



## Operating Instruction

# Modulating refrigerant valves, PN 63

# MVS661..EX

for ammonia (R717) und CO<sub>2</sub> (R744).

- One valve type for expansion, hot-gas and suction throttle applications
- Certification per ATEX Directive 2014/34/EU
- Test certificate: SEV 17 ATEX 0110 X
- Hermetically sealed
- Selectable standard interface DC 0/2...10 V or DC 0/4...20 mA
- High resolution and control accuracy
- Precise positioning control and position feedback signal
- Short positioning time (< 1 second)
- Closed when deenergized
- Robust and maintenance-free
- DN 25 with  $k_{vs}$  values from 0.10 to 6.3 m<sup>3</sup>/h

### Note



II 3 G Ex ec IIC T4 Gc

Refrigerant valve MVS661..EX is a device per ATEX Directive 2014/34/EU Appendix II as well as per IEC 60079-0 from device group II category 3G that may be used per directive 99/92/EG (ATEX 137) in zone 2 as well as gas groups IIA, IIB, and IIC, at risk of explosion by flammable materials in the range of temperature classes T1 to T4.

The permissible ambient temperature range is -25°C to +55°C.

The housing must be protected against shock waves for a temperature range of -25 °C ≤ Tamb ≤ -15 °C. See Requirement "Environment" under Special conditions for protection against explosion, page 9.

The MVS661..EX refrigerant valve is designed for modulating control of refrigerant circuits including chillers and heat pumps. It is suitable for use in expansion, hot-gas and suction throttle applications. In addition to ammonia (R717), the valve can handle all standard safety refrigerants, noncorrosive gases / liquids and CO<sub>2</sub> (R744). It is not suited for use with inflammable refrigerants.

## Type summary

The refrigeration capacity refers to applications using ammonia.

Product number	Item no.	DN	$k_{vs}$ [m <sup>3</sup> /h]	$k_{vs}$ reduced [m <sup>3</sup> /h]	$\Delta p_{max}$ [MPa]	$Q_0 E$ [kW]	$Q_0 H$ [kW]	$Q_0 D$ [kW]	$S_{NA}$ [VA]	$P_{med}$ [W]
MVS661.25-016EX	S55320-M110	25	0,16	0,10	2,5	95	10	2	22	12
MVS661.25-0.4EX	S55320-M111	25	0,40	0,25		245	26	5		
MVS661.25-1.0EX	S55320-M112	25	1,0	0,63		610	64	12		
MVS661.25-2.5EX	S55320-M113	25	2,5	1,6		1530	159	29		
MVS661.25-6.3EX	S55320-M114	25	6,3	4,0		3850	402	74		

$k_{vs}$  = Nominal flow rate of refrigerant through the fully open valve ( $H_{100}$ ) at a differential pressure of 100 kPa (1 bar) to VDI 2173  
If required  $k_{vs}$ -value and refrigeration capacity  $Q_0$  can be reduced to 63 %, refer to "k<sub>vs</sub> reduction" on page 3

$\Delta p_{max}$  = Maximum permissible differential pressure across the control path A → AB of the valve, valid for the entire actuating range of the motorized valve

$Q_0 E$  = Refrigeration capacity in expansion applications

$Q_0 H$  = Refrigeration capacity in hot-gas bypass applications

$Q_0 D$  = Refrigeration capacity in suction throttle applications and  $\Delta p = 0.5$  bar

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


$P_{med}$  = typical power consumption

The pressure drop across evaporator and condenser is assumed to be 0.3 bar each, and 1.6 bar upstream of the evaporator (e.g. spider).

The capacities specified are based on superheating by 6 K and subcooling by 2 K.

## Accessories

Valve insert ASR..N

Product number	DN	$k_{vs}$ [m <sup>3</sup> /h]	
ASR0.16N	25	0,16	
ASR0.4N	25	0,40	
ASR1.0N	25	1,0	
ASR2.5N	25	2,5	
ASR6.3N	25	6,3	

The replacement valve insert ASR...N can be used to completely renew the valve when resizing a plant or after considerable wear and tear.

The valve insert includes mounting instructions, 74 319 0486 0.

The selection software "Refrigeration VASP" calculates the capacity for various refrigerants and operating conditions for all three applications. The "Refrigeration VASP" software selection tool is available from your local Siemens office.

## Ordering

Valve body and magnetic actuator form one integral unit and cannot be separated.

Example:

Product number	Stock number	Designation
MVS661.25-0.4EX	S55320-M111	Ex-certified refrigerant valve

**Spare parts**  
Replacement electronics ASR61EX

Should the valve's electronics become faulty, the entire electronics housing is to be replaced by spare part ASR61EX, which is supplied complete with Mounting Instructions (A5W00036611).

Rev. no. See table on page 14.

**Technical design / functions**

**Features and benefits**

- 4 selectable standard signals for setpoint and measured value
- DIL switch to reduce the  $k_{vs}$  value to 63 % of the nominal value
- Potentiometer for adjustment of minimum stroke for suction throttle applications
- Automatic stroke calibration
- Forced control input for "Valve closed" or "Valve fully open"
  
- LED for indicating the operating state

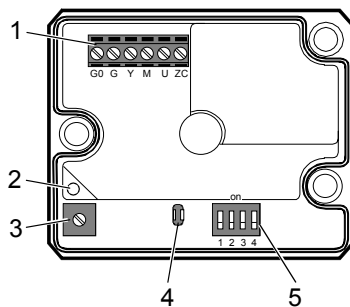
**Control**

The MVS661..EX refrigerant valve can be driven by Siemens or third-party controllers that deliver a DC 0/2...10 V or DC 0/4...20 mA output signal. For optimum control performance, we recommend a 4-wire connection between controller and valve. When operating on DC voltage, a 4-wire connection is **mandatory!** The valve stroke is proportional to the control signal.

**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 control path 1 → 3.

**Operator controls and indicators in the electronics housing**



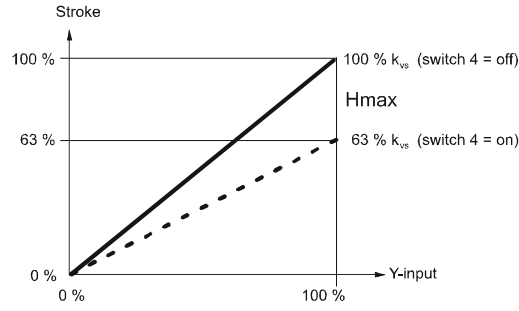
- 1 Connection terminals
- 2 LED for indication of operating state
- 3 Minimal stroke setting potentiometer Rv
- 4 Autocalibration
- 5 DIL switches for mode control

**Configuration of DIL switches**

Switch	Function	ON / OFF	Description
	Positioning signal Y	ON	Current [mA]
		OFF	<b>Voltage [V]</b> <sup>1)</sup>
	Positioning range Y and U	ON	DC 2...10 V, 4...20 mA
		OFF	<b>DC 0...10 V, 0...20 mA</b> <sup>1)</sup>
	Position feedback U	ON	Current [mA]
		OFF	<b>Voltage [V]</b> <sup>1)</sup>
	Nominal flow rate $k_{vs}$	ON	63 %
		OFF	<b>100 %</b> <sup>1)</sup>

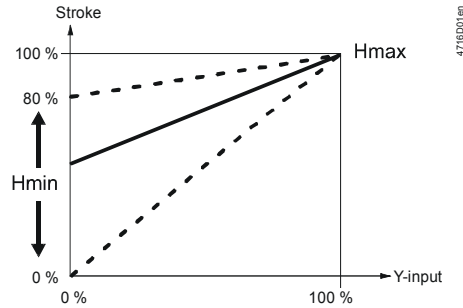
<sup>1)</sup> Factory setting

**k<sub>vs</sub>-reduction**



When  $k_{vs}$  reduction (DIL switch 4 in position ON) the stroke will be limited to 63 % mechanical stroke. 63 % of full stroke then corresponds to an input / output signal of 10 V. If, in addition, the stroke is limited to 80 %, for example, the minimum stroke will be  $0.63 \times 0.8 = 0.50$  of full stroke.

**Minimum stroke setting**



In the case of the suction throttle valve, it is essential that a minimum stroke limit be maintained to ensure compressor cooling and efficient oil return. This can be achieved with a reinjection valve, a bypass line across the valve, or a guaranteed minimum opening of the valve. The minimum stroke can be defined via the controller and control signal Y, or it can be set directly with potentiometer Rv.

The **factory setting** is zero (mechanical stop in counterclockwise direction, CCW). The minimum stroke can be set by turning the potentiometer clockwise (CW) to a maximum of 80 %  $k_{vs}$ .

Attention

**Under no circumstances must potentiometer Rv be used to limit the stroke on expansion applications. It must be possible to close the valve fully.**

**Forced control input ZC**

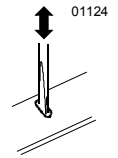
		ZC – Function		
		no function	fully open	closed
Connections				
	Transfer			
function		<ul style="list-style-type: none"> <li>• ZC not connected</li> <li>• Valve will follow the Y-signal</li> <li>• Minimum stroke set-ting with potentiometer Rv possible</li> </ul>	<ul style="list-style-type: none"> <li>• ZC connected to G</li> <li>• Valve will fully open control path A → AB</li> </ul>	<ul style="list-style-type: none"> <li>• ZC connected to G0</li> <li>• Valve will close control path A → AB</li> </ul>

**Signal priority**

1. Forced control signal ZC
2. Signal input Y and/or minimum stroke set-ting with potentiometer Rv possible

## Calibration

The printed circuit board of the MVS661..EX has a slot to facilitate calibration. To make the calibration, insert a screwdriver in the slot so that the contacts inside are connected. As a result, the valve will first be fully closed and then fully opened.



Calibration matches the electronics to the valve's mechanism.






During the calibration process the green LED flashes for about 10 seconds; refer to "Indication of operating state" (page 5).

**MVS661..EX refrigerant valves are supplied fully calibrated.**

When is a calibration required?

Execute a calibration after replacing the electronics, when the red LED is on or when the valve is leaking (at seat).

## Indication of operating state

LED	Indication	Function	Remarks, troubleshooting
Green	Lit 	Control mode	Automatic operation; everything o.k.
	Flashing 	Calibration in progress	Wait until calibration is finished (green or red LED will be lit)
Red	Lit 	Calibration error Internal error	Recalibrate (operate button in opening 1x) Replace electronics module
	Flashing 	Mains fault	Check mains network (outside the frequency or voltage range)
Both	Dark 	No power supply Electronics faulty	Check mains network, check wiring Replace electronics module

## Connection type <sup>1)</sup>

The 4-wire connection should always be given preference!

4-wire connection  
3-wire connection

Product number	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> ]		
	[VA]	[W]	[VA]	[W]	[A]	1,5	2,5	4,0 <sup>2)</sup>
MVS661..EX	32	12	≥ 50	≥ 40	1,6...4 A	65	110	160
MVS661..EX	32	12	≥ 50	≥ 40	1,6...4 A	20	35	50

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

P<sub>MED</sub> = typical power consumption (Application)

S<sub>TR</sub> = Minimum transformer apparent power

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

I<sub>F</sub> = Minimum required slow-blow 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

1) All information at AC 24 V or DC 24 V

2) With 4 mm<sup>2</sup> electrical wiring reduce wiring cross-section for connection inside valve to 2.5 mm<sup>2</sup>.

For accurate valve sizing, we recommend using the "Refrigeration VASP" software sizing tool, available from your local Siemens office.

Engineering notes

Additional installation notes may also need be observed as well as the use of proper safety elements (e.g. pressure switches, motor protection) depending on the particular application.

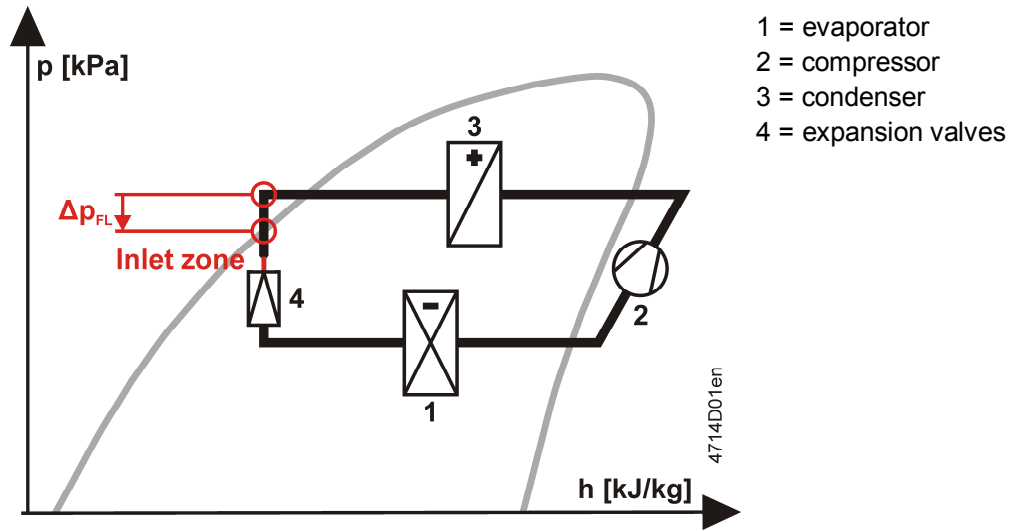
**Warning** 

In order not to damage the seal inside the valve insert, the plant must be vented on the low-pressure side after the pressure test has been made (valve port AB), or the valve must be fully open during the pressure test and during venting (power supply connected and positioning signal at maximum or forced opening by G → ZC).

**Expansion application**

To prevent the formation of flash gas on expansion applications, the velocity of the refrigerant in the fluid pipe must not exceed 1 m/s. To assure this, the diameter of the fluid pipe must under certain circumstances be greater than the nominal size of the valve.

Engineering notes



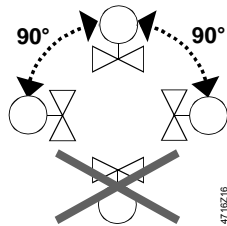
- a) The differential pressure over reduction must be less than half the differential pressure  $\Delta p_{FL}$ .
- b) The inlet path between diameter reduction and expansion valve inlet
  - Must straight for at least 600 mm
  - May not contain any valves

**A filter / dryer must be mounted upstream of the expansion valve.**

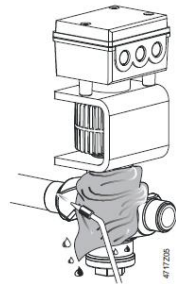
Use only properly qualified technicians to mount and commission the valve. The same applies to replacement electronics and configuring the controller (e.g. SAPHIR or Poly-Cool).



Comply with all requirements per EN 60079-14 for use/installation of the valve. Additional installation notes may also need be observed as well as the use of proper safety elements (e.g. pressure switches, motor protection) depending on the particular application..



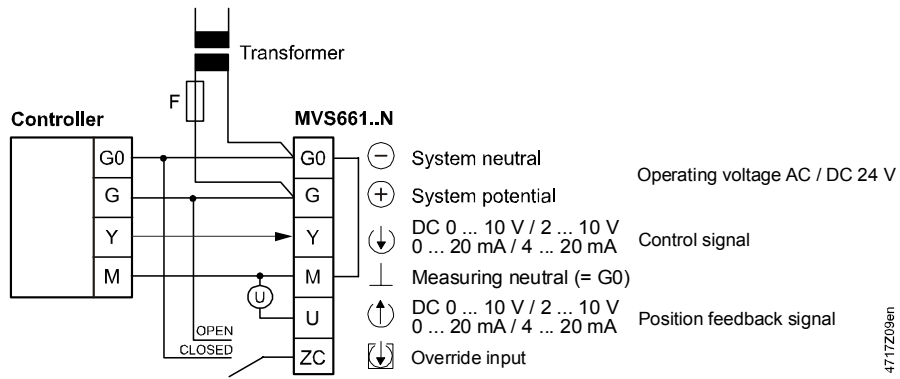
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- The refrigerant valves can be mounted in any orientation, but upright mounting is preferable.
- Arrange the pipe work in such a way that the valve is not located at a low point in the plant where oil can collect.
- The pipes should be fitted in such a way that the alignment does not distort the valve connections. Fix the valve body so that that it cannot vibrate. Vibration can lead to burst connection pipes.
- Before soldering the pipes, ensure that the direction of flow through the valve is correct.
- The pipes must be soldered with care. To avoid dirt and the formation of scale (oxide), inert gas is recommended for soldering.
- The flame should be large enough to ensure that the junction heats up quickly and the valve does not get too hot.
- The flame should be directed away from the valve.
- During soldering, cool the valve with a wet cloth, for example, to ensure that it does not become too hot.
- Port B must be sealed off when a 2-port valve (AB → A) is used.
- The valve body and the connected pipe work should be lagged.
- The actuator must not be lagged.
- The valve has a mechanical shut-off function that is Normally Closed (NC) without power. This must be observed during commissioning and servicing work.

The valve is supplied complete with Mounting Instructions A5W00034456.

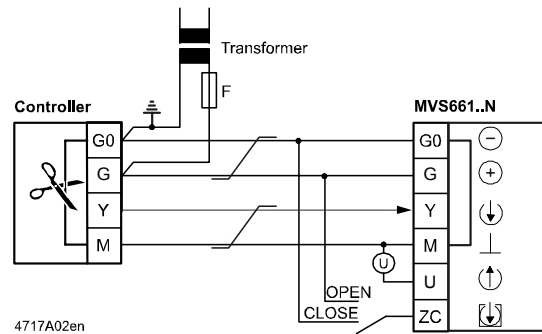
## Connection terminals



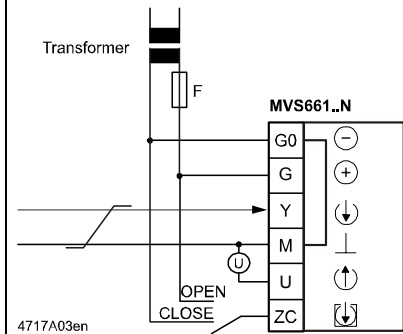
## Connection diagrams

**Terminal assignment for controller with 4-wire connection (to be preferred!)**

### Common Transformer

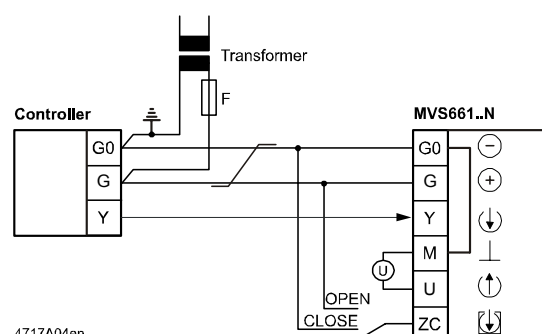


### Separate Transformer

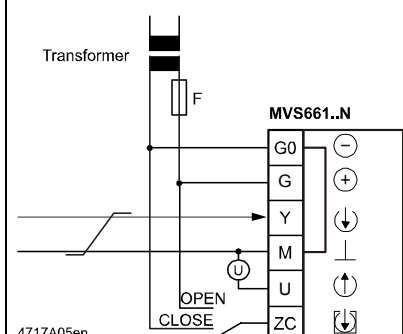


**Terminal assignment for controller with 3-wire connection**

### 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 0...20 mA, DC 4...20 mA) positioning signal are routed separately, the AC 24 V line need not be twisted.

**Warning**

**Piping must be connected to potential earth!**

**Ground only one transformer on the secondary side if the controller and valve are powered separately.**

**Caution**

**In case of DC power supply, a 4-wire connection is mandatory!**

**DIL switch**

Factory setting: Valve characteristics equal-percentage, positioning signal DC 0...10 V. Details see "Configuration DIL switches", page 3.

**Calibration**

See "Calibration", page 5.





## Special conditions of safe use for Ex Equipment

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Cabling and conduits	The MVL661 *** refrigerating valve are to be connected via cable and corresponding Ex certified cable glands suitable for this purpose.
Cable and conduit entries	The unused inlet openings with predefined breakouts locations shall be closed with separate "Ex e" sealing plugs.
Protection class	The degree of protection (solid foreign objects, dust and water protection) according to IEC / EN 60529, at least IP 65 during installation and operation, is achieved only if the cable and wiring entries and, if applicable, blanking elements are correctly used.
Protection against UV-radiation	The refrigerating valves MVL661 *** and MVS661 must be installed in such a way that it is adequately protected against sunlight or other sources of UV radiation.
Exceeding rated voltage	Actions must be taken either within or outside of the equipment (cold valve MVL661 *** and MVS661 ***) which prevent the rated voltage from exceeding transient faults by more than 40% (transient protection).
Environment	In order not to exceed the maximum permissible temperatures on the electronics housing and the solenoid valve, the valve must be installed lying (horizontal) at $40\text{ }^{\circ}\text{C} < T_{amb} < 55\text{ }^{\circ}\text{C}$ and $80\text{ }^{\circ}\text{C} < T_{med} < 120\text{ }^{\circ}\text{C}$ .
Cleaning	Due to the risk of electrostatic charging, the appliance may only be cleaned with a damp cloth.
Grounding	It is ensure that the refrigerating valve is earthed through the pipe fittings.
Housing protection	At the temperature range of $-25\text{ }^{\circ}\text{C} \leq T_{amb} \leq -15\text{ }^{\circ}\text{C}$ the electronic enclosure must be protected against impacts.


## Maintenance notes

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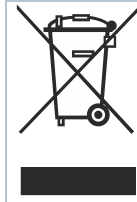
	The refrigerant valve is maintenance-free.
Valve repair	If the valve's interior is subject to considerable wear and tear, you can renew the valve using valve insert ASR...N. (Mounting instructions 74 319 0486 0). Otherwise, the valve cannot be repaired.
Replacement electronics	Simply exchange the connection housing on a defective valve electronics with the replacement part ASR61EX. The replacement electronics include mounting instructions A5W00036611.

**Warning**  **Do not plug in or remove the connection housing when connected to power.**

A calibration must be triggered after replacing to ensure the electronics are optimally matched to the valve (See "Calibration", page 5).

**Warning**  The actuator gets hot at operating states at the edge of the application data, but there is no risk of fire. Maintain a minimum distance to wall, see "Dimensions", page 13.

## Disposal



The device is considered electrical and electronic equipment for disposal in terms of the applicable European Directive and may not be disposed of as domestic garbage.

- Dispose of the device through channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

## Warranty


Application-specific technical data must be observed.

**If specified limits are not observed, Siemens Building Technologies / CPS Products will not assume any responsibility.**

## Technical data

### Functional actuator data

Power supply	Extra low-voltage only (SELV, PELV)	
AC 24 V	Operating voltage	AC 24 V $\pm$ 20% (SELV) or AC 24 V class 2 (US)
	Frequency	45...65 Hz
	Typical power consumption	$P_{med}$ 12 W Stand by < 1 W (valve closed)
	Rated apparent power $S_{NA}$	32 VA (for selecting the transformer)
	Required fuse $I_F$	1.6...4 A, slow
	External supply line protection	Fuse slow max. 10 A or Circuit breaker max. 13 A Characteristic B, C, D according to EN 60898 or Power source with current limitation of max. 10 A
DC 24 V	Operating voltage	DC 20...30 V
	Current draw	0,5 A / 2 A (max.)
Signal inputs	Positioning signal Y	DC 0/2...10 V or DC 0/4...20 mA
	Impedance	DC 0/2...10 V 100 k $\Omega$ // 5nF (load < 0,1 mA) DC 0/4...20 mA 240 $\Omega$ // 5nF
	Forced control ZC	
	Input impedance	22 k $\Omega$
	Close valve (ZC connected to G0)	< AC 1 V; < DC 0,8 V
	Open valve (ZC connected to G)	> AC 6 V; > DC 5 V
	No function (ZC not wired)	Positioning signal Y active
Signal outputs	Position feedback U	Voltage DC 0/2...10 V; load resistance $\geq$ 500 $\Omega$ Current DC 0/4...20 mA; load resistance $\leq$ 500 $\Omega$
	Stroke measurement	Inductive
	Nonlinearity	$\pm$ 3 % of end value
Positioning time	Positioning time	< 1 s
Electrical connection	Cable entry	3 x $\varnothing$ 17 mm (for M16)
	Minimal wire cross-section	0.75 mm <sup>2</sup>
	Maximum wire cross-section	2.5 mm <sup>2</sup>
	Tightening torque (terminal block)	0.5 – 0.6 Nm <sup>1)</sup>

	Maximum cable length	Refer to "Connection type", page 5		
<b>Functional valve data</b>	Permissible operating pressure	max. 6.3 MPa (63 bar) <sup>1)</sup>		
	Differential pressure $\Delta p_{\max}$	2.5 MPa (25 bar)		
	Valve characteristic (stroke, $k_v$ )	linear (to VDI / VDE 2173)		
	Leakage rate (internally across seat)	max. 0,002 % $k_{vs}$ resp. max. 1 NI/h gas at $\Delta p = 4$ bar Shut/off function, like solenoid normally closed (NC) function		
	External seal	hermetically sealed!		
	Permissible media	Ammonia (R717) and CO <sub>2</sub> (R744)		
	Media temperature at valve inlet (A)	-0...120 °C; max. 140 °C for 10 min		
	Media temperature at valve outlet (AB)	-40...120 °C; max. 140 °C for 10 min		
	Stroke resolution $\Delta H / H_{100}$	1 : 1000 (H = stroke)		
	Hysteresis	typically 3 %		
	Mode of operation	modulating		
	Position when deenergized	control path A → AB closed		
	Mounting position	Upright to horizontal <sup>3)</sup>		
	<b>Materials</b>	Valve body	steel / CrNi steel	
Seat / piston		CrNi steel		
Sealing disk / O-rings		PTFE / CR (chloroprene)		
<b>Dimensions and weight</b>	Dimensions	refer to "Dimensions", page 13		
	Weight	5.17 kg		
<b>Pipe connections</b>	Solder (weld-on-ends)	Referring to EN 1092-1 and ASME B16.25 schedule 40		
		Inner diameter	22.4 mm	
		Outer diameter	33.7 mm	
<b>Standards, directives and approvals</b>	Electromagnetic compatibility (Application)	For use in residential, commercial and light-industrial environments		
	Product standard	EN60730-x Automatic electrical controls for household and similar use		
	EU Conformity (CE)	A5W00038747 <sup>4)</sup>		
	Electrical safety	EN 60730-1		
	Protection class	Class III to EN 60730		
	Pollution degree	Degree 2 to EN 60730		
	Housing protection			
	Upright to horizontal	IP65 to EN 60529 <sup>2)</sup>		
	Vibration <sup>5)</sup>	EN 60068-2-6 5 g acceleration, 10...150 Hz, 2.5 h (5 g horizontal, max. 2 g upright)		
	Environmental compatibility	The product environmental declaration contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).		
	ATEX directive area	2014/34/EU <sup>6)</sup>		
	ATEX certification		II 3G Ex ec IIC T4 Gc SEV 17 ATEX 0110 X	
	Housing protection	Electronics <sup>7)</sup>		
	Permissible operating pressure	PED 2014/68/EU		
Pressure accessories	Scope: Article 1, section 1 Definitions: Article 2, section 5			

Fluid group 1 Without CE-marking as per article 4, section 3  
(sound engineering practice)

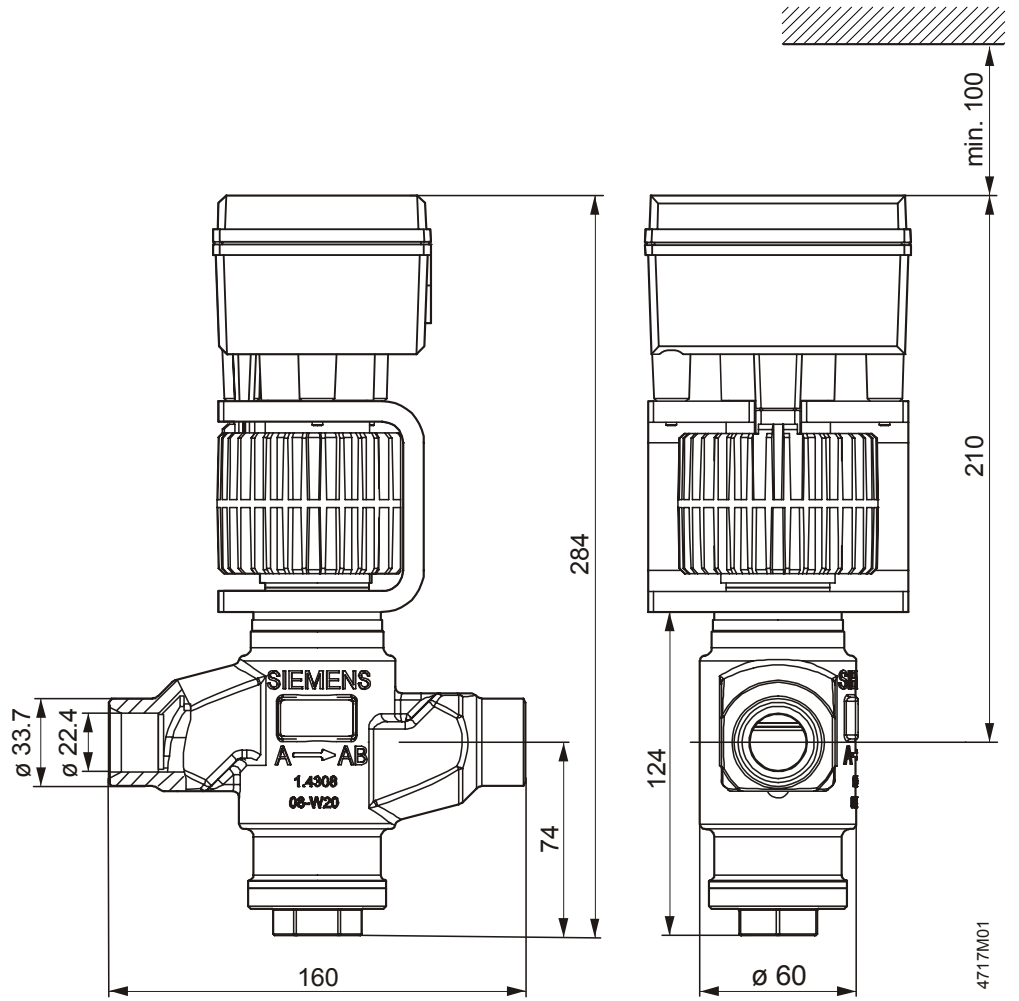
**General  
environmental conditions**

	<b>Operation</b> EN 60721-3-3	<b>Transport</b> EN 60721-3-2	<b>Storage</b> EN 60721-3-1
Climatic conditions	Class 3K6	Class 2K3	Class 1K3
Temperature	-25...55 °C <sup>7)</sup>	-25...70 °C	-5...45 °C
Humidity	10...100 % r. h.	< 95 % r. h.	5...95 % r. h.

- 1) Use the appropriate ferrules on multistrand wiring. Use the appropriate double ferrules when using two wires per connection.
- 2) To EN 12284 tested with 1,43 x operating pressure at 90 bar
- 3) At 45 °C < Tamb < 55 °C and 80 °C < Tmed < 120 °C the valve must be installed on its side to avoid shortening the service life of the valve electronics
- 4) The documents can be downloaded from <http://siemens.com/bt/download>.
- 5) Use high-flex stranded wires for safety reasons.
- 6) Comply with the special conditions on page 9 and requirements per EN 60079-14 on applications in potentially explosive atmospheres.
- 7) The electronic housing must be protected against shock waves at a temperature range of -25 °C ≤ Tamb ≤ -15 °C.

# Dimensions

Dimensions in mm



## ATEX label

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Siemens Switzerland Ltd, 6300 Zug, Switzerland  
Type MVL661\*\*\* / MVS661\*\*\*

II 3G Ex ec IIC T4 Gc  
SEV 17 ATEX 0110 X

WARNING – POTENTIAL  
ELECTROSTATIC CHARGING  
HAZARD – SEE INSTRUCTIONS

## Revision numbers

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Product number	Valid from rev. no.
MVS661.25-016EX	A
MVS661.25-0.4EX	A
MVS661.25-1.0EX	A
MVS661.25-2.5EX	A
MVS661.25-6.3EX	A

Issued by  
Siemens Switzerland Ltd  
Building Technologies Division  
International Headquarters  
Gubelstrasse 22  
6301 Zug  
Switzerland  
Tel. +41 58-724 24 24  
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