SIEMENS

Technical Instructions
Document No. 125-4461
March 19, 2014

MXG461B Series

Modulating Control Valves with Magnetic Actuators, Positioning Control and Position Feedback for Domestic Water

Description

Control valves with magnetic actuators, for modulating control of domestic water, cold water and hot water systems.

Features

- Fast positioning time (< 2 seconds)
- Selectable valve characteristic: Equal percentage or linear
- Selectable standard interface: 0/2 to 10 Vdc or 0/4 to 20 mA
- High resolution (>1:1000)
- High rangeability
- Wear-free inductive stroke measurement
- Spring return A → AB closed when de-energized
- Positioning control and position feedback signal
- Low-friction, heavy-duty and maintenance-free
- Accepts 0 to 20 Vdc phase-cut control signal input

Product Numbers

See Table 1.

Warning/Caution Notations

WARNING:	⚠	Personal injury or loss of life may occur if you do not follow the procedures as specified.
CAUTION:	⚠	Equipment damage or loss of data may occur if you do not follow the procedures as specified.

Application

The MX4G61B Series valves are through-port or mixing valves with magnetic actuators. The actuator is equipped with an electronics module for positioning control and position feedback. If the power is off, the valve control path A → AB is closed.

The short positioning time, high resolution and high rangeability make these valves ideal for modulating control of domestic, hot and cold water systems.

Table 1. Product Numbers.

Product Number	Line Size (in)	Cv	Δp_S (psi)	Δp_{max} (psi)	S_{NA} (VA)	Pmed (W)	I_N Fuse	Wire Gauge (AWG) 16	14 L (ft)	12
MXG461B15-0.6	1/2	0.7	145	70	33	15	3.15	130	215	360
MXG461B15-1.5	1/2	1.8	145	70	33	15	3.15	130	215	360
MXG461B15-3	1/2	3.5	145	70	33	15	3.15	130	215	360
MXG461B20-5	3/4	5.8	116	70	33	15	3.15	130	215	360
MXG461B25-8	1	9.3	102	40	33	15	3.15	130	215	360
MXG461B32-12	1-1/4	14	87	40	43	20	4	100	165	260
MXG461B40-20	1-1/2	23	87	40	43	20	4	100	165	260
MXG461B50-30	2	35	87	40	65	22	6.3	65	100	185

Key:

Δp_{max} = Maximum permissible differential pressure across the valve's control path, valid for the entire actuating range of the motorized valve (maximum recommended operating differential pressure).
Δp_S = Maximum permissible differential pressure at which the motorized valve will close securely against the pressure (close-off pressure).
S_{NA} = Nominal apparent power for selecting the transformer.
Pmed = Average true power.
I_N = Slow fuse (mandatory).
Cv = Nominal flow rate of cold water [41°F to 86°F (5°C to 30°C)].
L = Maximum cable length. With four-wire connections the maximum permissible length of the separate 14 AWG Cu signal cable is 656 feet (200 m).

Ordering

- The valve body and magnetic actuator assemblies cannot be separated.
- The brass/bronze fittings are included.
- The Z366 stem heater must be ordered separately.
- When placing an order, specify the quantity, product number and description.

Example: 1 MXG461B15-0.6 valve and 1 Z366 stem heater

Accessories

Z366 Stem heater for 24 Vac/10W. Required for medium temperatures <32°F (0°C).

ASE12 Replacement Circuit Board

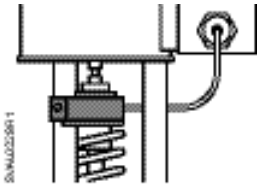


Figure 1.

Technical/ Mechanical Design

Operation 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 according to 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. This enables 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 any controller with a 0/2 to 10 Vdc or 0/4 to 20 mA output signal.

To achieve optimum control performance, it is recommended to use a 4-wire connection for the valve.

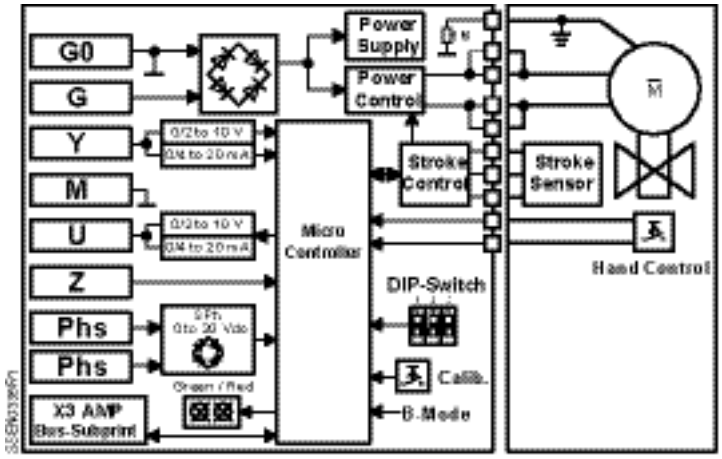
NOTE: When using a dc power supply a 4-wire connection is **mandatory**.

The controller's signal ground terminal M must be connected to the valve's terminal M. Terminals M and G0 have the same potential, and are internally interconnected in the valve's electronics.

CAUTION:

You must use a four-wire connection with Vdc power supply.

Basic Diagram



Spring Return Action

If the power or positioning signal is switched off or fails, the valve control path (port A → AB) is automatically closed by the force of the spring.

Table 2. Indication of Operating State.

LED	Indication	Operating State, Function	Remarks, Troubleshooting
Green	Lit	Control mode	Normal operation; everything OK.
	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	Recalibrate (bridge contacts behind the calibration slot).
		Internal error	Replace electronics module.
	Flashing	Mains fault	Check electric main network (outside the frequency or voltage range);
		DC Supply -/+	Vdc supply +/- connection polarity.
Both	Dark	No power supply	Check electric main network, check wiring.
		Electronics faulty	Replace electronics module.

Manual Adjustment

Press (**a**) and turn the hand wheel (**b**):

- clockwise (CW). Control path A → AB can be mechanically opened to between 80% and 90%, or
- 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, the input signal Y, nor 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.

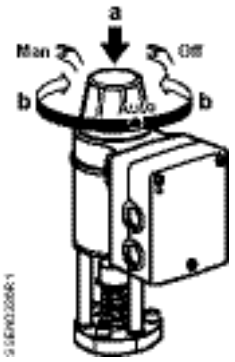


Figure 2.

Calibration

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

The printed circuit board has a slot (see Figure 3). Calibrate by bridging the contacts located behind the slot on the printed circuit board, 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 (see *Indication of Operating State*).

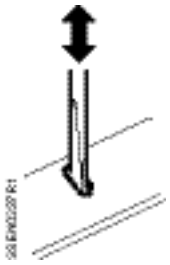


Figure 3.

DIP Switches

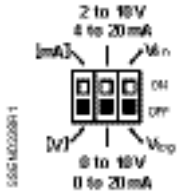


Figure 4. Configuration DIP Switches.

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 to 10 Vdc, 0 to 20 mA	2 to 10 Vdc, 4 to 20 mA	Offset settings of input and output
3 ON OFF	Characteristic	V_{log} (equal percentage)	V^{lin} (linear)	–

DIP Switches, Continued

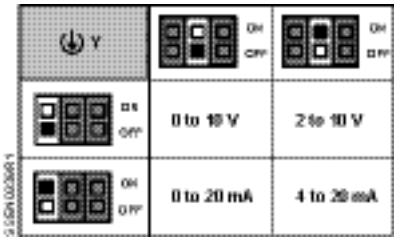


Figure 5. Assignment of Positioning Signal Y: Voltage or Current.

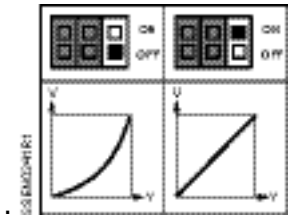


Figure 6. Selection of Valve Characteristic: Equal-Percentage or Linear.

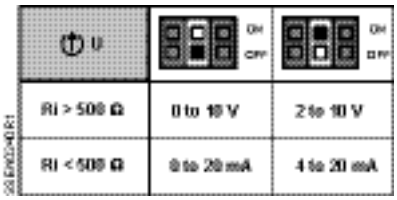


Figure 7. Assignment of Correcting Span Y and U: 0 to 10 Vdc/0 to 20 mA or 2 to 10 Vdc/4 to 20 mA.

Output signal U (position feedback signal) is dependent on the load resistance. Above 500 ohm, it is automatically a voltage signal; below 500 ohm a current signal.

Forced Control Input

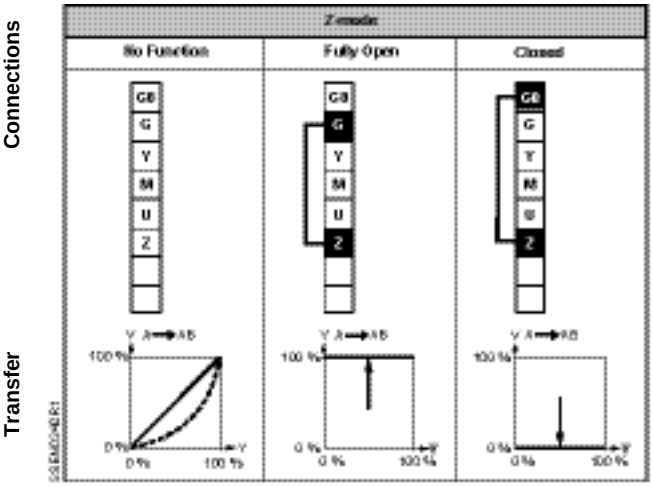


Figure 8.

If terminal Z for the forced control input is:

- not connected, the valve will follow the Y-signal or the phase-cut signal.
- connected to G, the valve will fully open via control path A → AB.
- connected to G0, the valve will close via control path A → AB.

Signal Priority

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

Valve Sizing

Characteristic

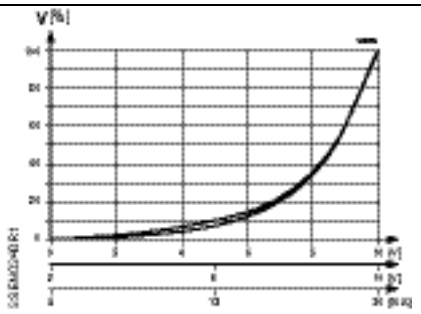


Figure 9. Equal Percentage.

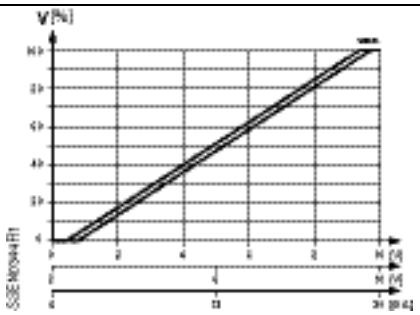


Figure 10. Linear.

Installation Notes

- Installation instructions for the valve and terminal housing are enclosed with the valve.
- Valves are supplied complete with brass/bronze fittings.
- The screwed valves are flat-faced to facilitate sealing with the gaskets supplied. The use of sealing compounds, tape or hemp thread is not recommended.
- For electrical installation, see *Wiring Diagrams*.

CAUTION:

- Always disconnect the power before fitting or removing the terminal housing. The terminal housing is calibrated and matched to the actuator, and should be replaced only by qualified personnel.
- Use the valve only as a mixing or straight-through valve, not as a diverting valve. Note the flow direction.
- Do not allow the surface temperature of the actuator to fall below the dew point temperature of the surrounding air (causing condensation). If necessary, insulate the valve. Do not insulate the actuator.

Use in Straight-through Applications

Only three-way valves are supplied. These may be used as straight-through valves by closing off port B with the accessories supplied (nut, cover and gasket).

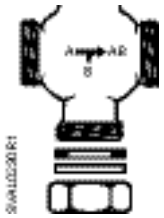


Figure 11. Straight-through Application.

Mounting Position

Vertical to horizontal mounting:
Do not mount the valve below the horizontal.

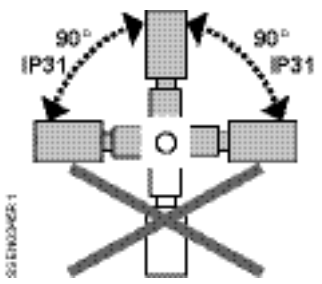


Figure 12. Acceptable Mounting Positions.

Connecting the Z366 Stem Heater

The Z366 includes connectors for the stem heater.

The stem heater is designed for a 24 Vac power supply.

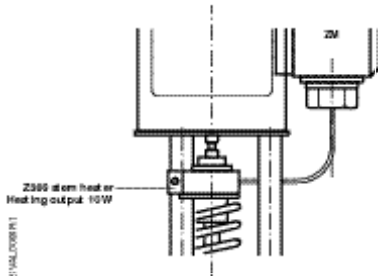


Figure 13. Z366 Stem Heater.

Specifications

	Low-voltage use only		Class 2 (SELV, PELV)
Electrical	24 Vac		
	Operating voltage		24 Vac +20/-15%
	Frequency		45 to 65 Hz
	Typical power consumption		See Table 1 P_{med}
	Standby		<1 W (valve fully closed)
	Nominal apparent power		See Table 1, S_{NA}
	Suitable fuse		Slow, see Table 1, I_N
	24 Vdc		
	Operating voltage		20 to 30 Vdc
Functional data, actuator	Input		
	Positioning signal Y		0/2 to 10 Vdc or 0/4 to 20 mA, or 0 to 20 Vdc Phs phase cut
	Impedance	0/2 to 10Vdc	100K ohm//5nF (load < 0.1mA)
		0/4 to 20 mA	240 ohm//5nF
	Forced control		
	Impedance		22K ohm
	Closing the valve (Z connected to G0)		<1 Vac; <0.8 Vdc
	Opening the valve (Z connected to G0)		>6 Vac; >5 Vdc
	No function (Z not wired)		Phase-cut or positioning signal Y active
	Output		
	Position feedback signal U	voltage	0/2 to 10 Vdc; load resistance > 500Ω
		current	0/4 to 20 mA; load resistance ≤ 500Ω
	Stroke measurement		Inductive
	Nonlinearity		±3% of end value
Functional data, valve	Nominal pressure		ANSI 125 (PN 16)
	Operating pressure p_{emax} [1]		232 psi (16 bar)
	Pressure differential Δp_{vmax}		See Table 1
	Leakage at		A→ AB max. 0.05% Cv
	Δp = 14.5 psi (1 bar)		B→ AB < 0.2% Cv depending on operating conditions
	Water temperature[2]		–4°F to 266°F (–20°C to 130°C)
	Valve characteristic [3]		Equal percentage or linear, optimized near the closing point
	Resolution $\Delta H/H_{100}$		1 : 1000 (H = Stroke)
	Type of operation		Modulating
	Position when de-energized		A → AB closed
	Orientation:		Upright to horizontal
	Positioning time		<2 seconds

1. Tested at 1.5 × PN (24 bar), similar to DIN 3230-3
2. For medium temperatures <32°F (0°C), the Z366 stem heating element is required.
3. Can be selected via DIP switch.

Specifications, Continued

Materials	Valve body	Red bronze (CC491K)
	Cover flange	Red bronze (CC491K)
	Seat/Inner valve	Stainless Steel
	Valve stem seal	EPDM (O-ring)
Pipe connections	Screwed fittings	Bronze/brass
Electrical connections	Cable entries	3 × M20 × 1.5 or PG13.5/G1/2
	Connection terminals	Screw terminals for up to 12 AWG wires
	Min. cross-sectional area [1)]	0.75 mm^2
	Max. cable length	See Table 1, 9 (AWG)
Ambient conditions	Temperature	
	Operation and storage	23°F to 113°F (-5°C to 45°C)
	Transport	-13°F to 158°F (-25°C to 70°C)
	Humidity	5 to 95% rh (non-condensing)
Agency approvals	Degree of protection	IP31 to IEC 529 Conforms to CE requirements 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
Miscellaneous	Weight	See Figure 18
	Dimensions	See Figure 18

Connection Terminals

WARNING:

If the controller and the valve receive their power supply from separate sources, the valve transformer must not be grounded on the secondary side.

A four-wire connection is mandatory with DC power supply.

Controllers with:
0 to 10 Vdc
2 to 10 Vdc
0 to 20 mA
4 to 20 mA

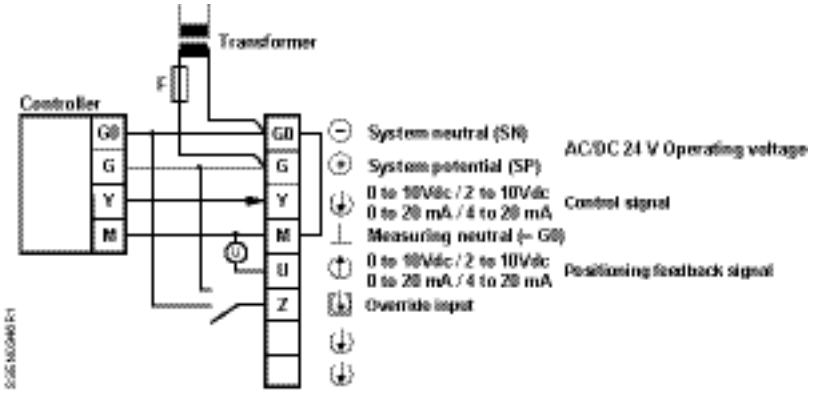


Figure 14.

1. In case of strong vibrations, use high-flex stranded wires.

Connection Terminals, Continued

Controllers with phase-cut 0 to 20 Vdc

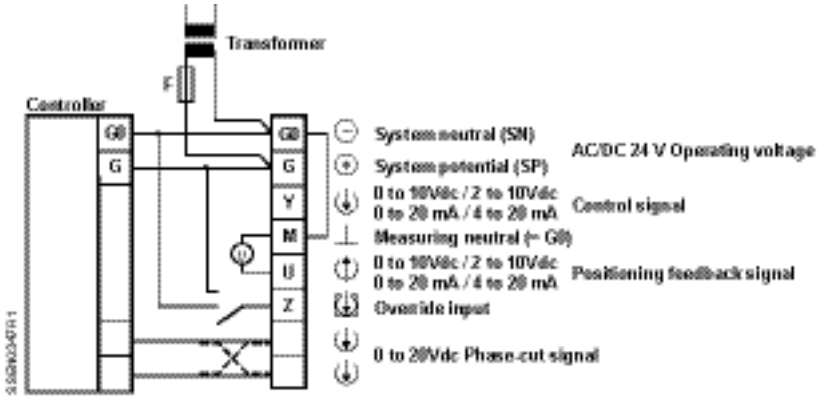


Figure 15.

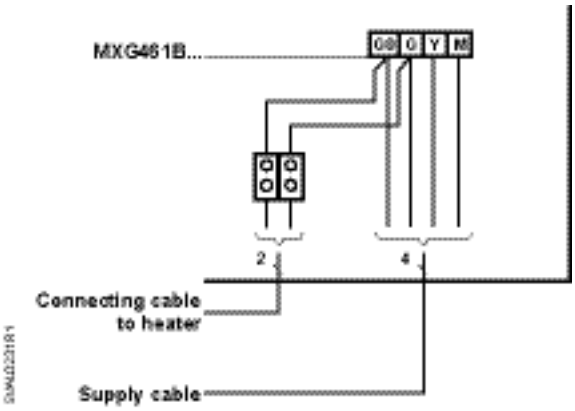


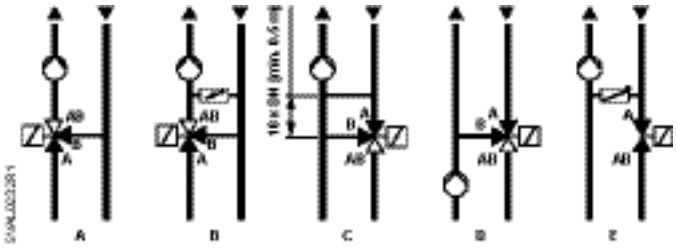
Figure 16. Stem Heating Element Z366.

Application Examples

This example shows only a schematic diagram, without installation-specific details.

CAUTION:

1. Use the valve only as a mixing or straight-through valve, not a diverting valve. Note the direction of flow.
2. Ensure that adequate air venting is provided for the entire hydronic system.
3. Select a non-return valve with minimum pressure loss for the circulating pipes.



Key :

A Mixing circuit
B Mixing circuit with bypass (underfloor heating system)
C Injection circuit
D Diverting circuit
E Injection circuit with throughport valve

Figure 17.

Service

CAUTION:

Do not disassemble the valve and actuator combination. This assembly is factory-calibrated, and should only be replaced by qualified personnel.

- The low-friction and robust, maintenance-free design makes regular servicing unnecessary and ensures 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.
- If required, the circuit board can be replaced. Order part number ASE12.

Dimensions

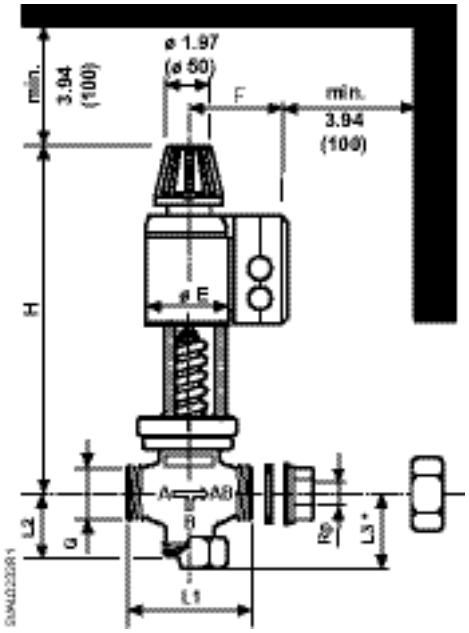


Figure 18. Dimensions in Inches (Millimeters).

NOTE: The screwed fittings and gaskets are supplied with these valves.

Product Number	DN		G (in)	L1	L2	L3	H	E	F	W lb (kg)
	(mm)	(in)								
MXG461B15-0.6	15	Rp ½	G1B	3.15 (80)	1.67 (42.5)	1.97 (50)	13.4 (340)	3.15 (80)	4.53 (115)	15.65 (7.1)
MXG461B15-1.5	15	Rp ½	G1B	3.15 (80)	1.67 (42.5)	1.97 (50)	13.4 (340)	3.15 (80)	4.53 (115)	16.09 (7.3)
MXG461B15-3	15	Rp ½	G1B	3.15 (80)	1.67 (42.5)	1.97 (50)	13.4 (340)	3.15 (80)	4.53 (115)	16.09 (7.3)
MXG461B20-5	20	Rp ¾	G1¼B	3.74 (95)	2.07 (52.5)	2.36 (60)	13.3 (339)	3.15 (80)	4.53 (115)	16.97 (7.7)
MXG461B25-8	25	Rp 1	G1½B	4.33 (110)	2.22 (56.5)	2.52 (64)	13.6 (346)	3.15 (80)	4.53 (115)	18.73 (8.5)
MXG461B32-12	32	Rp 1¼	G2B	4.92 (125)	2.66 (67.5)	2.95 (75)	15.12 (384)	3.94 (100)	4.92 (125)	28.22 (12.8)
MXG461B40-20	40	Rp 1½	G2¼B	5.51 (140)	3.17 (80.5)	3.66 (93)	15.79 (401)	3.94 (100)	4.92 (125)	32.19 (14.6)
MXG461B50-30	50	Rp 2	G2¾B	6.69 (170)	3.68 (93.5)	4.2 (108)	402 (15.83)	3.94 (100)	4.92 (125)	41.00 (18.6)

G: External thread G…B to ISO228/1
DN: Internal thread Rp to ISO7/1
Fittings to ISO 49/DIN 2950 (supplied complete with flange gaskets)