SIEMENS

4721

ACVATIX™

Modulating refrigerant valves with magnetic actuator, PS43

M3FB..LX..

Soldered connection, hermetically sealed

- **Modulating control valve for hot-gas applications for capacity control of refrigeration units and heat recovery systems**
- **For organic safety refrigerants**
- **AC 24 V operating voltage or power signal DC 0…20 V Phs (phase cut)**
- **Selectable electrical interface ZM.. with DC 0…10 V, DC 4…20 mA or DC 0…20 V Phs positioning signal**
- **High resolution and control accuracy**
- **Short positioning time (< 1 s)**
- **Port AB → A closed when de-energized**
- **Robust and maintenance-free**
- **DN 15…32, k_{vs} values 0.6…12 m^3/h**

Use

The M3FB..LX.. 3-port and 2-port valves with magnetic actuators are used for modulating capacity control of refrigeration units and for heat recovery systems. They may be used as hot gas diverting or 2-port valves.
Suitable for organic safety refrigerants such as R22, R134a, R404A, R407C, R507, etc. Not suitable for flammable refrigerants.

Type summary

Type reference	DN	k_{vs} AB → A [m^3/h]	Δp_{max} AB → A [MPa]	[bar]	S_{NA} [VA]	P_{med} [W]
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_{max} = Maximum permissible differential pressure across the valve's control path AB → A valid for the entire actuating range
S_{NA} = Rated apparent power for transformer selection
P_{med} = Typical power consumption
k_{vs} = Nominal flow rate of cold water through the fully opened valve (H_{100}) 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 ZM101/A and ZM121/A the DC 0…20 V Phs positioning signal without operating voltage is also possible.

Ordering

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:

Type reference	Stock number	Description	Quantity
M3FB20LX/A	M3FB20LX/A	Modulating refrigerant valve with magnetic actuator	2
ZM101/A	ZM101/A	Terminal housing	2

Delivery

Valves and terminal housings are packed separately.

Rev. no.

Overview table, see page 9.

Technical 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 opened. 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.

Correct valve sizing (to ensure a sufficiently large pressure drop Δp_{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

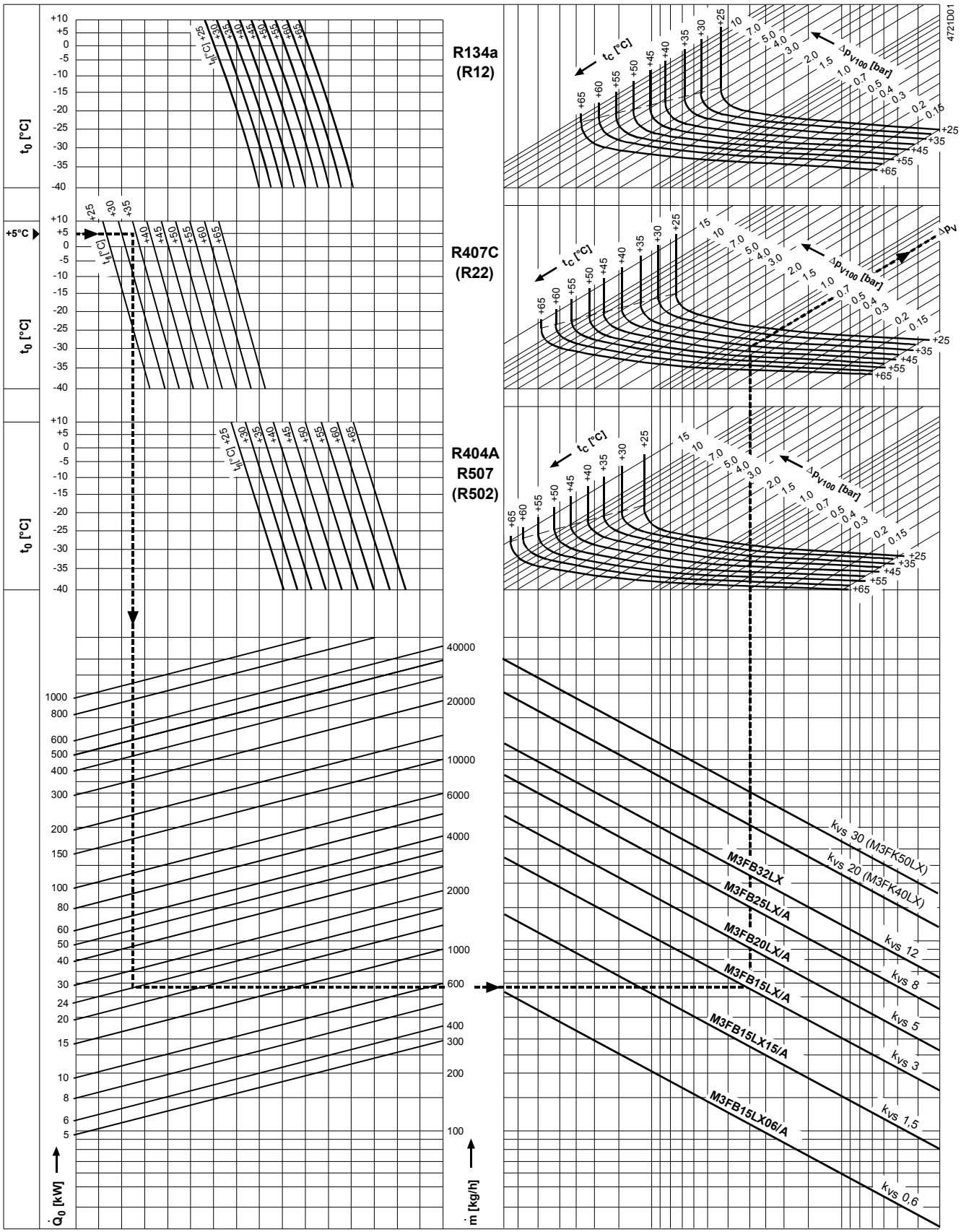
Nominal capacity in kW at evaporation temperature t_0 = 5 °C

Selection table for approximate valve size

		Refrigerant								
		R407C (R22)			R134a (R12)			R404A / R507		
Δp_{v100}	Valve type	Condensation temperature t_c [°C]								
		50	40	30	50	40	30	50	40	30
0.5 bar	**M3FB15LX06/A**	4.5	4.0	3.6	3.8	3.3	2.9	3.7	3.3	2.9
	M3FB15LX15/A	11	10	8.9	9.5	8.3	7.2	9.2	8.1	7.2
	M3FB15LX/A	22	20	18	19	17	14	18	16	14
	M3FB20LX/A	37	33	30	32	28	24	31	27	24
	M3FB25LX/A	59	53	48	51	44	38	49	43	38
	M3FB32LX	89	80	72	76	67	57	74	65	58
1 bar	**M3FB15LX06/A**	6.2	5.6	4.9	5.3	4.6	3.9	5.1	4.5	4.0
	M3FB15LX15/A	16	14	12	13	11	10	13	11	10
	M3FB15LX/A	31	28	25	26	23	20	26	23	20
	M3FB20LX/A	52	46	41	44	38	33	43	38	33
	M3FB25LX/A	83	74	66	70	61	52	69	61	53
	M3FB32LX	125	111	99	106	92	78	103	91	80
4 bar	**M3FB15LX06/A**	11.4	9.9	8.4	9.2	7.5	5.8	9.6	8.3	7.0
	M3FB15LX15/A	28	25	21	23	19	15	24	21	18
	M3FB15LX/A	57	50	42	46	38	29	48	41	35
	M3FB20LX/A	95	83	70	76	63	48	80	69	58
6 bar	**M3FB15LX06/A**	13	11	8.9	10	7.6	5.8	11	9.4	7.7
	M3FB15LX15/A	33	28	22	25	19	15	28	23	19
	M3FB15LX/A	65	55	45	50	38	29	55	47	39
	M3FB20LX/A	108	92	74	83	63	48	92	78	64
8 bar	**M3FB15LX06/A**	14	11	8.9	9.8	7.6		12	9.9	7.7
	M3FB15LX15/A	35	28	22	24	19		30	25	19
	M3FB15LX/A	69	56	45	49	38		60	49	39
	M3FB20LX/A	115	94	74	81	63		100	82	64

Δp_{V100} = Differential pressure across the fully opened valve (control path AB → A) at a volumetric flow V_{100}

Selection chart The example refers to 3-port hot-gas bypass control application.



t_0 = Evaporation temperature [°C]
t_c = Condensation temperature [°C]
t_{fl} = t_c – degree of subcooling [°C]

Q_0 = Refrigeration capacity [kW]
m = Mass flow of refrigerant [kg/h]
Δp_{v100} = Admissible differential pressure [bar], installation-specific

k_{vs} = Nominal flow rate [m^3/h] of cold water through the fully opened valve (H_{100}) by a differential pressure of 100 kPa (1 bar)

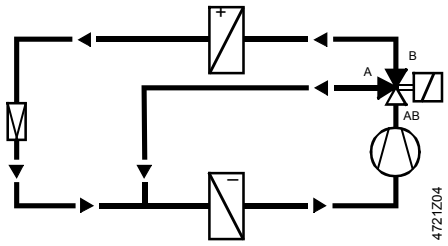
The diagrams shown here are principles only, without installation-specific details.

3-port hot-gas bypass control application

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 differential pressure Δp_{v100} across the fully opened valve (control path AB → A) 0.5 < Δp_{v100} < 1 bar (see selection chart)



Refrigeration capacity Q_0	24 kW
Refrigerant	R22
Condensation temperature t_c	40 °C
Evaporation temperature t_0	+ 5 °C
Liquid temperature t_{fl}	35 °C
Selected valve	**M3FB15LX/A**
Differential pressure Δp_{v100} across valve	0.7 bar

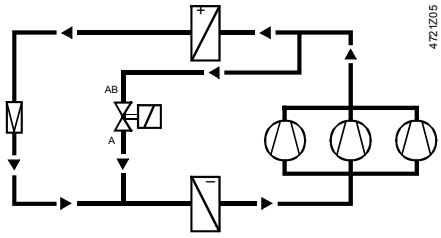
Indirect hot-gas bypass

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 Δp_{v100} across the fully opened 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 Δp_{v100} can be assumed to be 4 bar.



Refrigeration capacity Q_0 ,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_{fl}	40 / 30 °C
Differential pressure Δp_{v100} (from R22 vapor table)	5.6 bar
Selected valve	**M3FB15LX/A**
Actual capacity, approx.	40 kW

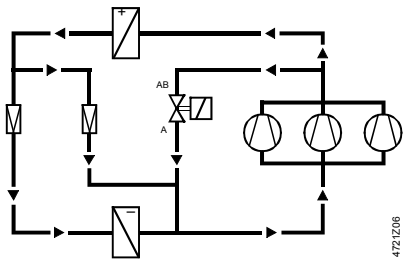
Direct hot-gas bypass

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 ranges 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 Δp_{v100} across the fully opened valve is determined by the condensation pressure at low load minus the suction pressure.

If no details are provided, the differential pressure Δp_{v100} can be assumed to be 6 bar.

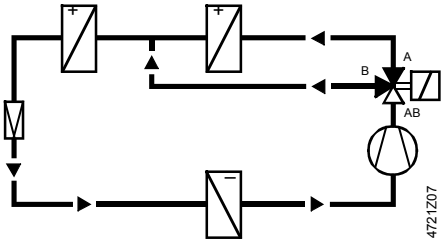


Refrigeration capacity Q_0 of one compressor stage	40 kW
Refrigerant	R22
Condensation temperature full/low load t_c	45 / 35 °C
Evaporation temperature full load/low load t_0	2 / 10 °C
Liquid temperature t_{fl}	40 / 30 °C
Differential pressure Δp_{v100} (from R22 vapor table)	6.5 bar
Selected valve	**M3FB15LX/A**

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 differential pressure Δp_{v100} across the fully opened valve (control path AB → A) 0.5 < Δp_{v100} < 1 bar.

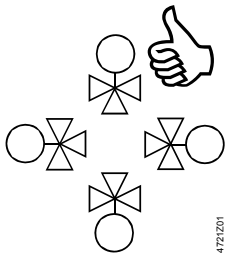


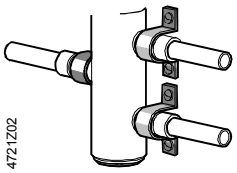
Example:	
Refrigeration capacity Q_0	67 kW
Refrigerant	R134a
Condensation temperature t_c	50 °C
Evaporation temperature t_0	2 °C
Liquid temperature t_{fl}	45 °C
Selected valve	**M3FB32LX**
Actual pressure drop Δp_{v100}	0.7 bar

Mounting notes

Mounting instructions are enclosed with the valve:

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





- The refrigerant valves can be mounted in any orientation, but upright mounting is preferable.
- Arrange the pipework 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 (control path AB → A) is used.
- The valve body and the connected pipework should be lagged.
- The actuator must not be lagged.

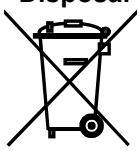
Caution Always switch off the power supply before connecting or disconnecting the ZM.. terminal housing.

Installation notes

The hot-gas control valves are maintenance-free.
The low friction and robust design make regular maintenance unnecessary and ensure a long product 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 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 will not assume any responsibility.

Technical data

Functional actuator data

Power supply	Extra low-voltage only (SELV, PELV)		
	Operating voltage [1]		AC 24 V + 15 % / -10 %
	Frequency		50…60 Hz
	Typical power consumption P_{med}		refer to «Type summary» table
	Rated apparent power S_{NA}		refer to «Type summary» table
	Required fuse I_F		1.6…2.5 A, slow
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
	Input resistance	DC 0…10 V	> 100 kΩ
	Input resistance	DC 4…20 mA	< 150 Ω
Positioning time	Positioning time		< 1 s
Electrical connections	Cable entry		2 x Pg11 (ZM101/A, ZM121/A)
	Connection terminals		max. 1 x 4 mm^2 wire cross-section
	Min. wire cross-section		0.75 mm^2
Functional valve data	Permissible operating pressure		Max. 4.3 MPa (43 bar) [2]
	Max. differential pressure Δp_{max}		
		AB → A	refer to «Type summary» table
		AB → B	0.8 MPa (8 bar)
	Leakage rate Δp = 0.1 MPa (1 bar)		
		AB → A	max. 0.05 % of k_{vs}-value
		AB → B	max. 0.5 % k_{vs}
	Valve characteristic (stroke, k_v)		linear (to VDI / VDE 2173), optimized in low opening range
	Permissible media		for organic safety refrigerants (R22, R134a, R404A, R407C, R410A, R507 etc.). Not suitable for ammonia (R717) Not suitable for flammable refrigerants
	Medium temperature		-40...120 °C
	Position when de-energized		AB → A closed
	Orientation		any
	Type of operation		modulating
	Stroke resolution ΔH / H_{100}		> 1 : 200 (H = stroke)
	Pressure tightness to outside		hermetically sealed (fully welded, no static or dynamic seals)
Materials	Housing components		steel / CrNi steel
	Seat / inner valve		brass / CrNi steel
	Pipe connections		internally soldered, CrNi steel
Dimensions and weight	Dimensions		refer to «Dimensions»

Pipe connections	Weight	refer to table in « Dimensions »
	Sleeves	internally soldered sleeves
Standards	CE conformity	
	to EMC standard	2004/108/EC
	Immunity	EN 61000-6-2:[2005] Industrial [3]
	Emission	EN 61000-6-3:[2007] Residential [3]
	Electrical safety	EN 60730-1
	Housing protection	
	Upright to horizontal	IP54 to EN 60529
	Environmental compatibility	ISO 14001 (Environment) ISO 9001 (Quality) SN 36350 (Environmentally compatible products) RL 2002/95/EC (RoHS)
	Pressure Equipment Directive	PED 97/23/EC
	Pressure Accessories	as per article 1, section 2.1.4
	Fluid group 2	without CE-marking as per article 3, section 3 (sound engineering practice)

[1] No operating voltage is required for the DC 0…20 V Phs power positioning signal.

[2] To EN 12284, checked with 1.43 x operating pressure at 62 bar

[3] Transformer 160 VA (e.g. Siemens 4AM 3842-4TN00-0EA0)

General environmental conditions

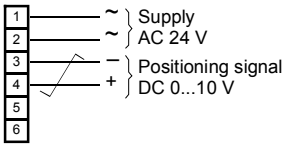
	Operation EN 60721-3-3	**Transport** EN 60721-3-2	**Storage** EN 60721-3-1
Climatic conditions	Class 3K6	Class 2K3	Class 1K3
Temperature	-25...55 °C	-25...70 °C	-5...45 °C
Humidity	10...100 % r.h.	< 95 % r.h.	5...95 % r.h.

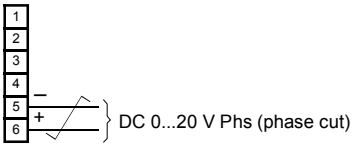
Connection terminals

Warning

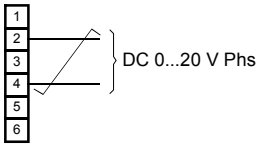
If a ZM../A terminal housing is used with DC 0…20 V Phs (phase cut), AC 24 V must not be connected!
Always switch off the power supply before connecting or disconnecting the ZM.. terminal housing.

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

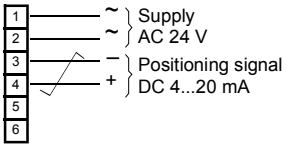


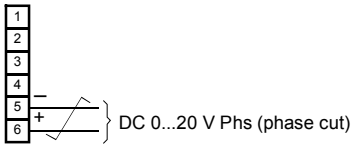


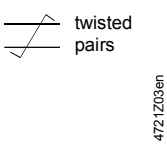
ZM111 (DC 0...20 V Phs)



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





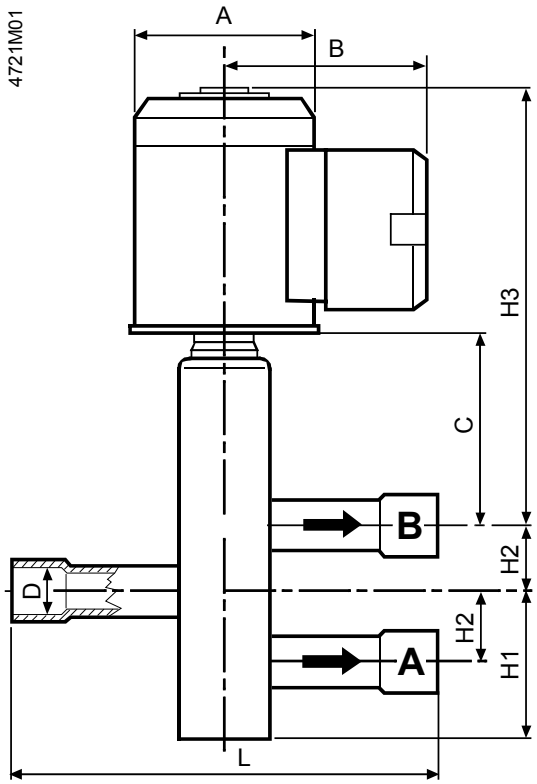


Connection diagrams

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

Dimensions

Dimensions in mm



Type reference	DN	ø D [Inch]	L	H1	H2	H3	A	B	C	Weight [kg]
M3FB15LX06/A	15	⅝	150	65	25	184	80	84	67	4.3
M3FB15LX15/A	15	⅝	150	65	25	184	80	84	67	4.3
M3FB15LX/A	15	⅝	150	65	25	184	80	84	67	4.3
M3FB20LX/A	20	⅞	170	69	30	238	100	94	84	8.9
M3FB25LX/A	25	1⅛	200	72	36	248	100	94	94	9.5
M3FB32LX	32	1⅜	250	91	43	245	100	94	98	11.4

D: Pipe connections

G: Weight (incl. packaging)

Revision numbers

Type reference	Valid up to rev. No.
M3FB15LX06/A	..D
M3FB15LX15/A	..D
M3FB15LX/A	..D
M3FB20LX/A	..E
M3FB25LX/A	..E
M3FB32LX	..F