 40-20								
MXG461K 50-30	65	26	≥100		6.3	30	50	80

S<sub>NA</sub> nominal apparent power

P<sub>med</sub> typical power consumption in the application

S<sub>TR</sub> Minimal apparent transformer power

P<sub>TR</sub> Minimum DC supply power

I<sub>F</sub> Minimal required slow fuse

L max. cable length with 4-wire connections, the max. permissible length of the separate 1.5 mm<sup>2</sup> copper positioning signal wire is 200 m

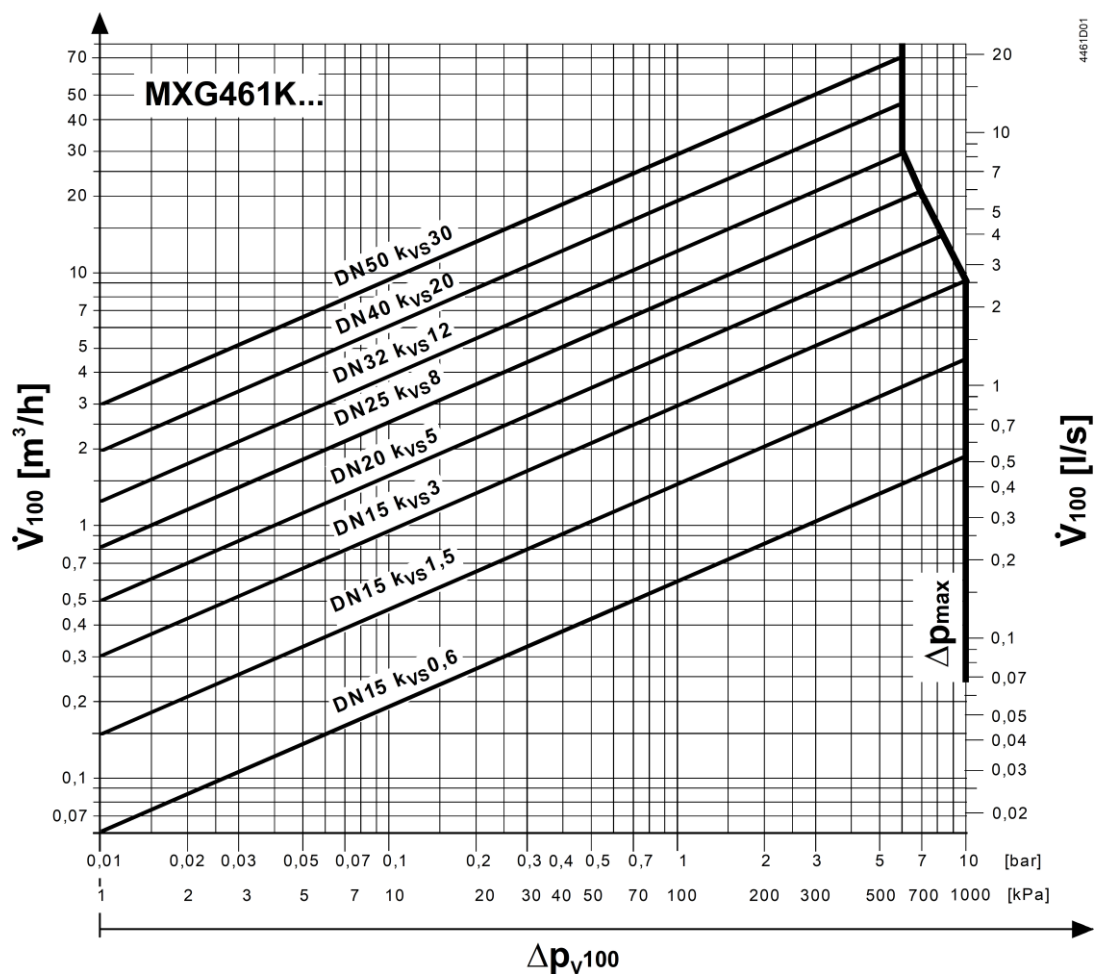
## Environmental compatibility and Standards

Ambient conditions	
Climatic ambient conditions <ul style="list-style-type: none"> <li>• Transport as per IEC/EN 60721-3-2</li> <li>• Storage as per IEC/EN 60721-3-1</li> <li>• Operation as per IEC/EN 60721-3-3</li> </ul>	<ul style="list-style-type: none"> <li>• Class 2K3 Temperature –25...+70 °C Air humidity 5...95 % r.h.</li> <li>• Class 1K3 Temperature –5...+45 °C Air humidity 5...95 % r.h.</li> <li>• Class 3K5 Temperature –5...+45 °C Air humidity 5...95 % r.h.</li> </ul>
Mechanical ambient conditions <ul style="list-style-type: none"> <li>• Operation as per IEC/EN 60721-3-6</li> </ul>	<ul style="list-style-type: none"> <li>• Class 6M2</li> </ul>

Standards, directives and approvals	
Product standard	IEC/EN 60730-1 Automatic electronic controls for household and similar use
Electromagnetic compatibility	For residential, commercial, and industrial environments
EU conformity (CE)	See EU declaration of conformity CA2T4461.1 *)
UK conformity (UKCA)	See UK declaration of conformity A5W00186230A-001 *)
RCM conformity	See RCM declaration of conformity A5W00004453 *)
UL certification	UL 873
EAC conformity	Eurasia Conformity for all MXG..
CSA certification	C22.2 No. 24
Housing protection (upright to horizontal)	IP31 to EN 60529
Vibration (In case of strong vibrations, use high-flex stranded wires for safety reasons)	IEC 60068-2-6 1 g acceleration, 1...100 Hz, 10 min
Environmental compatibility	The product environmental declaration (CE2E4461.1) contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).
<b>Pressure Equipment Directive</b>	
Directive	PED 2014/68/EU
Pressure accessories	Scope: Article 1, section 1 Definitions: Article 2, section 5
Fluid group 2	without CE-marking as per article 4, section 3 (sound engineering practice) Valves where PS x DN < 1000, do not require special testing and cannot carry the CE label

\*) The documents can be downloaded at <https://www.siemens.com/bt/download>.

Flow chart



$\Delta p_{V100}$  Differential pressure across the fully open valve and the valve's control path A to AB by a volume flow of  $\dot{V}_{100}$

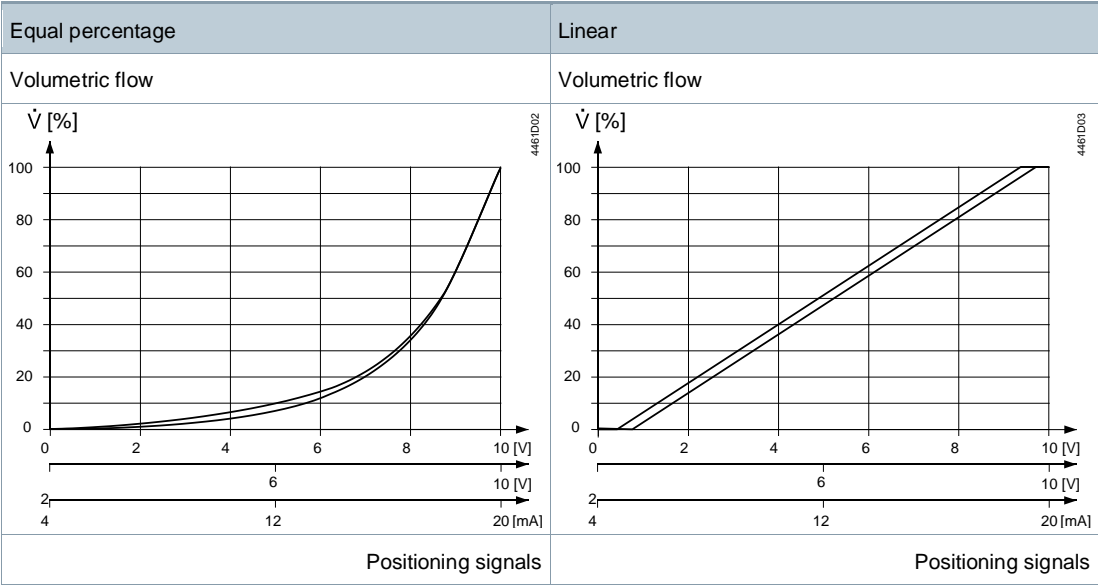
$\dot{V}_{100}$  Volume flow through the fully open valve ( $H_{100}$ )

$\Delta p_{max}$  Max. permissible differential pressure across the valve's control path for the entire actuating range of the motorized valve

100 kPa 1 bar  $\approx$  10 mWC

1 m<sup>3</sup>/h 0,278 l/s water at 20 °C

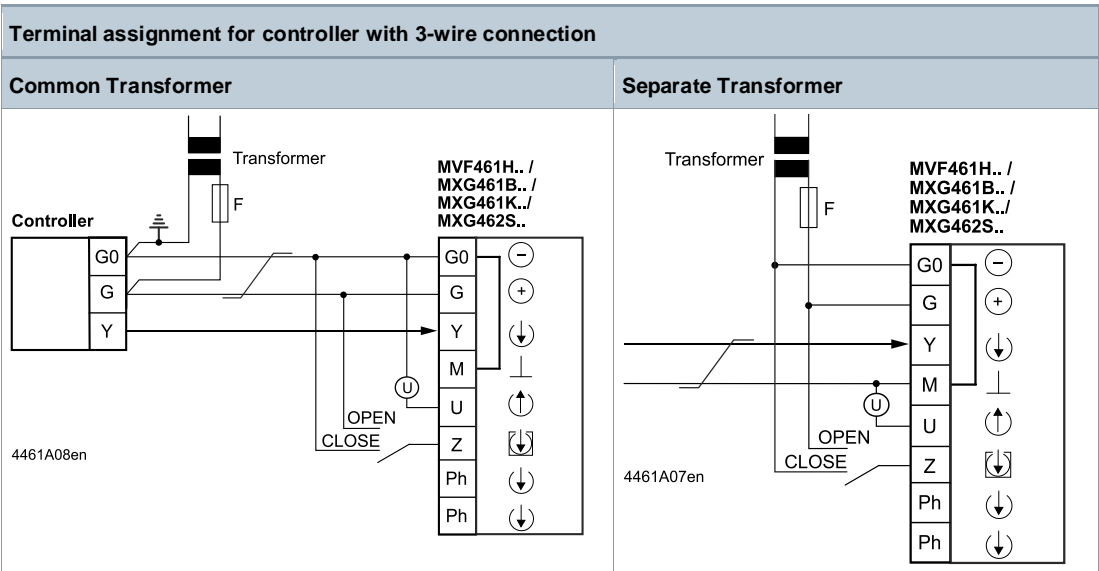
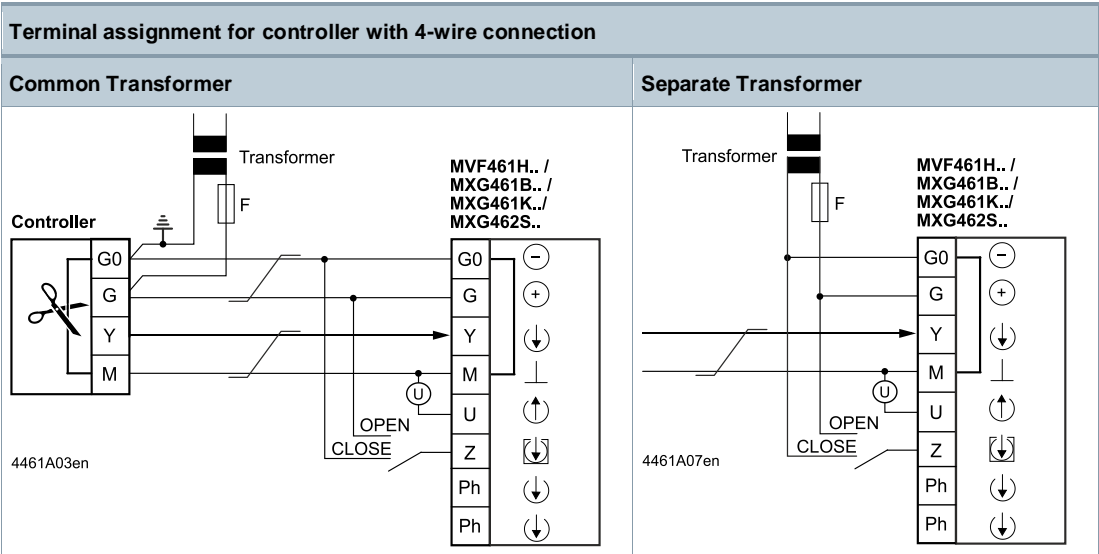
Valve characteristics



Diagrams

Connection terminals

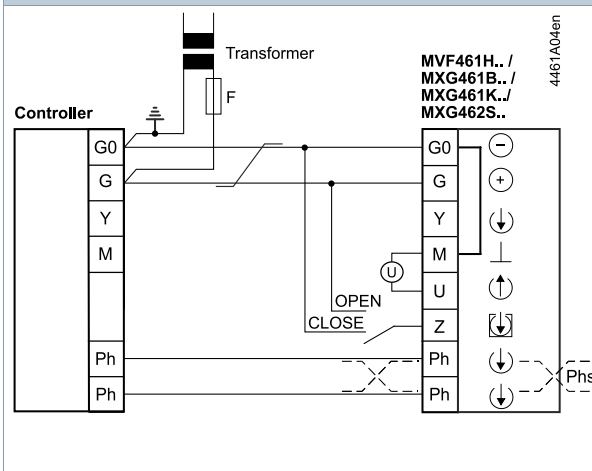
<div><div>4461A06</div><div><div><div>G0</div><div>G</div><div>Y</div><div>M</div><div>U</div><div>Z</div><div>Ph</div><div>Ph</div></div><div><div><div>⊖</div><div>⊕</div><div>⬇</div><div>⊥</div><div>⬆</div><div>⬇</div><div>⬇</div></div><div>AC / DC</div><div><div>Phs</div></div></div></div></div> <td><div>System neutral AC 24 V, DC 20...30 V</div><div>System potential AC 24 V, DC 20...30 V</div><div>Control signal DC 0/2...10 V, DC 0/4...20 mA</div><div>Measuring neutral (= G0)</div><div>Position feedback signal DC 0/2...10 V, DC 0/4...20 mA</div><div>Forced- control input Z</div><div>Phase-cut signal DC 0...20 V Phs, interchangeable, galvanically isolated</div><div>Phase-cut signal DC 0...20 V Phs, interchangeable, galvanically isolated</div></td>	<div>System neutral AC 24 V, DC 20...30 V</div> <div>System potential AC 24 V, DC 20...30 V</div> <div>Control signal DC 0/2...10 V, DC 0/4...20 mA</div> <div>Measuring neutral (= G0)</div> <div>Position feedback signal DC 0/2...10 V, DC 0/4...20 mA</div> <div>Forced- control input Z</div> <div>Phase-cut signal DC 0...20 V Phs, interchangeable, galvanically isolated</div> <div>Phase-cut signal DC 0...20 V Phs, interchangeable, galvanically isolated</div>
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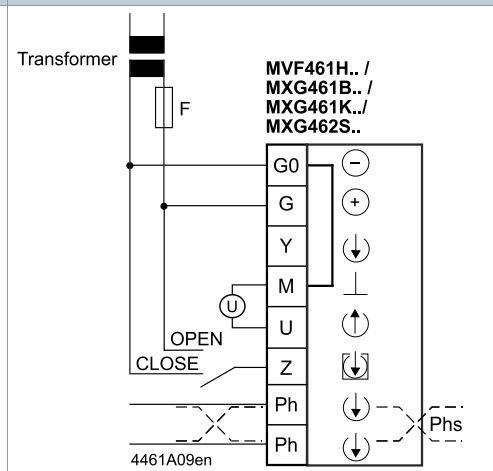


## Controllers with phase-cut DC 0...20 V Phs

### Common Transformer



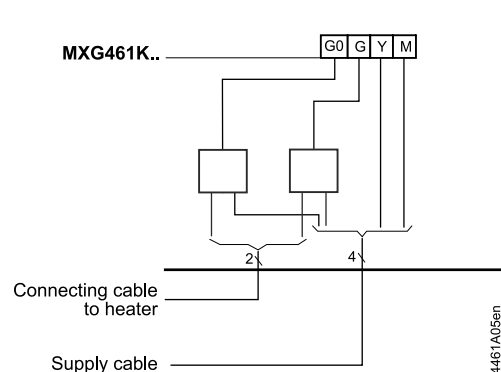
### Separate Transformer



Ⓢ = Indication of valve position (only if required). DC 0 ...10 V → 0...100 % volumetric flow V100.

⧻ = Twisted pairs. If the lines for AC 24 V power supply and the DC 0...10 V (DC 2...10 V, DC 4... 20 mA) positioning signal are routed separately, the AC 24 V line need not be twisted.

### Stem heating element Z366



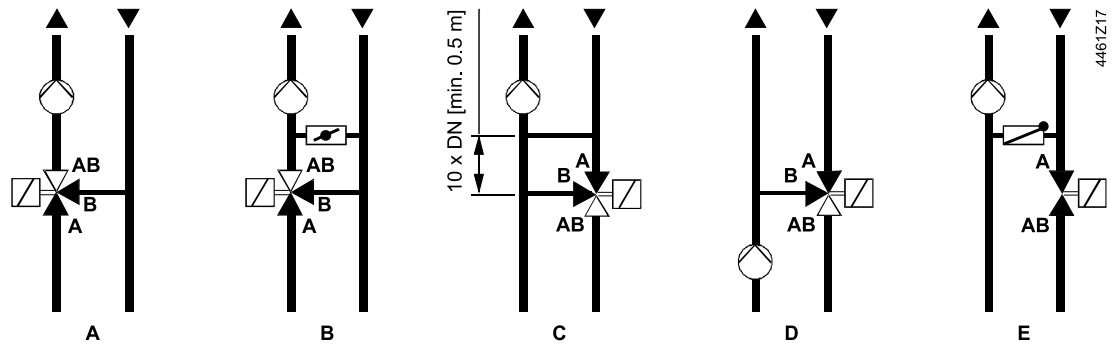
2 = AC / DC 24 V power supply for heating element

4 = Power supply, positioning signals

The required connection terminals are not included in the delivery.

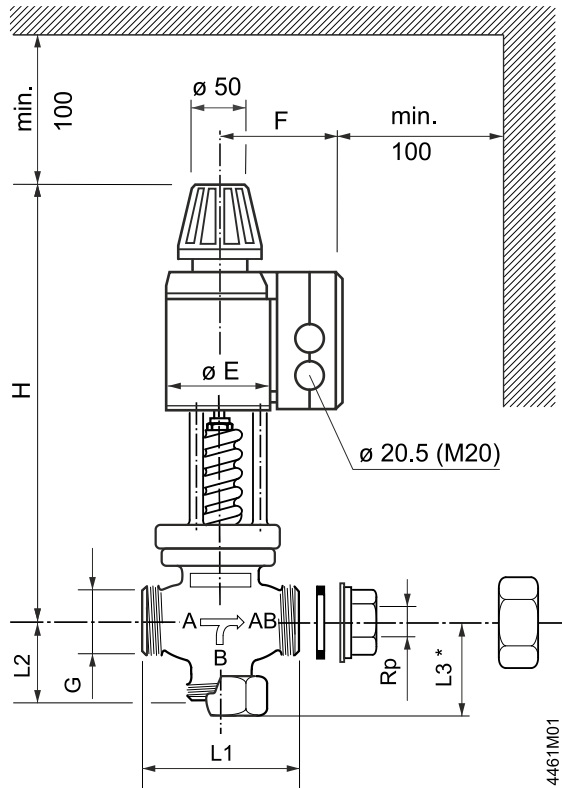
## Application examples

The examples are basic schemes without installation-specific details.



- A Mixing circuit
- B Mixing circuit with bypass
- C Injection circuit
- D Diverting circuit
- E Injection circuit with 2-port valve

## Dimensions



Externally threaded G...B to ISO 228-1

Internally threaded Rp to ISO 7-1

Fittings to ISO 49 / DIN 2950 (supplied complete with flange gaskets)

Type	DN	G [inch]	Rp [inch]	L1 mm	L2 mm	L3 mm	H mm	E mm	F mm	Weight [kg]
MXG461K15-0.6	15	G 1 B	Rp ½	80	42,5	50	340	80	115	7,1
MXG461K15-1.5	15	G 1 B	Rp ½	80	42,5	50	340	80	115	7,3
MXG461K15-3	15	G 1 B	Rp ½	80	42,5	50	340	80	115	7,3
MXG461K20-5	20	G 1¼ B	Rp ¾	95	52,5	60	339	80	115	7,7
MXG461K25-8	25	G 1½ B	Rp 1	110	56,5	64	346	80	115	8,5
MXG461K32-12	32	G 2 B	Rp 1¼	125	67,5	75	384	100	125	12,8
MXG461K40-20	40	G 2¼ B	Rp ½	140	80,5	93	401	100	125	14,6
MXG461K50-30	50	G 2¼ B	Rp 2	170	93,5	108	402	100	125	18,6

**L3 [mm]** when used as a 2-port valve

**Weight [kg]** incl. packaging

Issued by  
Siemens Switzerland Ltd  
Smart Infrastructure  
Global Headquarters  
Theilerstrasse 1a  
CH-6300 Zug  
+41 58 724 2424  
[www.siemens.com/buildingtechnologies](http://www.siemens.com/buildingtechnologies)

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