

## Modulating control valve

for suction throttle control

## M2FS...LX...



**Straight-through magnetic valve for modulating suction throttle control of refrigeration units**

- Short positioning time (approx. 1 s)
- High resolution (> 1 : 200)
- High rangeability
- Hermetically sealed
- Versatile electrical interface
- Low friction, robust and maintenance-free

### Use

The M2FS...LX... straight-through valves with magnetic actuator are used for modulating suction throttle control of refrigeration units. They are suitable for safety refrigerants such as R22, R134a, R404A, R507, etc.

### Type summary

#### Operating data

Valve type (without ZM...)	DN [mm]	k <sub>vs</sub> [m <sup>3</sup> /h]	P <sub>N</sub> [VA]	P <sub>med</sub> [VA]
<b>M2FS15LX06</b>	15	0.6	13	3
<b>M2FS15LX15</b>	15	1.5	13	3
<b>M2FS15LX</b>	15	3.0	13	3
<b>M2FS20LX</b>	20	5.0	16	4
<b>M2FS25LX</b>	25	8.0	16	4
<b>M2FS32LX</b>	32	12.0	20	5

$\Delta p_{Vmax}$  = Max. admissible pressure differential

P<sub>N</sub> = Nominal power

P<sub>med</sub> = Mean operating power

k<sub>vs</sub> = Flow rate to VDI/VDE2173, tolerance  $\pm 10\%$

### Ordering

The M2FS...LX... control valve and the ZM... or ZM.../A terminal housing must be ordered separately. See data sheet N4591 for information on the ZM... and ZM.../A terminal housing.

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

*Example :* 1 control valve **M2FS15LX06** and 1 terminal housing **ZM101/A**

## 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 open. This reduces pressure losses and ensures quiet operation.

The valves are fitted with extended female solder unions, making pipe connection easy.

## Manual control

On delivery, the valve is closed and the handwheel has no effect. For service purposes, or to set it to minimum flow, the valve can be opened by removing the protective cap and using a screwdriver (turn clockwise to OPEN). This does not affect the characteristic of the remaining stroke.

## Mechanical design

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 etc.). 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 if the power is switched off or fails.

## Sizing Notes

Correct valve sizing (to ensure a sufficiently large pressure drop across the fully-open valve,  $\Delta p_{V100}$ ) 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 page 5 show the recommended pressure drop in each case.

### Refrigeration capacity in kW (Liquid temperature $t_{li} = 35\text{ °C}$ )

#### Selection table for suction throttle applications

(for an approximate guide to valve size)

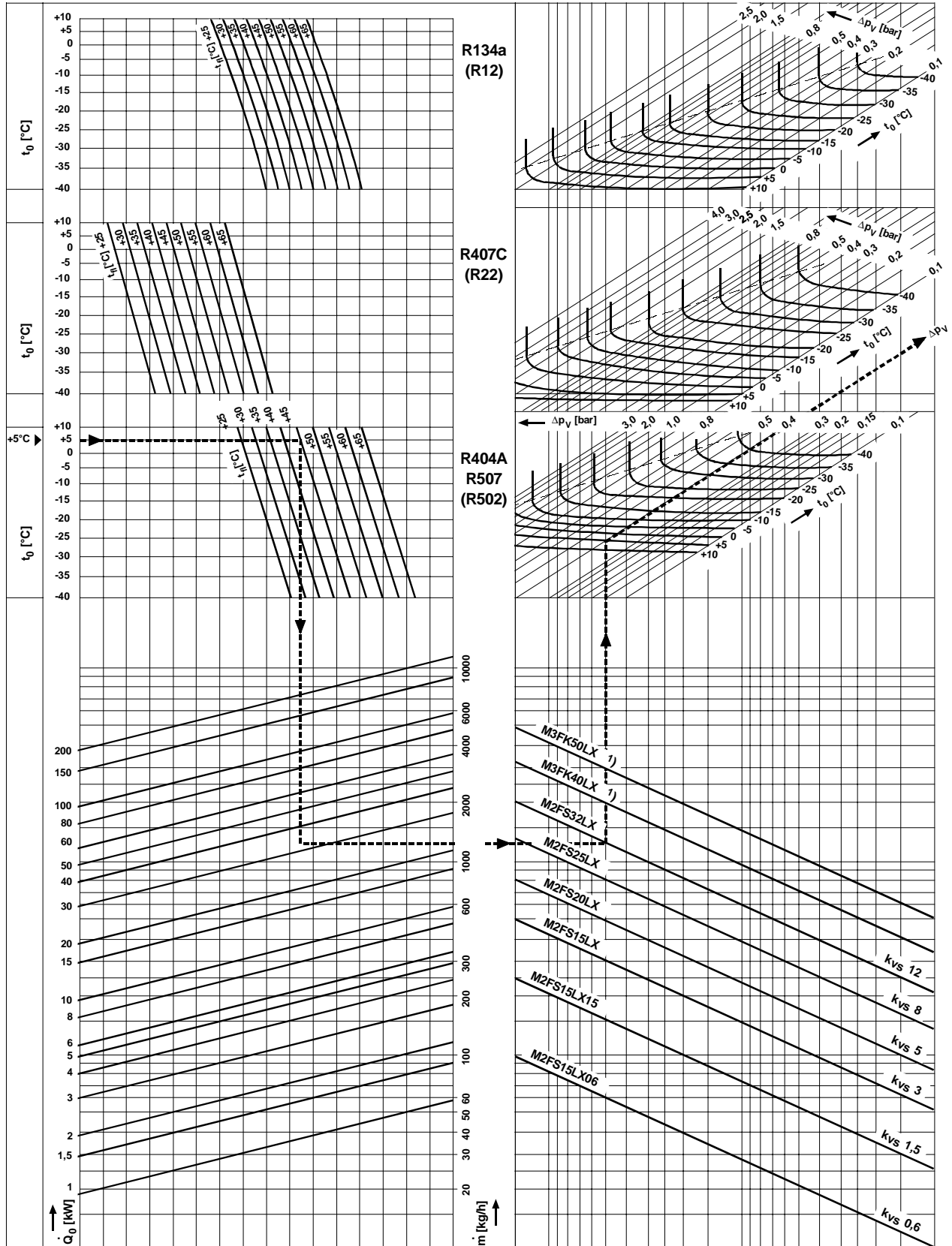
$\Delta p_{V100}$	Valve type	Refrigerant											
		R407C (R22)				R134a (R12)				R404A / R507			
		Evaporation temperature to [°C]											
		10	0	-10	-20	10	0	-10	-20	10	0	-10	-20
0.15 bar	M2FS15LX06	1.5	1.3	1.1	0.9	1.2	1.0	0.8	0.6	1.2	1.0	0.8	0.7
	M2FS15LX15	3.9	3.3	2.7	2.2	3.0	2.5	2.0	1.5	3.1	2.6	2.1	1.7
	M2FS15LX	7.7	6.5	5.5	4.4	6.1	4.9	3.9	3.1	6.2	5.2	4.2	3.3
	M2FS20LX	13	11	9.1	7.4	10	8.2	6.6	5.1	10	8.6	7.0	5.5
	M2FS25LX	21	17	15	12	16	13	10	8	17	14	11	8.9
	M2FS32LX	31	26	22	18	24	20	16	12	25	21	17	13
	M3FK40LX <sup>1)</sup>	51	43	36	30	40	33	26	20	42	35	28	22
	M3FK50LX <sup>1)</sup>	77	65	55	44	61	49	39	31	62	52	42	33
0.3 bar	M2FS15LX06	2.2	1.8	1.5	1.2	1.7	1.4	1.1	0.8	1.7	1.4	1.2	0.9
	M2FS15LX15	5.4	4.5	3.8	3.0	4.2	3.4	2.7	2.0	4.4	3.6	2.9	2.3
	M2FS15LX	11	9.1	7.5	6.1	8.4	6.8	5.3	4.0	8.7	7.2	5.8	4.6
	M2FS20LX	18	15	13	10	14	11	9	7	15	12	9.7	7.6
	M2FS25LX	29	24	20	16	22	18	14	11	23	19	16	12
	M2FS32LX	43	36	30	24	34	27	21	16	35	29	23	18
	M3FK40LX <sup>1)</sup>	72	60	50	41	56	45	36	27	58	48	39	30
	M3FK50LX <sup>1)</sup>	108	91	75	61	84	68	53	40	87	72	58	46
0.45 bar	M2FS15LX06	2.6	2.2	1.8	1.4	2.0	1.6	1.2	0.9	2.1	1.7	1.4	1.1
	M2FS15LX15	6.5	5.5	4.5	3.6	5.1	4.0	3.1	2.3	5.3	4.4	3.5	2.7
	M2FS15LX	13	11	9.0	7.2	10	8.1	6.2	4.6	11	8.7	7.0	5.4
	M2FS20LX	22	18	15	12	17	13	10	8	18	15	12	9
	M2FS25LX	35	29	24	19	27	22	17	12	28	23	19	15
	M2FS32LX	52	44	36	29	40	32	25	18	42	35	28	22
	M3FK40LX <sup>1)</sup>	87	73	60	48	67	54	42	30	71	58	47	36
	M3FK50LX <sup>1)</sup>	131	109	90	72	101	81	62	46	106	87	70	54

<sup>1)</sup> Note on M3FK... when used for suction pressure control:

- Seal off port "2".
- Note that the minimum admissible flow rate required to cool the condenser must be achieved by external means.
- Refer to data sheet N4722 for operating data and dimensions.

# Selection chart for suction throttle applications

50319A



$t_0$  Evaporation temperature [°C]  
 $t_c$  Condensation temperature [°C]  
 $t_{fl}$  Liquid temperature ( $t_c$  – degree of sub-cooling) [°C]  
 $Q_o$  Refrigeration capacity [kW]  
 $m$  Mass flow of refrigerant [kg/h]

$kvs$  Flow rate [m<sup>3</sup>/h]  
 $\Delta p_v$  Pressure differential across the valve [bar]  
 1) M3FK...LX : Seal off port "2" ; minimum admissible flow rate must be ensured by external means

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## Mounting notes

Mounting instructions are enclosed with the valve:  
Ref. 35541(ZM... terminal housing) and Ref. 35549 (valve).

The refrigerant valves can be mounted in any orientation, but upright mounting is preferable. The pipes should be fitted such that the alignment does not distort the valve connections. Before soldering the pipes, ensure that the direction of flow through the valve is correct.

Pipes must be soldered with care. 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. Cool the valve body with a wet cloth while soldering.

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

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## Commissioning notes

Connect a manometer to the suction side of the compressor, and close the valve manually to the point where the manometer shows the minimum admissible suction pressure.

The valve stroke is now limited, thus ensuring the minimum flow rate required to cool the condenser. This is essential for configurations without a hot gas control valve / re-injection valve.

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## Maintenance notes

The modulating control valves in the type series M2FS...LX... for suction throttle control are maintenance-free.

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## Technical data

Electrical interface:	Only admissible with low voltage (SELV, PELV)
Control signals:	ZM101/A DC 0 ...10 V or DC 0 ... 20 V phase cut ZM121/A DC 4 ... 20 mA or DC 0 ... 20 V phase cut ZM111 DC 0 ... 20 V phase cut
Supply voltage	AC 24 V for DC 0 ...10 V and DC 4 ... 20 mA
– Max. voltage tolerance	+15/–10 %
Nominal power	See table 'Operating data', page 1
Operating pressure, $p_{e,max}$	3.2 MPa (32 bar)
Pressure differential $\Delta p_{v,max}$ :	
Liquid	0.2 MPa (2 bar)
Gas	0.8 MPa (8 bar)
Leakage	Max 0.05 % $k_{vs}$ (to VDI/ VDE2174)
Temperature of medium	– 40 ...120 °C
Valve characteristic (stroke, $k_v$ )	Linear, optimised in low opening range
Resolution $\Delta H / H_{100}$	> 1 : 200 (H = Stroke)
Type of operation	Modulating
Position when de-energised	Closed
Orientation	Any
Positioning time	Approx. 1 s
Materials (valve body):	
Housing components	Steel and copper
Seat / inner valve	Bronze / CrNi steel
Pipe connections	Extended female solder unions
Connection terminals	Screw terminals for 4 mm <sup>2</sup> wire
Protection standard	IP54 to IEC529
Ambient temperature	– 40 ... 50 °C
Weight	See 'Dimensions', page 6
Conformity	Meets the requirements for <b>CE</b> marking

## Connection terminals

### Warning

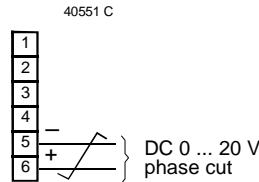
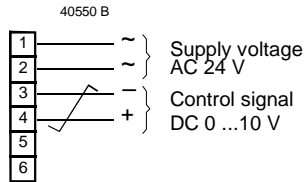
**ZM.../A terminal housing used with DC 0 ... 20 V signals:**

**Do not connect AC 24 V to Terminals 1 and 2.**

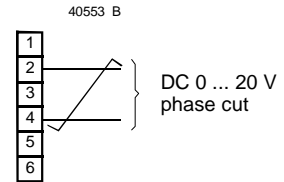
**Connect Terminal 5, (marked " - ")**

- to the appropriate Y output terminal on UNICO, KLIMO and MULTIREG (type 9 controllers)
- to Terminal 2 on type NKOA terminal modules.

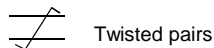
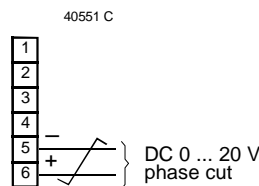
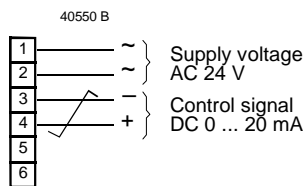
**ZM101/A** (DC 0 ...10 V or DC 0 ... 20 V phase cut)



**ZM111** (DC 0 ... 20 V phase cut)



**ZM121/A** (DC 4 ... 20 mA or DC 0 ... 20 V phase cut)

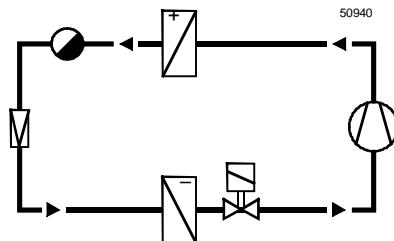


## Connection diagrams

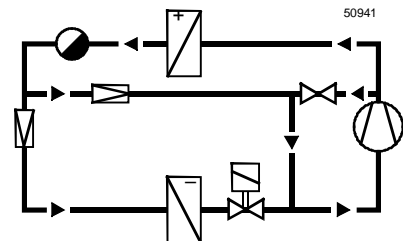
See sheet 4591 for connection diagrams for the ZM... and ZM.../A terminal housings.

## Application examples

Diagrams show principles only, without installation-specific details



Control range approx. 50 ... 100 %  
Compressor energy savings up to 40 %



Control range approx. 10 ... 100 %  
Compressor energy savings up to 40 %

## Suction throttle control

As the control valve closes, the evaporation temperature rises. The air cooling effect falls continuously. The electronic control system provides cooling on the basis of demand, without unwanted dehumidification and the associated costs of retreatment of the air.

The pressure on the suction side of the compressor falls and the power consumption of the compressor is reduced. The energy saving to be expected with low loads can be found by reference to the selection chart supplied by the compressor manufacturer (power consumption at minimum admissible suction pressure).

**Recommended pressure drop  $\Delta p_{V100}$  across the fully open control valve: between 0.15 and 0.5 bar.**

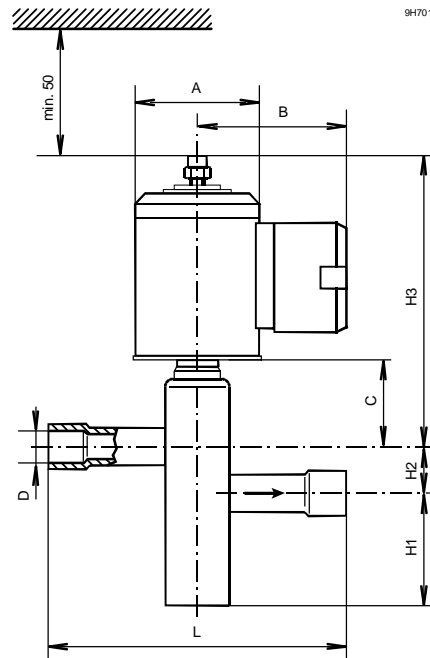
Example see page 6

Example

Refrigeration capacity $Q_0$	34 kW
Refrigerant	R404A
Evaporation temperature $t_0$	5 °C
Condensation temperature $t_c$	50 °C
Liquid temperature $t_{li}$	45 °C
Selected valve:	<b>M2FS32LX</b>
$\Delta p_v$ (from selection chart)	0.4 bar

Dimensions

All dimensions in mm



Valve type	DN [mm]	D [inches]	L	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	A	B	C	W [kg]
M2FS15LX06	15	5/8	150	57	25	180	60	73	67	2.6
M2FS15LX15	15	5/8	150	57	25	180	60	73	67	2.6
M2FS15LX	15	5/8	150	57	25	180	60	73	67	2.6
M2FS20LX	20	7/8	170	62	30	189	70	78	67	3.5
M2FS25LX	25	1 1/8	200	66	36	193	70	78	71	4.2
M2FS32LX	32	1 3/8	250	91	43	213	80	84	80	6.0

D : Pipe connections

G : Weight in kg (incl. packaging)