



## Refrigerant Valves PN 40 M3FB...LX...

for safety refrigerants

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- Modulating control valve for hot gas applications for capacity control of refrigeration units
- Hermetically sealed
- AC 24 V operating voltage or power signal DC 0...20 V Phs (phase cut)
- Selectable electrical interface DC 0...10 V, DC 4...20 mA or DC 0...20 V Phs
- High resolution and control accuracy
- Short positioning time (< 1 s)
- Port AB → A closed when de-energised
- Robust and maintenance-free
- DN 15...32,  $k_{vs}$  values 0.6...12 m<sup>3</sup>/h

### Use

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The M3FB...LX... three-way or straight-through valves with magnetic actuator are used for modulating capacity control of refrigeration units and for heat recovery. They may be used as hot gas diverting or straight-through valves. Suitable for safety refrigerants such as R22, R134a, R404A, R407C, R507, etc.

## Type summary

Type reference	DN	k <sub>vs</sub> AB → A [m <sup>3</sup> /h]	Δp <sub>max</sub> AB → A		S <sub>NA</sub> [VA]	P <sub>med</sub> [W]
			[MPa]	[bar]		
M3FB15LX06/A	15	0.6	2.2	22	26	6
M3FB15LX15/A	15	1.5	2.2	22	26	6
M3FB15LX/A	15	3.0	2.2	22	26	6
M3FB20LX/A	20	5.0	1.8	18	26	6
M3FB25LX/A	25	8.0	1.2	12	40	10
M3FB32LX	32	12.0	0.8	8	40	10

Δp<sub>max</sub> = Maximum permissible differential pressure across the valve's control path AB → A valid for the entire actuating range

S<sub>NA</sub> = Rated apparent power for transformer selection

P<sub>med</sub> = Typical power consumption

k<sub>vs</sub> = Nominal flow rate of cold water through the fully open valve (H<sub>100</sub>) by a differential pressure of 100 kPa (1 bar), to VDI 2173

## Accessories / ZM... terminal housing

Type reference	Operating voltage	Positioning signal	Working range	Data sheet
ZM101/A	AC 24 V	DC 0...10 V	DC 4...8 V	N4591
ZM121/A	AC 24 V	DC 4...20 mA	DC 8...16 mA	
ZM111		DC 0...20 V Phs	DC 10...15 V Phs	

For the ZM101/A and ZM121/A types also the DC 0...20 V Phs positioning signal is possible without operating voltage.

## Order

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

When placing an order, please specify the quantity, product description and type code.

Example: 1 refrigerant valve M3FB20LX/A  
1 terminal housing ZM101/A

## Delivery

Valves and terminal housings are packed separately.

## Technical and mechanical design

The armature or magnetic core is designed as a floating component within the pressure system, so that no external shaft gland is required. The leakage losses common with moving parts are thus avoided. The valve cross-section allows for easy flow whether the valve is fully or only partially open. This reduces pressure losses and ensures quiet operation.

The control signal is converted in the ZM.../A terminal housing into a phase cut signal, which generates a magnetic field in the coil. This causes the only moving part, the armature, to change its position in accordance with the interacting forces (magnetic field, counter-spring, hydraulics). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the control disc, enabling fast changes in load to be corrected quickly and accurately.

The force of the counter-spring closes the valve automatically (control path ports AB → A) if the power is switched off or fails.

## Sizing

Correct valve sizing (to ensure a sufficiently large pressure drop  $\Delta p_{V100}$  across the fully open valve) is the key to the correct operation of a refrigeration unit. All the components must be coordinated, and this can be ensured only by the refrigeration specialist. The application examples on pages 5 and 6 show the recommended pressure drop in each case.

**Refrigeration capacity**  
 $Q_0$

Nominal capacity in kW at evaporation temperature  $t_0 = 5\text{ °C}$

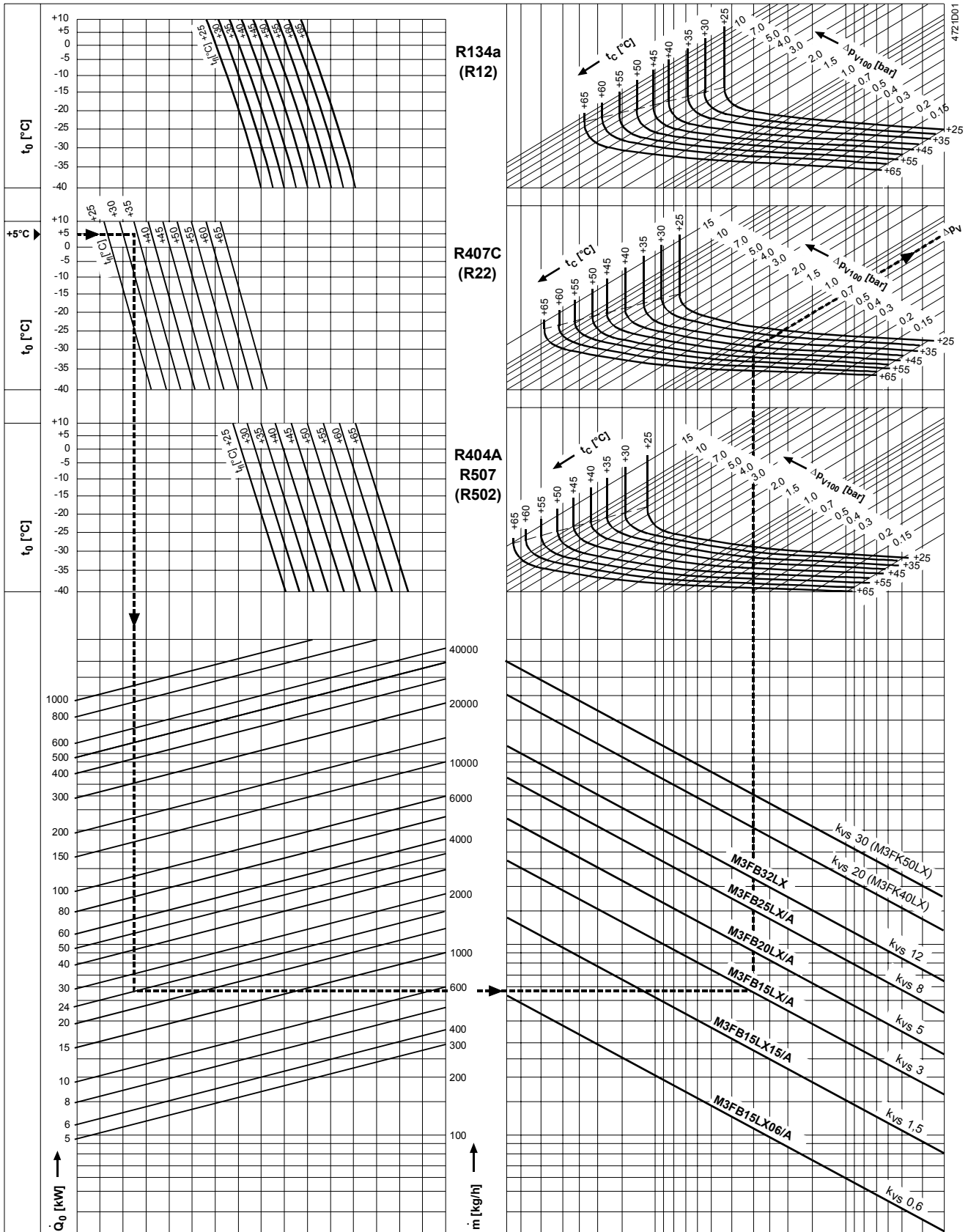
**Selection table for approximate guide to valve size**

$\Delta p_{V100}$	Valve type	Refrigerant								
		R407C (R22)			R134a (R12)			R404A / R507		
		Condensation temperature $t_c$ [°C]								
		50	40	30	50	40	30	50	40	30
0.5 bar	<b>M3FB15LX06/A</b>	4.5	4.0	3.6	3.8	3.3	2.9	3.7	3.3	2.9
	<b>M3FB15LX15/A</b>	11	10	8.9	9.5	8.3	7.2	9.2	8.1	7.2
	<b>M3FB15LX/A</b>	22	20	18	19	17	14	18	16	14
	<b>M3FB20LX/A</b>	37	33	30	32	28	24	31	27	24
	<b>M3FB25LX/A</b>	59	53	48	51	44	38	49	43	38
	<b>M3FB32LX</b>	89	80	72	76	67	57	74	65	58
1 bar	<b>M3FB15LX06/A</b>	6.2	5.6	4.9	5.3	4.6	3.9	5.1	4.5	4.0
	<b>M3FB15LX15/A</b>	16	14	12	13	11	10	13	11	10
	<b>M3FB15LX/A</b>	31	28	25	26	23	20	26	23	20
	<b>M3FB20LX/A</b>	52	46	41	44	38	33	43	38	33
	<b>M3FB25LX/A</b>	83	74	66	70	61	52	69	61	53
	<b>M3FB32LX</b>	125	111	99	106	92	78	103	91	80
4 bar	<b>M3FB15LX06/A</b>	11.4	9.9	8.4	9.2	7.5	5.8	9.6	8.3	7.0
	<b>M3FB15LX15/A</b>	28	25	21	23	19	15	24	21	18
	<b>M3FB15LX/A</b>	57	50	42	46	38	29	48	41	35
	<b>M3FB20LX/A</b>	95	83	70	76	63	48	80	69	58
6 bar	<b>M3FB15LX06/A</b>	13	11	8.9	10	7.6	5.8	11	9.4	7.7
	<b>M3FB15LX15/A</b>	33	28	22	25	19	15	28	23	19
	<b>M3FB15LX/A</b>	65	55	45	50	38	29	55	47	39
	<b>M3FB20LX/A</b>	108	92	74	83	63	48	92	78	64
8 bar	<b>M3FB15LX06/A</b>	14	11	8.9	9.8	7.6		12	9.9	7.7
	<b>M3FB15LX15/A</b>	35	28	22	24	19		30	25	19
	<b>M3FB15LX/A</b>	69	56	45	49	38		60	49	39
	<b>M3FB20LX/A</b>	115	94	74	81	63		100	82	64

$\Delta p_{V100}$  = Differential pressure across the fully open valve (control path AB → A) by a volume flow  $\dot{V}_{100}$

# Selection chart

The example refers to the 3-way hot-gas bypass control application.



$t_0$  = Evaporation temperature [°C]       $Q_0$  = Refrigeration capacity [kW]       $k_{vs}$  = Nominal flow rate [m<sup>3</sup>/h] of cold water through the fully open valve ( $H_{100}$ ) by a differential pressure of 100 kPa (1 bar)  
 $t_c$  = Condensation temperature [°C]       $m$  = Mass flow of refrigerant [kg/h]  
 $t_{fi}$  =  $t_c$  - degree of sub-cooling [°C]       $\Delta p_{v100}$  = Admissible differential pressure [bar], installation-specific

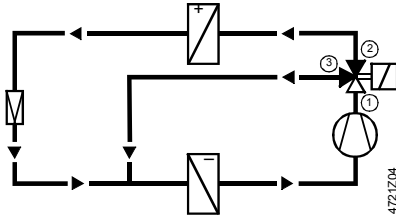
The diagrams shown here are principles only, without installation-specific details.

**3-way hot-gas bypass control**

For accurate control of evaporators, from 0...100% refrigeration capacity.

- Suitable for test rooms, laboratory systems, small chilled water units and DX evaporators with a refrigeration capacity of up to approx. 40 kW.

**Recommended pressure drop  $\Delta p_{V100}$  across the fully-open valve (control path AB  $\rightarrow$  A)  $0.5 < \Delta p_{V100} < 1$  bar (see selection chart)**



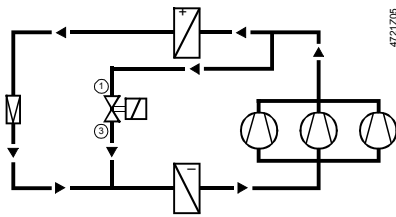
Example:	
Refrigeration capacity $Q_0$	24 kW
Refrigerant	R22
Condensation temperature $t_c$	40 °C
Evaporation temperature $t_0$	+ 5 °C
Liquid temperature $t_{li}$	35 °C
Selected valve	<b>M3FB15LX/A</b>
Differential pressure $\Delta p_{V100}$ across valve	0.7 bar

**Indirect hot-gas bypass**

The control valve throttles the capacity of a compressor stage. The hot gas is injected directly into the evaporator allowing capacity control from 100 % to approximately 0 %.

- Suitable for use in large refrigeration systems in air conditioning applications, to prevent unacceptable fluctuations in temperature between compressor stages.

The differential pressure  $\Delta p_{V100}$  across the fully-open valve is determined by the condensation pressure at low load minus the pressure upstream of the evaporator  
**If no details are provided, the differential pressure  $\Delta p_{V100}$  can be assumed to be 4 bar.**



Example:	
Refrigeration capacity $Q_0$ of one compressor stage	30 kW
Refrigerant	R22
Condensation temperature full/low load $t_c$	45 / 35 °C
Evaporation temperature full load/low load $t_0$	5 / 15 °C
Liquid temperature $t_{li}$	40 / 30 °C
Differential pressure $\Delta p_{V100}$ (from R22 vapour table)	5.6 bar
Selected valve	<b>M3FB15LX/A</b>
Actual capacity approx.	40 kW

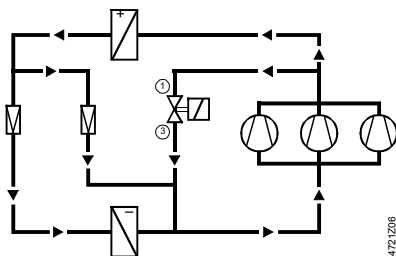
**Direct hot-gas bypass**

The control valve throttles the capacity of a compressor stage. The gas is fed to the suction side of the compressor and cooled by a re-injection valve. Capacity control range from 100 % to approx. 10 %.

- Suitable for large refrigeration systems for air conditioning, with several compressors or compressor stages, and where the evaporator and compressor are some distance apart (attention must be paid to oil return).

The differential pressure  $\Delta p_{V100}$  across the fully-open valve is determined by the condensation pressure at low load minus the suction pressure.

**If no details are provided, the differential pressure  $\Delta p_{V100}$  can be assumed to be 6 bar.**



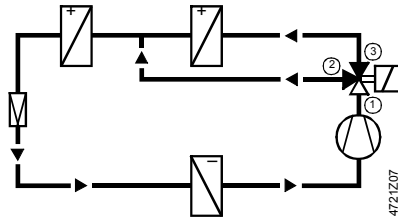
Example:	
Refrigeration capacity $Q_0$ of one compressor stage	40 kW
Refrigerant	R22
Condensation temperature full/low load $t_c$	45 / 35 °C
Evaporation temperature full load/low load $t_0$	2 / 10 °C
Liquid temperature $t_{li}$	40 / 30 °C
Differential pressure $\Delta p_{V100}$ (from R22 vapour table)	6.5 bar
Selected valve	<b>M3FB15LX/A</b>

**Heat recovery**

The hot-gas diverting valve may be used for modulating recovery of the heat from the condenser, even in the event of high differential pressures.

**Recommended pressure drop  $\Delta p_{v100}$  across the fully-open valve (control path AB  $\rightarrow$  A)**

$0.5 < \Delta p_{v100} < 1 \text{ bar.}$

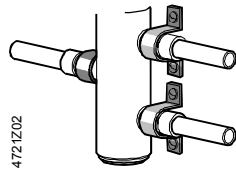
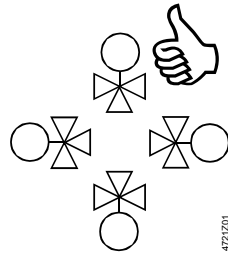


Example:	
Refrigeration capacity $Q_0$	67 kW
Refrigerant	R134a
Condensation temperature $t_c$	50 °C
Evaporation temperature $t_0$	2 °C
Liquid temperature $t_{fl}$	45 °C
Selected valve	<b>M3FB32LX</b>
Actual pressure drop $\Delta p_{v100}$	0.7 bar

**Mounting notes**

Mounting instructions are enclosed with the valve:

- Nr. 35548 (valve)
- Nr. 35541 (ZM... terminal housing)



- The refrigerant valves can be mounted in any orientation, but upright mounting is preferable.
- Pipework should be arranged such that the valve is not located at a low point in the plant where oil can collect.
- The pipes should be fitted such that the alignment does not distort the valve connections. The valve body should be fixed such 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 the valve is used in a straight-through application (AB  $\rightarrow$  A).
- The valve body and the connected pipework should be lagged.
- The actuator must not be lagged.

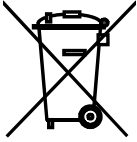
**Caution** Always switch off the power supply before connecting or disconnecting the ZM... terminal housing.

**Maintenance**

The modulating control valves for hot gas control require no maintenance. The low friction and robust design make regular servicing unnecessary and ensure a long service life.

**Repair** The valve cannot be repaired. It has to be replaced as a complete unit.

## Disposal



The device must not be disposed of together with domestic waste. This applies in particular to the PCB.

Legislation may demand special handling of certain components, or it may be sensible from an ecological point of view

**Current local legislation must be observed.**

## Warranty

Application-specific technical data must be observed.

**If specified limits are not observed, Siemens Switzerland Ltd / HVAC Products will not assume any responsibility.**

## Technical data

### Functional actuator data

Power supply	Extra low-voltage only (SELV, PELV)	
Operating voltage <sup>1)</sup>	AC 24 V + 15 % / -10 %	
Frequency	50...60 Hz	
Typical power consumption P <sub>med</sub>	refer to «Type summary» table	
Rated apparent power S <sub>NA</sub>	refer to «Type summary» table	
Input	Positioning signal ZM101/A	DC 0...10 V or DC 0...20 V Phs (phase cut)
	ZM121/A	DC 4...20 mA or DC 0...20 V Phs
	ZM111	DC 0...20 V Phs
Current draw DC 0...10 V	max. 1 mA	
Input resistor DC 4...20 mA	2 x 56 kΩ	

### Functional valve data

PN class	PN 40 to EN 1333	
Permissible operating pressure	3.2 MPa (32 bar)	
Max. differential pressure Δp <sub>max</sub>	AB → A	refer to «Type summary» table
	AB → B	0.8 MPa (8 bar)
Leckrate (intern über Sitz)	AB → A	max. 0.05 % k <sub>vS</sub> (nach DIN EN 1349)
	AB → B	max. 0.5 % k <sub>vS</sub>
Leakage rate	hermetically sealed (fully welded, no static or dynamic seals)	
Permissible media	for organic safety refrigerants (R22, R134a, R404A, R407C, R410A, R507 etc.). not suited for ammonia (R717)	
Medium temperature	- 40...120 °C	
Valve characteristic (stroke, k <sub>v</sub> )	linear (to VDI / VDE 2173), optimised in low opening range	
Stroke resolution ΔH / H100	> 1 : 200 (H = stroke)	
Type of operation	modulating	
Position when de-energised	AB → A	closed
Orientation	any	
Positioning time	< 1 s	
Materials	Housing components	steel / CrNi steel
	Seat / inner valve	brass / CrNi steel
Pipe connections	Sleeves	internally soldered, CrNi steel
Electrical connections	Screw terminals	2 x Pg11 (ZM101/A, ZM121/A)
	Min. cross-sectional area of cable	0.75 mm <sup>2</sup>
Dimensions and weight	Connection terminals	max. 1 x 4 mm <sup>2</sup> copper cross-sectional area
	Dimensions	refer to «Dimensions»
	Weight	refer to table in « Dimensions »
Norms und standards	Protection standard	IP 54 to IEC 529
	Conformity	meets the requirements for CE marking

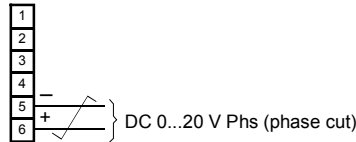
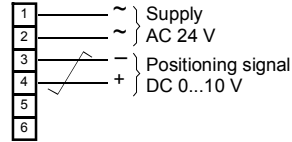
<sup>1)</sup> No operating voltage is required for the DC 0...20 V Phs power positioning signal.

## Connection terminals

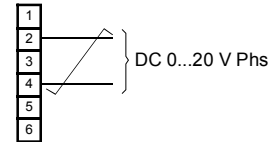
### Warning

If a ZM.../A terminal housing is used with DC 0...20 V Phs (phase cut), AC 24 V must not be connected!  
 Always switch off the power supply before connecting or disconnecting the ZM... terminal housing.

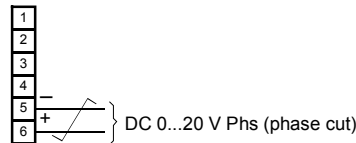
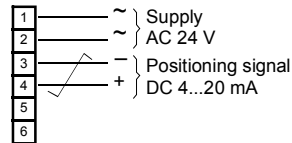
### ZM101/A (DC 0...10 V or DC 0...20 V Phs)



### ZM111 (DC 0...20 V Phs)



### ZM121/A (DC 4...20 mA oder DC 0...20 V Phs)



twisted pairs

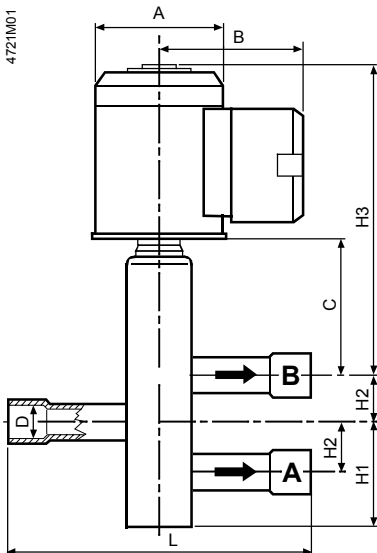
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## Connection diagrams

Refer to data sheet N4591 for the ZM... terminal housings

## Dimensions

Dimensions in mm



Type reference	DN	ø D [Zoll]	L	H1	H2	H3	A	B	C	Weight [kg]
<b>M3FB15LX06/A</b>	15	5/8	150	65	25	184	80	84	67	4.3
<b>M3FB15LX15/A</b>	15	5/8	150	65	25	184	80	84	67	4.3
<b>M3FB15LX/A</b>	15	5/8	150	65	25	184	80	84	67	4.3
<b>M3FB20LX/A</b>	20	7/8	170	69	30	238	100	94	84	8.9
<b>M3FB25LX/A</b>	25	1 1/8	200	72	36	248	100	94	94	9.5
<b>M3FB32LX</b>	32	1 3/8	250	91	43	245	100	94	98	11.4

D : Pipe connections

G : Weight (incl. packaging)