



- Electrically or pneumatically actuated valves
- With internal or external pilot air
- Sturdy and reliable

Specified types in accordance with ATEX directive for potentially explosive atmospheres

→ [www.festo.com/en/ex](http://www.festo.com/en/ex)

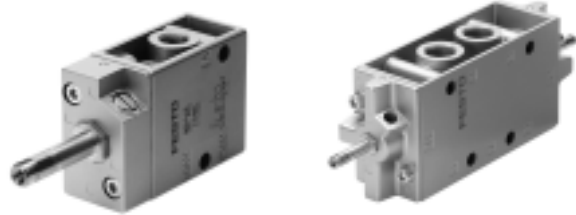
# Solenoid/pneumatic valves, Tiger Classic

Key features



## General information

- Highly durable poppet valve concept for all 3/2 and 5/2-way valves
- Pneumatic or electrical actuation with F solenoid coil
- With flow rates of up to 7,500 l/min
- Pipe thread in sizes G1/8, G1/4, G1/2 and G3/4
- Tried and tested assembly on PAL or PRS manifold strips with hollow bolts
- Optimised response times with patented U-ring and servo control



## Solenoid coils

F solenoid coils

Voltage:

- 12 to 230 V DC
- 12 to 240 V AC (50 to 60 Hz)

Power consumption:

- 4.5 W

- Selected types acc. to ATEX directive for explosive atmospheres

- Easily interchangeable solenoid coils
- Solenoid coil not included in scope of delivery

## Variants

VL/O-3-...

Depending upon selected connections:  
Normally closed or normally open

MFH-3-..., MOFH-3-...

- MFH-3-...  
Normally closed
- MOFH-3-...  
Normally open

These valves can be converted from one function to the other by rotating the seal under the cover.

MFH-3-...-S

This valve type can be used within a range of 0 to 8 bar and also as MOFH (through flow when not actuated) with a separate pilot line.

MFH-5-...-S

The external pilot air connection means that these valves can also be used with low operating pressures.

# Solenoid/pneumatic valves, Tiger Classic

Key features

## Manifold mounting

With PAL manifold strip



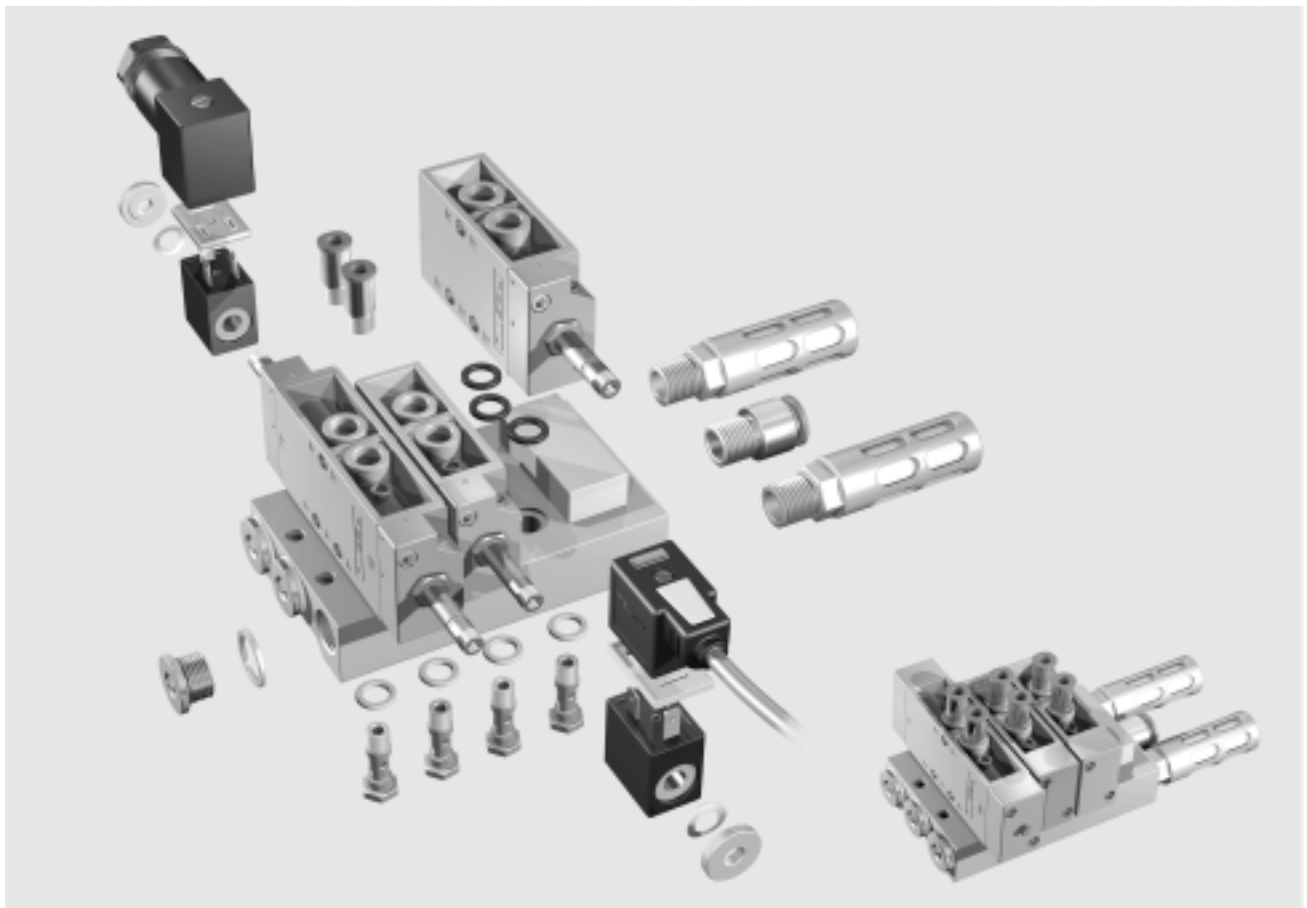
With PRS manifold block



The Tiger Classic valves can be mounted on PAL manifold strips with common supply port or on PRS manifold blocks with common supply port and common exhausts. The valves are mounted on the strips and blocks with hollow bolts. The manifold strip and manifold block have 2 to 6 valve positions.

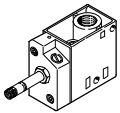
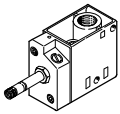
Vacant positions can be sealed on PAL manifold strips with blanking caps, or with blanking plates on PRS manifold blocks.

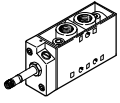
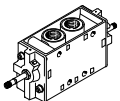
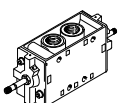
Separate pressure levels can be provided to individual valves by means of hollow bolts with threaded connection.



# Solenoid valves, Tiger Classic

Product range overview

Function	Design	Type	Pneumatic connection	Operating voltage	
				[V DC]	[V AC]
3/2-way valves	Solenoid valve				
		MFH	G $\frac{1}{8}$	12, 24, 42, 48	24, 42, 48, 110, 230, 240
			G $\frac{1}{4}$		
			G $\frac{1}{2}$		
			G $\frac{3}{4}$		
		MOFH	G $\frac{1}{8}$	12, 24, 42, 48	24, 42, 48, 110, 230, 240
			G $\frac{1}{4}$		
			G $\frac{1}{2}$		
G $\frac{3}{4}$					

Function	Design	Type	Pneumatic connection	Operating voltage	
				[V DC]	[V AC]
5/2-way valves	Solenoid valve				
		MFH	G $\frac{1}{8}$	12, 24, 42, 48	24, 42, 48, 110, 230, 240
			G $\frac{1}{4}$		
			G $\frac{1}{2}$		
	Double solenoid valve				
		JMFH	G $\frac{1}{8}$	12, 24, 42, 48	24, 42, 48, 110, 230, 240
			G $\frac{1}{4}$		
			G $\frac{1}{2}$		
	Double solenoid valve with dominant signal				
		JMGH	G $\frac{1}{8}$	12, 24, 42, 48	24, 42, 48, 110, 230, 240
G $\frac{1}{4}$					

# Solenoid valves, Tiger Classic

Product range overview

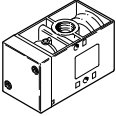
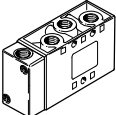
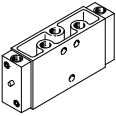
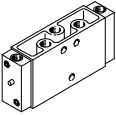
Type	Normal position		Pilot air supply		Type of reset		→ Page/Internet
	Closed	Open	Internal	External	Air spring	Mechanical spring	
<b>Solenoid valve</b>							
MFH	■	-	■	■	-	■	12
	■	-	■	■	-	■	
	■	-	■	■	-	■	
	■	-	■	■	-	■	
MOFH	-	■	■	-	-	■	12
	-	■	■	-	-	■	
	-	■	■	-	-	■	
	-	■	■	-	-	■	

Type	Pilot air supply		Type of reset		→ Page/Internet
	Internal	External	Air spring	Mechanical spring	
<b>Solenoid valve</b>					
MFH	■	■	-	■	17
	■	■	-	■	
	■	■	-	■	
<b>Double solenoid valve</b>					
JMFH	■	■	-	-	22
	■	■	-	-	
	■	■	-	-	
<b>Double solenoid valve with dominant signal</b>					
JMFHDH	-	■	-	-	22
	-	■	-	-	

# Pneumatic valves, Tiger Classic

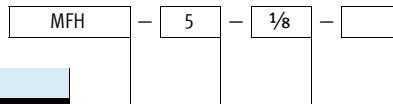
Product range overview



Function	Design	Type	Pneumatic connection	Type of reset		→ Page/Internet
				Air spring	Mechanical spring	
3/2-way valves	<b>Pneumatic valve</b>					
		VL/O	G1/8	-	■	29
			G1/4	-	■	
			G1/2	-	■	
G3/4			-	■		
5/2-way valves	<b>Pneumatic valve</b>					
		VL	G1/8	-	■	33
			G1/4	-	■	
			G1/2	-	■	
	<b>Double pilot valve</b>					
		JH	G1/8	-	-	36
			G1/4	-	-	
			G1/2	-	-	
	<b>Double pilot valve with dominant signal</b>					
		JDH	G1/8	-	-	36
G1/4			-	-		

# Solenoid valves, Tiger Classic

Type codes



Type	
MFH	Single solenoid, for F solenoid coil, normally closed
MOFH	Single solenoid, for F solenoid coil, normally open
JMFH	Double solenoid, for F solenoid coil
JMFDH	Double solenoid, for F solenoid coil, with dominant signal

Valve function	
3	3/2-way valve
5	5/2-way valve

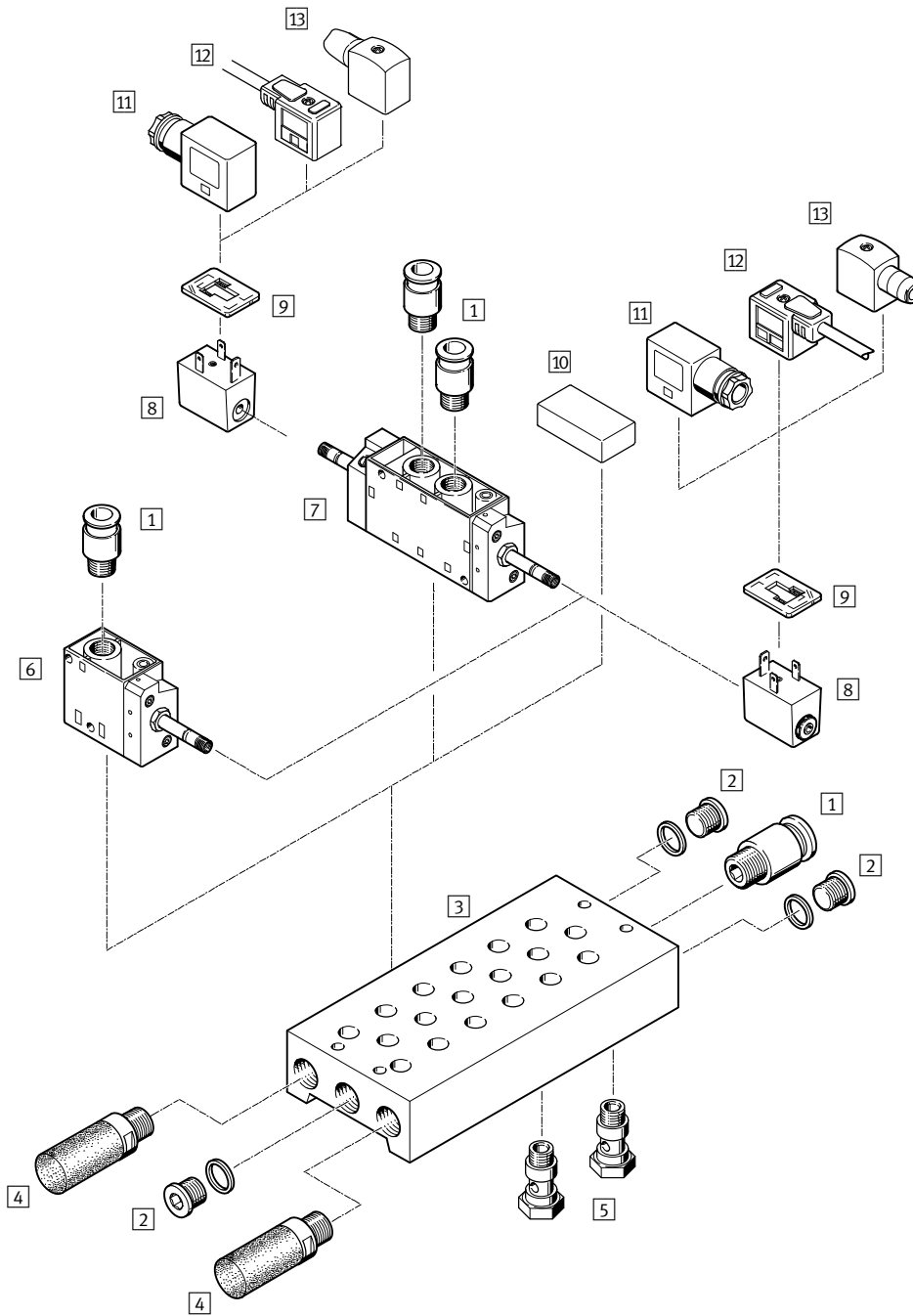
Pneumatic connection	
1/8	G1/8
1/4	G1/4
1/2	G1/2
3/4	G3/4

Pilot air supply	
	Internal
S	External

# Solenoid valves, Tiger Classic

Peripherals overview

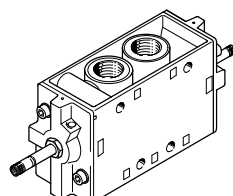
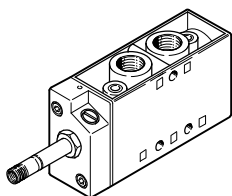
## Mounting on manifold block



### Variants

MFH-5-...

JMFH-5-...





# Solenoid valves, Tiger Classic

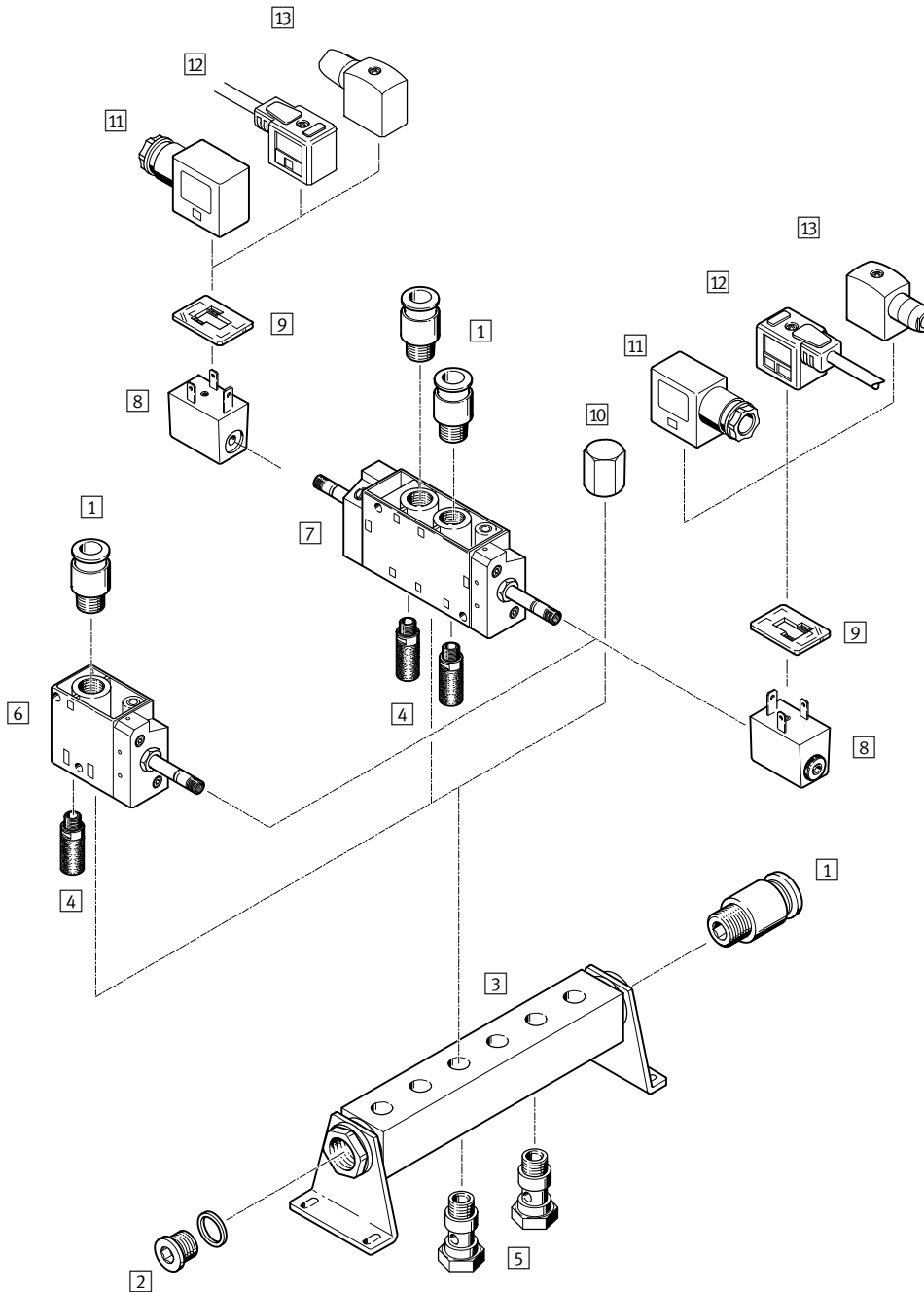
Peripherals overview

Accessories		
	Brief description	→ Page/Internet
1	Push-in fitting QS	For connecting standard O.D. tubing quick star
2	Blanking plug B	3 included in the scope of delivery for PRS manifold block blanking plug
3	Manifold block PRS	42
4	Silencer	For fitting in exhaust ports u
5	Hollow bolt VT	For distribution of compressed air or for separate compressed air supply 41
6	Solenoid valve MFH	For F solenoid coil 4
7	Double solenoid valve JMFH	For F solenoid coil 4
8	F solenoid coil MSFG, MSFW	msfg, msfw
9	Luminescent seal M...-LD	For displaying the switching status 44
10	Blanking plate PRSB	For covering an unused valve position 43
11	Plug socket MSSD-F	For valves MFH, JMFH 44
12	Plug socket with cable KMF	For valves MFH, JMFH 44
13	Plug socket MSSD-F-S	For valves MFH, JMFH 44

# Solenoid valves, Tiger Classic

Peripherals overview

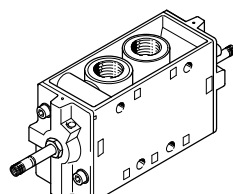
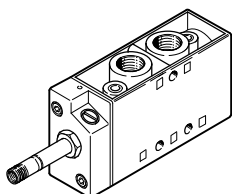
## Mounting on manifold strip



### Variants

MFH-5-...

JMFH-5-...





# Solenoid valves, Tiger Classic

Peripherals overview

Accessories		
	Brief description	→ Page/Internet
1	Push-in fitting QS	For connecting standard O.D. tubing quick star
2	Blanking plug B	1 included in the scope of delivery for PAL manifold strip blanking plug
3	Manifold strip PAL	40
4	Silencer	For fitting in exhaust ports u
5	Hollow bolt VT	For distribution of compressed air or for separate compressed air supply 41
6	Solenoid valve MFH	For F solenoid coil 4
7	Double solenoid valve JMFH	For F solenoid coil 4
8	F solenoid coil MSFG, MSFW	msfg, msfw
9	Luminescent seal M...-LD	For displaying the switching status 44
10	Blanking cap VTM	For blanking an unused valve position 41
11	Plug socket MSSD-F	For valves MFH, JMFH 44
12	Plug socket with cable KMF	For valves MFH, JMFH 44
13	Plug socket MSSD-F-S	For valves MFH, JMFH 44

# Solenoid valves MFH, Tiger Classic

Technical data – 3/2-way valves

-  - Flow rate  
500 ... 7500 l/min
-  - Voltage  
12, 24, 42, 48 V DC  
24, 42, 48, 110, 230,  
240 V AC

Wearing parts kits → 16



General technical data					
Pneumatic connection	G1/8	G1/4	G1/2	G3/4	
Valve function	3/2-way, single solenoid				
Constructional design	Poppet valve				
Sealing principle	Soft				
Actuation type	Electrical				
Type of reset	Mechanical spring				
Type of control	Piloted				
Pilot air supply	Internal or external				
Direction of flow	Non reversible				
Exhaust function	With flow control				
Manual override	Detenting				
Type of mounting	Via through holes				
Mounting position	Any				
Nominal size	[mm]	5	7	14	19
Standard nominal flow rate	[l/min]	500	800	3700	7500
Product weight	[g]	240	320	1100	1260

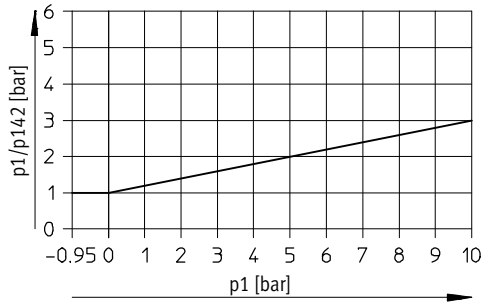
Operating and environmental conditions				
Pneumatic connection	G1/8	G1/4	G1/2	G3/4
Operating medium	Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Note on operating/pilot medium	Operation with lubricated medium possible (in which case lubricated operation will always be required)			
Operating pressure	Internal pilot air supply	[bar]	1.5 ... 8	2 ... 8
	External pilot air supply	[bar]	-0.95 ... +10	
Pilot pressure	[bar]	1 ... 8		
Ambient temperature	[°C]	-5 ... +40		
Temperature of medium	[°C]	-10 ... +60		
Note on materials	RoHS-compliant			
Certification	c CSA us (OL)		-	
	c UL us - Recognized (HL)		-	

# Solenoid valves MFH, Tiger Classic

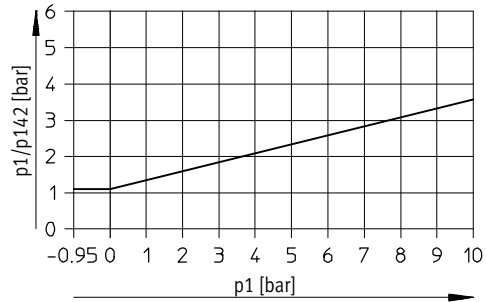
Technical data – 3/2-way valves

## Minimal pilot pressure $p_{12}/p_{14}$ as a function of operating pressure $p_1$ (external pilot air supply)

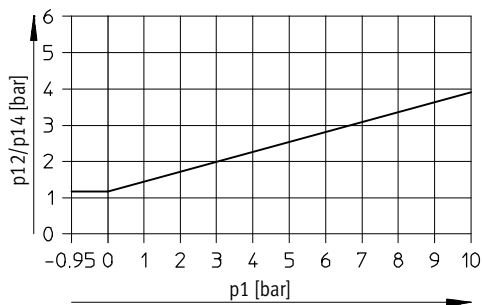
MFH-3-1/8-S



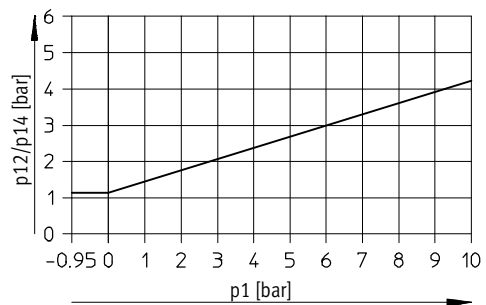
MFH-3-1/4-S



MFH-3-1/2-S



MFH-3-3/4-S



## Valve response times [ms]

Pneumatic connection	G1/8		G1/4		G1/2		G3/4	
Normal position	Closed	Open	Closed	Open	Closed	Open	Closed	Open
Internal pilot air supply								
On	9	9	10	15	18	18	40	40
Off	29	29	29	45	90	90	29	29
External pilot air supply								
On	9	-	10	-	18	-	40	-
Off	29	-	29	-	90	-	29	-

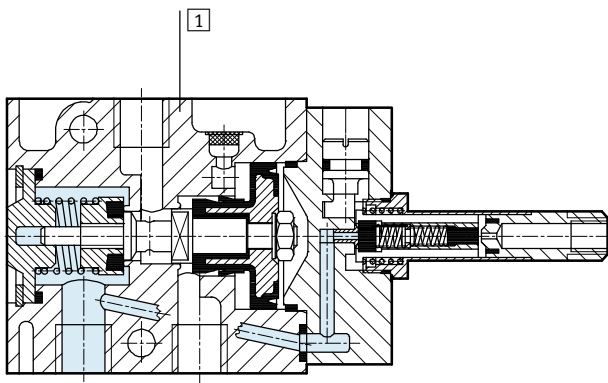
# Solenoid valves MFH, Tiger Classic

Technical data – 3/2-way valves

Electrical data			
F solenoid coil			
Electrical connection	Plug vanes for plug sockets MSSD-F, KMF		
Operating voltage	D.C. voltage	[V DC]	12, 24, 42, 48
	A.C. voltage	[V AC]	24, 42, 48, 110, 230, 240 (50 ... 60 Hz)
Coil characteristics	D.C. voltage	[W]	4.5
	A.C. voltage	[VA]	Pull: 7.5 Hold: 6
Protection class to EN 60 529	IP65 (in combination with plug socket)		

## Materials

Sectional view



1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber

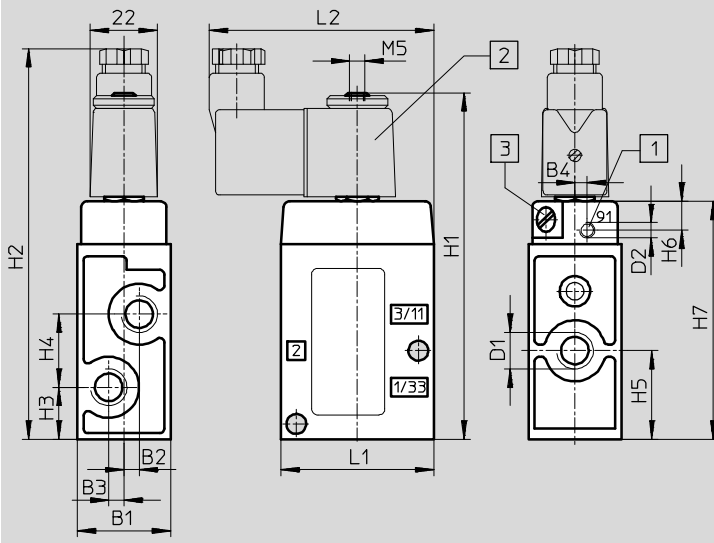
# Solenoid valves MFH, Tiger Classic

Technical data – 3/2-way valves

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

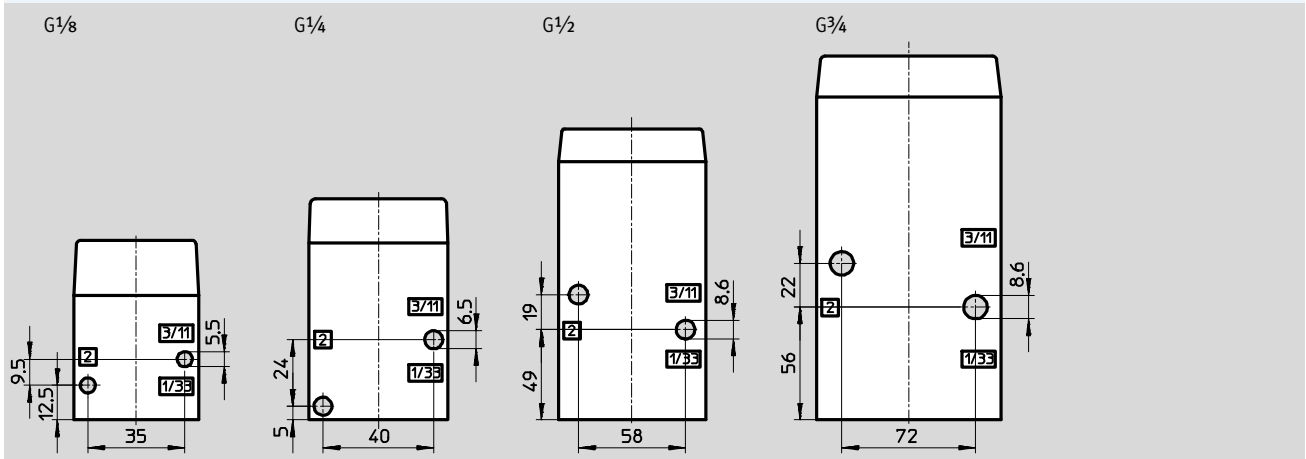
MFH, MOFH



- 1 Additional connection for external pilot air with MFH-3-...-S
- 2 Solenoid coil is 360° rotatable
- 3 Manual override can be repositioned by 180°

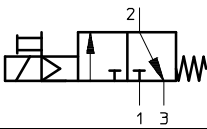
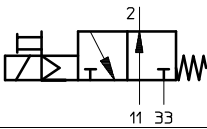
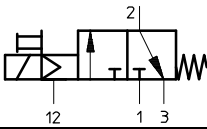
Pneumatic connection	B1	B2	B3	B4	D1	D2	H1	H2	H3	H4	H5	H6	H7	L1	L2
G $\frac{1}{8}$	26	3.5	3.5	2.7	G $\frac{1}{8}$	M5	97	111	12.5	19	22	9.5	63	45	71
G $\frac{1}{4}$	30.4	5	5	4	G $\frac{1}{4}$	M5	112	126	17	24	29	9.5	78	50	74
G $\frac{1}{2}$	52	8	8	-	G $\frac{1}{2}$	G $\frac{1}{8}$	151	165	30	38	49	10.5	117	80	89
G $\frac{3}{4}$	68	8	8	-	G $\frac{3}{4}$	G $\frac{1}{8}$	171	185	34	44	56	11	137	92	95

## Attachment diagram



# Solenoid valves MFH, Tiger Classic

Technical data – 3/2-way valves

Ordering data				
Circuit symbol	Description	Pneumatic connection	Part No.	Type
	Without F solenoid coil <sup>1)</sup> , internal pilot air supply	G <sup>1</sup> / <sub>8</sub>	<b>7802</b>	<b>MFH-3-1/8</b>
		G <sup>1</sup> / <sub>4</sub>	<b>9964</b>	<b>MFH-3-1/4</b>
		G <sup>1</sup> / <sub>2</sub>	<b>9857</b>	<b>MFH-3-1/2</b>
		G <sup>3</sup> / <sub>4</sub>	<b>11967</b>	<b>MFH-3-3/4</b>
	Without F solenoid coil <sup>1)</sup> , internal pilot air supply	G <sup>1</sup> / <sub>8</sub>	<b>7877</b>	<b>MOFH-3-1/8</b>
		G <sup>1</sup> / <sub>4</sub>	<b>7876</b>	<b>MOFH-3-1/4</b>
		G <sup>1</sup> / <sub>2</sub>	<b>7884</b>	<b>MOFH-3-1/2</b>
		G <sup>3</sup> / <sub>4</sub>	<b>11969</b>	<b>MOFH-3-3/4</b>
	Without F solenoid coil <sup>1)</sup> , external pilot air supply	G <sup>1</sup> / <sub>8</sub>	<b>7958</b>	<b>MFH-3-1/8-S</b>
		G <sup>1</sup> / <sub>4</sub>	<b>7959</b>	<b>MFH-3-1/4-S</b>
		G <sup>1</sup> / <sub>2</sub>	<b>7960</b>	<b>MFH-3-1/2-S</b>
		G <sup>3</sup> / <sub>4</sub>	<b>11968</b>	<b>MFH-3-3/4-S</b>



1) F solenoid coils → 44

Ordering data – Wearing parts kits		
Pneumatic connection	Part No.	Type
G <sup>1</sup> / <sub>8</sub>	<b>104206</b>	<b>MFH-3-1/8</b>
G <sup>1</sup> / <sub>4</sub>	<b>104207</b>	<b>MFH-3-1/4</b>
G <sup>1</sup> / <sub>2</sub>	<b>104208</b>	<b>MFH-3-1/2</b>



# Solenoid valves MFH, Tiger Classic

Technical data – 5/2-way valves

-  - Flow rate  
500 ... 3700 l/min
-  - Voltage  
12, 24, 42, 48 V DC  
24, 42, 48, 110, 230,  
240 V AC

Wearing parts kits → 21



General technical data				
Pneumatic connection		G <sup>1</sup> / <sub>8</sub>	G <sup>1</sup> / <sub>4</sub>	G <sup>1</sup> / <sub>2</sub>
Valve function		5/2-way, single solenoid		
Constructional design		Poppet valve		
Sealing principle		Soft		
Actuation type		Electrical		
Type of reset		Mechanical spring		
Type of control		Piloted		
Direction of flow		Non reversible		
Pilot air supply		Internal or external		
Exhaust function		With flow control		
Manual override		Detenting		
Type of mounting		Via through holes		
Mounting position		Any		
Nominal size	[mm]	5	7	14
Standard nominal flow rate	[l/min]	500	1000	3700
Product weight	[g]	270	290	1135

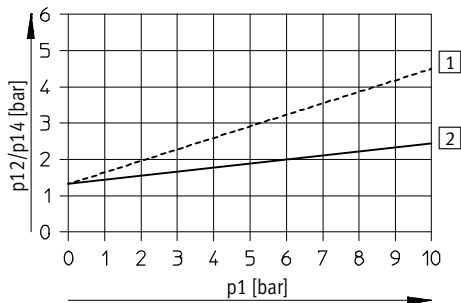
Operating and environmental conditions					
Pneumatic connection		G <sup>1</sup> / <sub>8</sub>	G <sup>1</sup> / <sub>4</sub>	G <sup>1</sup> / <sub>2</sub>	
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Note on operating/pilot medium		Operation with lubricated medium possible (in which case lubricated operation will always be required)			
Operating pressure	Internal pilot air supply	[bar]	1.8 ... 8	2.2 ... 8	2 ... 8
	External pilot air supply	[bar]	0 ... 10	0 ... 8	0 ... 8
Pilot pressure		[bar]	1 ... 8	1.5 ... 8	1.5 ... 8
Ambient temperature		[°C]	-5 ... +40		
Temperature of medium		[°C]	-10 ... +60		
Note on materials			RoHS-compliant		

# Solenoid valves MFH, Tiger Classic

Technical data – 5/2-way valves

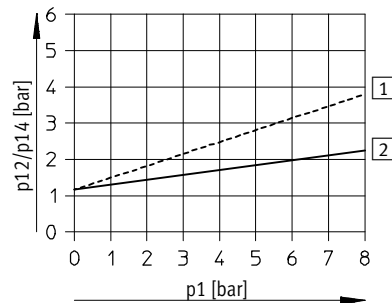
## Minimal pilot pressure $p_{12}$ , $p_{14}$ as a function of operating pressure $p_1$ (external pilot air supply)

MFH-5-1/8-S



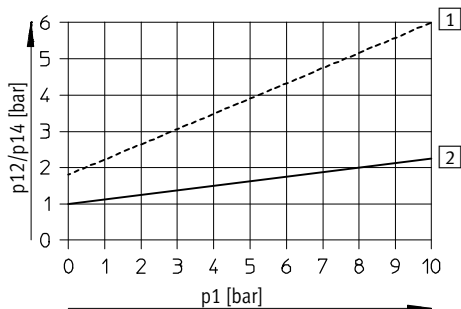
----- Exhaust throttled  
 ——— Exhaust unthrottled

MFH-5-1/4-S



----- Exhaust throttled  
 ——— Exhaust unthrottled

MFH-5-1/2-S



----- Exhaust throttled  
 ——— Exhaust unthrottled

Valve response times [ms]						
Pneumatic connection	G1/8		G1/4		G1/2	
Pilot air supply	Internal	External	Internal	External	Internal	External
On	8	8	9	9	15	21
Off	36	36	29	29	154	150

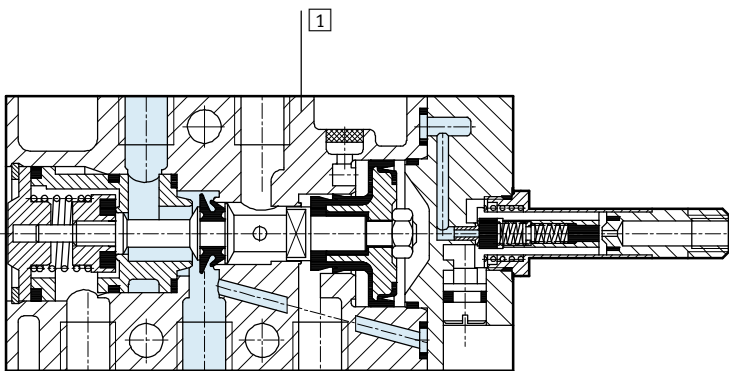
# Solenoid valves MFH, Tiger Classic

Technical data – 5/2-way valves

Electrical data			
F solenoid coil			
Electrical connection		Plug vanes for plug sockets MSSD-F, KMF	
Operating voltage	D.C. voltage	[V DC]	12, 24, 42, 48
	A.C. voltage	[V AC]	24, 42, 48, 110, 230, 240 (50 ... 60 Hz)
Coil characteristics	D.C. voltage	[W]	4.5
	A.C. voltage	[VA]	Pull: 7.5 Hold: 6
Protection class to EN 60 529		IP65 (in combination with plug socket)	

## Materials

Sectional view



1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber

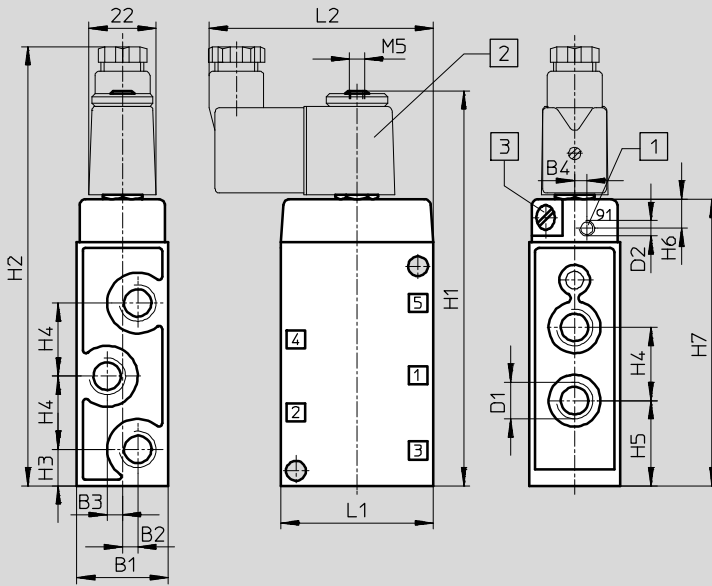
# Solenoid valves MFH, Tiger Classic

Technical data – 5/2-way valves

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

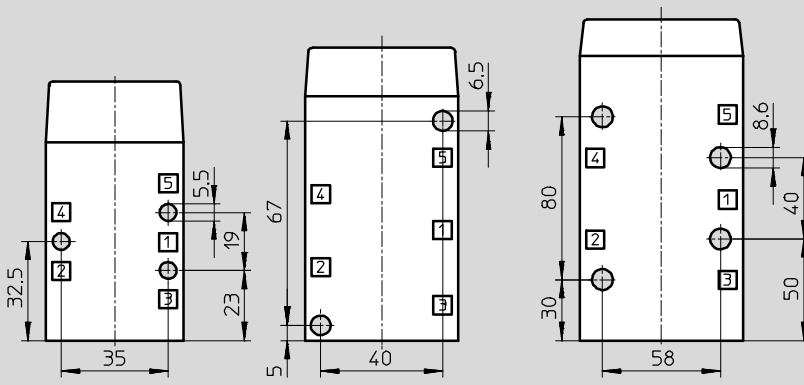
MFH



- 1 Additional connection for external pilot air with MFH-5-...-S
- 2 Solenoid coil is 360° rotatable
- 3 Manual override can be repositioned by 180°

Pneumatic connection	B1	B2	B3	B4	D1	D2	H1	H2	H3	H4	H5	H6	H7	L1	L2
G $\frac{3}{8}$	26	3.5	3.5	2.7	G $\frac{3}{8}$	M5	117	131	13.5	19	23	9.5	83	45	71
G $\frac{1}{4}$	30.4	-	5	4	G $\frac{1}{4}$	M5	128	143	12	24	28	9.5	128	50	74
G $\frac{1}{2}$	52	-	8	-	G $\frac{1}{2}$	G $\frac{3}{8}$	192	209	32	38	51	10.5	158	80	89

## Attachment diagram



# Solenoid valves MFH, Tiger Classic

Technical data – 5/2-way valves

Ordering data				
Circuit symbol	Description	Pneumatic connection	Part No.	Type
	Without F solenoid coil <sup>1)</sup> , internal pilot air supply	G $\frac{1}{8}$	<b>9982</b>	<b>MFH-5-1/8</b>
		G $\frac{1}{4}$	<b>6211</b>	<b>MFH-5-1/4</b>
		G $\frac{1}{2}$	<b>6420</b>	<b>MFH-5-1/2</b>
	Without F solenoid coil <sup>1)</sup> , external pilot air supply	G $\frac{1}{8}$	<b>10348</b>	<b>MFH-5-1/8-S</b>
		G $\frac{1}{4}$	<b>10349</b>	<b>MFH-5-1/4-S</b>
		G $\frac{1}{2}$	<b>35547</b>	<b>MFH-5-1/2-S</b>

1) F solenoid coils → 44



Ordering data – Wearing parts kits		
Pneumatic connection	Part No.	Type
G $\frac{1}{8}$	<b>104209</b>	<b>MFH-5-1/8<sup>1)2)</sup></b>
G $\frac{1}{4}$	<b>104211</b>	<b>MFH-5-1/4<sup>3)4)</sup></b>

- 1) Order mounting sleeves 228 389 separately
- 2) Use up to E602 series
- 3) Order mounting sleeves 229 363 separately
- 4) Use from 1/81 series

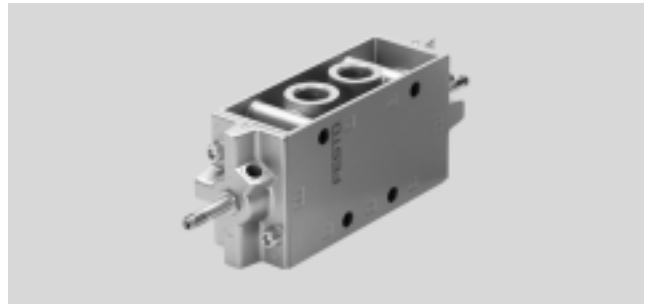
# Double solenoid valves JMFH, Tiger Classic

Technical data – 5/2-way double solenoid valves

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-  - Flow rate  
600 ... 4500 l/min
-  - Voltage  
12, 24, 42, 48 V DC  
24, 42, 48, 110, 230,  
240 V AC

Wearing parts kits → 26



General technical data					
Pneumatic connection		G $\frac{1}{8}$	G $\frac{1}{4}$	G $\frac{1}{2}$	
Valve function		5/2-way, double solenoid			
Constructional design		Poppet valve			
Sealing principle		Soft			
Actuation type		Electrical			
Type of control		Piloted			
Pilot air supply		Internal or external			
Direction of flow		Non reversible			
Exhaust function		With flow control			
Manual override		Detenting			
Type of mounting		Via through holes			
Mounting position		Any			
Nominal size		[mm]	5	7	14
Standard nominal flow rate	Internal pilot air supply	[l/min]	600	1100	4500
	External pilot air supply	[l/min]	600	1100	4000
Product weight		[g]	425	530	1210

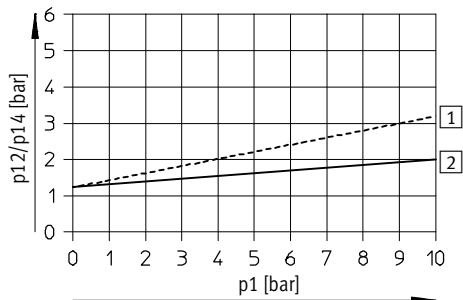
Operating and environmental conditions					
Pneumatic connection		G $\frac{1}{8}$	G $\frac{1}{4}$	G $\frac{1}{2}$	
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Note on operating/pilot medium		Operation with lubricated medium possible (in which case lubricated operation will always be required)			
Operating pressure	Internal pilot air supply	[bar]	1.5 ... 8	1.5 ... 8	2 ... 8
	External pilot air supply	[bar]	0 ... 8	0 ... 8	0 ... 8
	With dominant signal	[bar]	2.5 ... 8	2.5 ... 8	–
Pilot pressure		[bar]	1.2 ... 8	1.2 ... 8	0.5 ... 8
Ambient temperature		[°C]	–5 ... +40		
Temperature of medium		[°C]	–10 ... +60		
Note on materials		RoHS-compliant			

# Double solenoid valves JMFH, Tiger Classic

Technical data – 5/2-way double solenoid valves

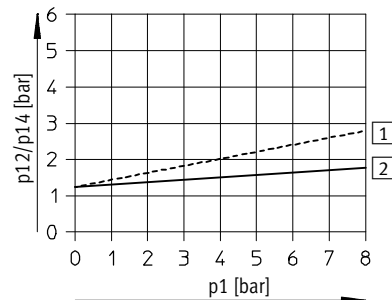
## Minimal pilot pressure p12, p14 as a function of operating pressure p1 (external pilot air supply)

JMFH-5-1/8-S



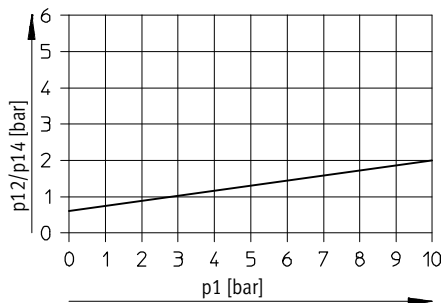
----- Exhaust throttled  
 ————— Exhaust unthrottled

JMFH-5-1/4-S



----- Exhaust throttled  
 ————— Exhaust unthrottled

JMFH-5-1/2-S



## Valve response times [ms]

Pneumatic connection	G <sup>1</sup> / <sub>8</sub>	Dominating signal at 14		G <sup>1</sup> / <sub>4</sub>	Dominating signal at 14		G <sup>1</sup> / <sub>2</sub>
<b>Internal pilot air supply</b>							
On/changeover	–	16	–	24	–	–	–
Off/changeover	18	24	11	32	20	–	–
<b>External pilot air supply</b>							
On/changeover	–	–	–	–	–	–	–
Off/changeover	18	–	11	–	20	–	–

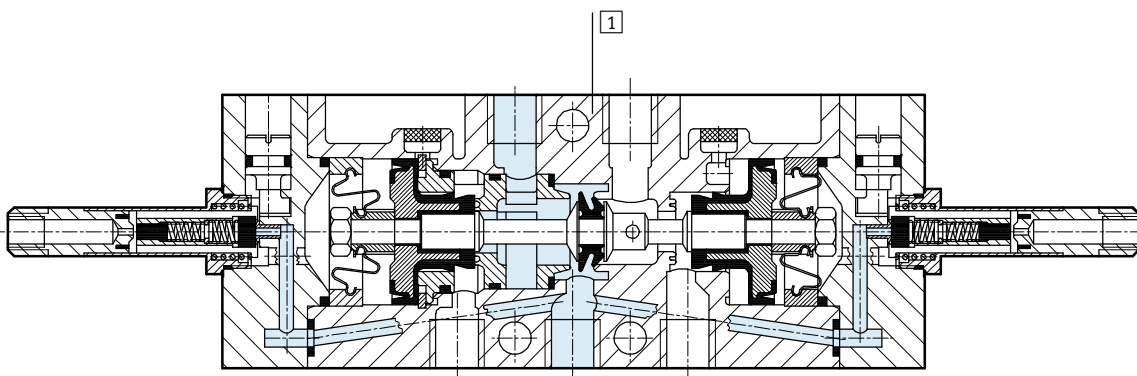
# Double solenoid valves JMFH, Tiger Classic

Technical data – 5/2-way double solenoid valves

Electrical data			
F solenoid coil			
Electrical connection		Plug vanes for plug sockets MSSD-F, KMF	
Operating voltage	D.C. voltage	[V DC]	12, 24, 42, 48
	A.C. voltage	[V AC]	24, 42, 48, 110, 230, 240 (50 ... 60 Hz)
Coil characteristics	D.C. voltage	[W]	4.5
	A.C. voltage	[VA]	Pull: 7.5 Hold: 6
Protection class to EN 60 529		IP65 (in combination with plug socket)	

## Materials

Sectional view



1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber



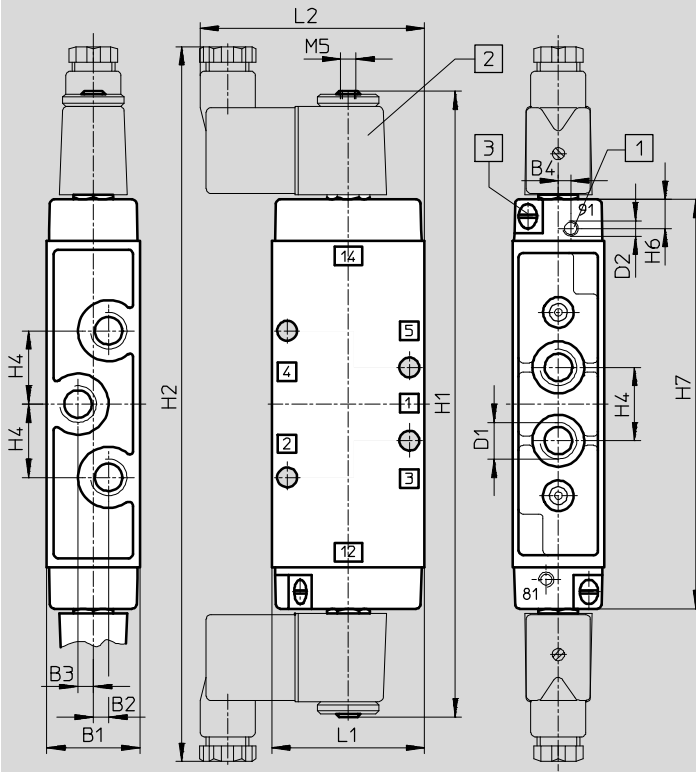
# Double solenoid valves JMFH, Tiger Classic

Technical data – 5/2-way double solenoid valves

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

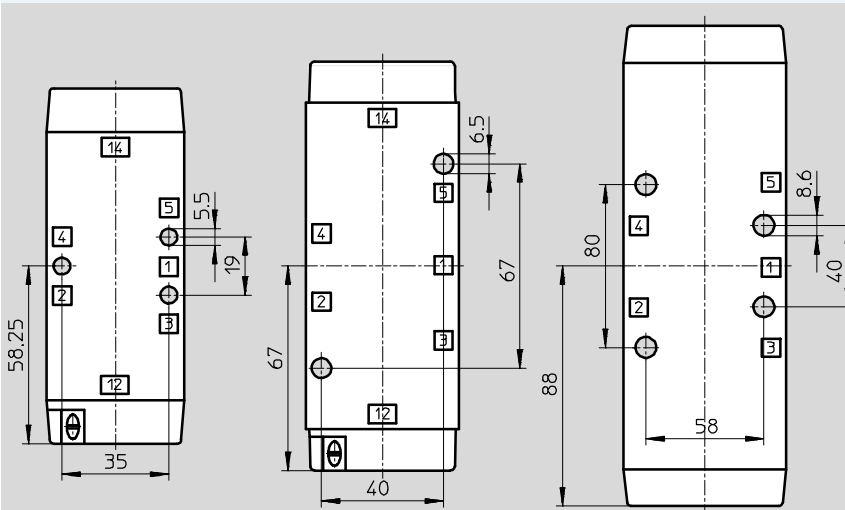
JMFH, JMFHDH



- 1 Additional connection for external pilot air with JMF...H-5-...-S
- 2 Solenoid coil is 360° rotatable
- 3 Manual override can be repositioned by 180°

Pneumatic connection	B1	B2	B3	B4	D1	D2	H1	H2	H4	H6	H7	L1	L2
G $\frac{1}{8}$	26	3.5	3.5	2.7	G $\frac{1}{8}$	M5	184	217	19	9.5	116.5	45	71
G $\frac{1}{4}$	30.4	–	5	4	G $\frac{1}{4}$	M5	202	235	24	9.5	134	50	74
G $\frac{1}{2}$	52	–	8	–	G $\frac{1}{2}$	G $\frac{1}{8}$	244	272	38	10.5	176	80	89

## Attachment diagram



# Double solenoid valves JMFH, Tiger Classic



Technical data – 5/2-way double solenoid valves

Ordering data				
Circuit symbol	Description	Pneumatic connection	Part No.	Type
	Without F solenoid coil <sup>1)</sup> , internal pilot air supply	G <sup>1</sup> / <sub>8</sub>	<b>8820</b>	<b>JMFH-5-1/8</b>
		G <sup>1</sup> / <sub>4</sub>	<b>10410</b>	<b>JMFH-5-1/4</b>
		G <sup>1</sup> / <sub>2</sub>	<b>10166</b>	<b>JMFH-5-1/2</b>
	Without F solenoid coil <sup>1)</sup> , external pilot air supply	G <sup>1</sup> / <sub>8</sub>	<b>14008</b>	<b>JMFH-5-1/8-S</b>
		G <sup>1</sup> / <sub>4</sub>	<b>14009</b>	<b>JMFH-5-1/4-S</b>
		G <sup>1</sup> / <sub>2</sub>	<b>35548</b>	<b>JMFH-5-1/2-S</b>
	Without F solenoid coil <sup>1)</sup> , internal pilot air supply, with dominating signal at 14	G <sup>1</sup> / <sub>8</sub>	<b>8821</b>	<b>JMFDH-5-1/8</b>
		G <sup>1</sup> / <sub>4</sub>	<b>10411</b>	<b>JMFDH-5-1/4</b>

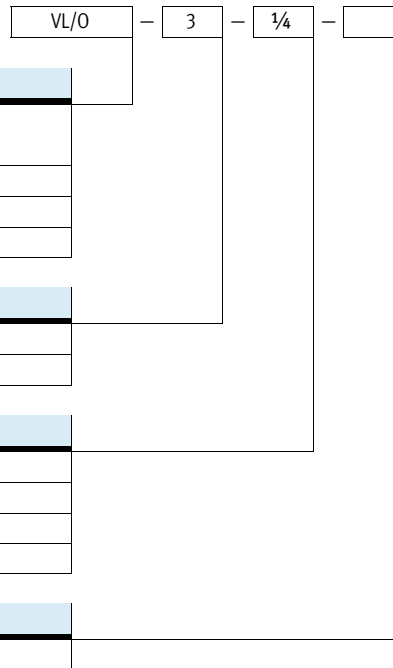
1) F solenoid coils → 44

Ordering data – Wearing parts kits		
Pneumatic connection	Part No.	Type
G <sup>1</sup> / <sub>8</sub>	<b>104891</b>	<b>JMFH-5-1/8<sup>1)</sup></b>
G <sup>1</sup> / <sub>4</sub>	<b>104892</b>	<b>JMFH-5-1/4<sup>2)</sup></b>

- 1) Order mounting sleeves 228 389 separately
- 2) Order mounting sleeves 229 363 separately

# Pneumatic valves, Tiger Classic

Type codes



Type	
VL/O	Single pilot, normally open or closed
VL	Single pilot
JH	Double pilot
JMFDH	Double pilot, dominant

Valve function	
3	3/2-way valve
5	5/2-way valve

Pneumatic connection	
1/8	G1/8
1/4	G1/4
1/2	G1/2
3/4	G3/4

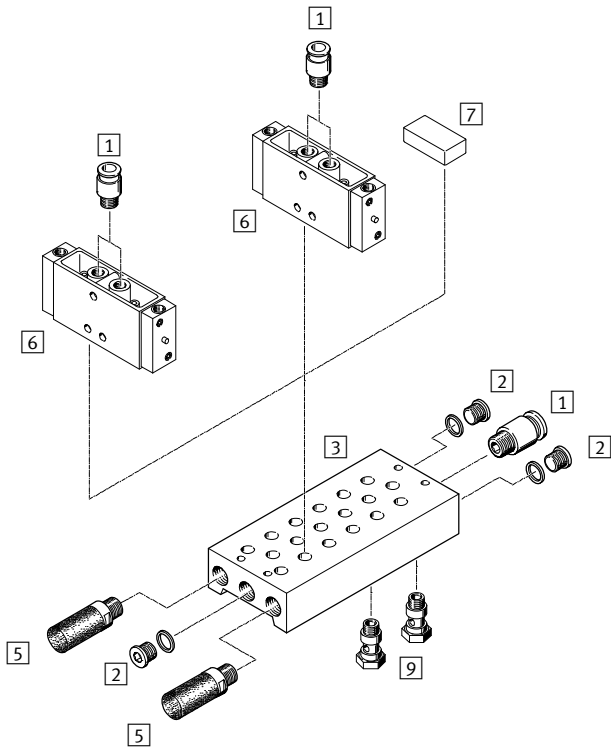
Generation	
B	Series B

# Pneumatic valves, Tiger Classic

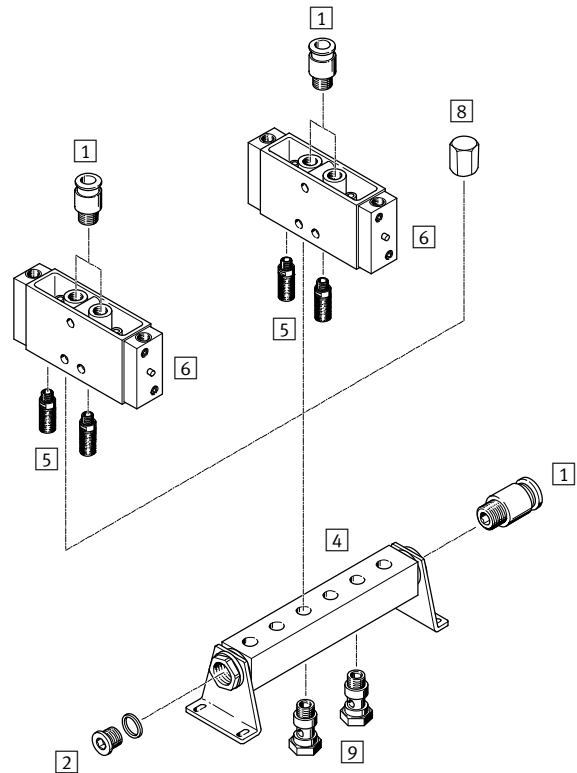
Peripherals overview

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## Mounting on manifold block




## Mounting on manifold strip



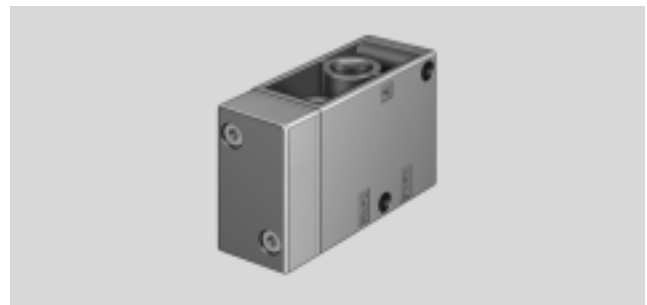
Accessories		Brief description	→ Page/Internet
1	Push-in fitting QS	For connecting standard O.D. tubing	quick star
2	Blanking plug B	3 included in the scope of delivery for PRS manifold block 1 included in the scope of delivery for PAL manifold strip	blanking plug
3	Manifold block PRS		42
4	Manifold strip PAL		40
5	Silencer	For fitting in exhaust ports	u
6	Pneumatic valve VL, JH		vl, jh
7	Blanking plate PRSB	For covering an unused valve position	43
8	Blanking cap VTM	For blanking an unused valve position	41
9	Hollow bolt VT	For distribution of compressed air or for separate compressed air supply	41

# Pneumatic valves VL/O, Tiger Classic

Technical data – 3/2-way valves

-  - Flow rate  
500 ... 7500 l/min

Wearing parts kits → 32



General technical data					
Pneumatic connection		G1/8	G1/4	G1/2	G3/4
Valve function		3/2-way, single pilot			
Constructional design		Poppet valve			
Sealing principle		Soft			
Actuation type		Pneumatic			
Type of reset		Mechanical spring			
Type of pilot control		Direct			
Direction of flow		Reversible			
Exhaust function		With flow control			
Manual override		None			
Type of mounting		Via through holes			
Mounting position		Any			
Nominal size	[mm]	5	7	14	19
Standard nominal flow rate	[l/min]	500	800	3700	7500
Product weight	[g]	150	230	860	1200

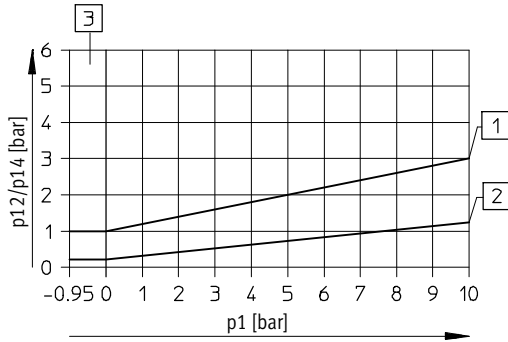
Operating and environmental conditions					
Pneumatic connection		G1/8	G1/4	G1/2	G3/4
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Note on operating/pilot medium		Operation with lubricated medium possible (in which case lubricated operation will always be required)			
Operating pressure	Normally closed	[bar]	-0.95 ... +10	-0.95 ... +10	-0.95 ... +10
	Normally open	[bar]	0 ... 10	0 ... 10	0 ... 10
Pilot pressure		See diagram (max. 10 bar)			
Ambient temperature		[°C]	-10 ... +60		
Note on materials		RoHS-compliant			

# Pneumatic valves VL/O, Tiger Classic

Technical data – 3/2-way valves

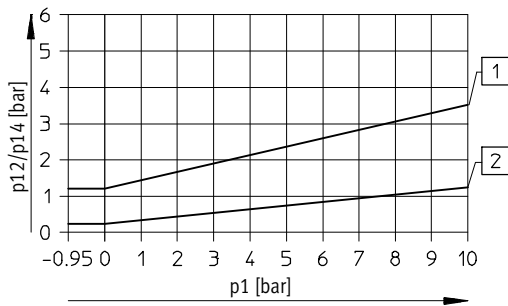
## Minimal pilot pressure $p_{12}/p_{14}$ as a function of operating pressure $p_1$

VL/O-3-1/8-B



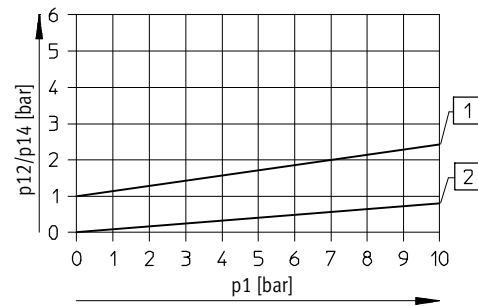
- 1 Switch-on pressure
- 2 Switch-off pressure
- 3 Only for normally closed

## VL/O-3-1/4 – Normally closed



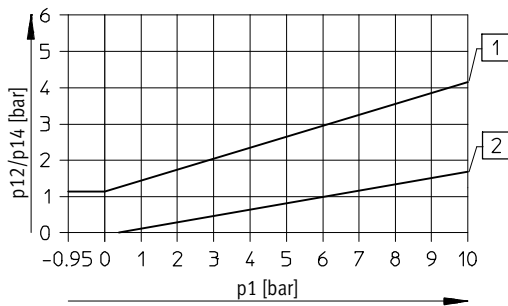
- 1 Switch-on pressure
- 2 Switch-off pressure

## VL/O-3-1/4 – Normally open



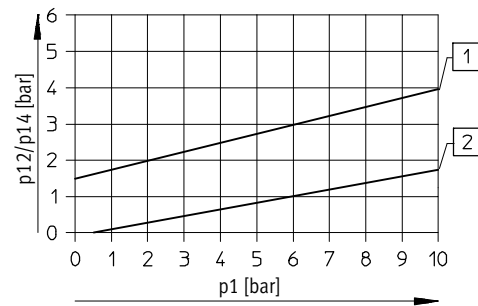
- 1 Switch-on pressure
- 2 Switch-off pressure

## VL/O-3-1/2 – Normally closed



- 1 Switch-on pressure
- 2 Switch-off pressure

## VL/O-3-1/2 – Normally open

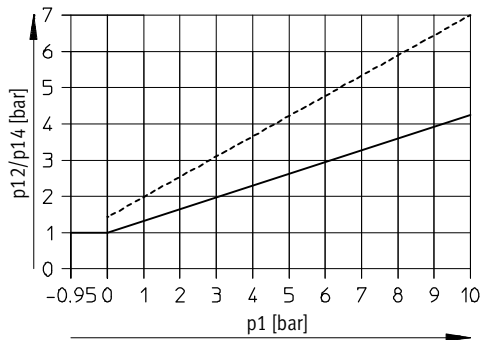


- 1 Switch-on pressure
- 2 Switch-off pressure

# Pneumatic valves VL/O, Tiger Classic

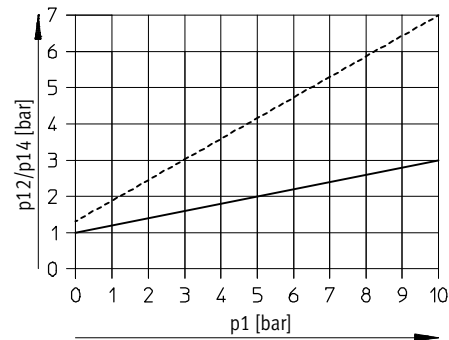
Technical data – 3/2-way valves

VL/O-3-3/4 – Normally closed



----- Exhaust throttled  
 ————— Exhaust unthrottled

VL/O-3-3/4 – Normally open



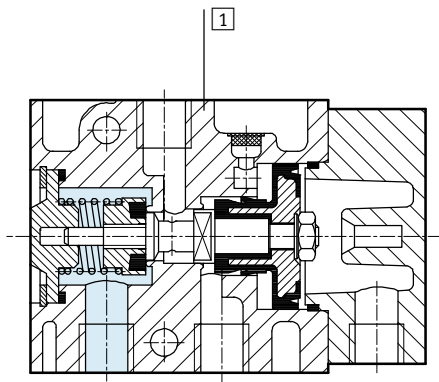
----- Exhaust throttled  
 ————— Exhaust unthrottled

## Valve response times [ms]

Pneumatic connection	G1/8	G1/4	G1/2	G3/4
On	4	8	17	8
Off	10	30	30	23

## Materials

Sectional view



1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber

# Pneumatic valves VL/O, Tiger Classic

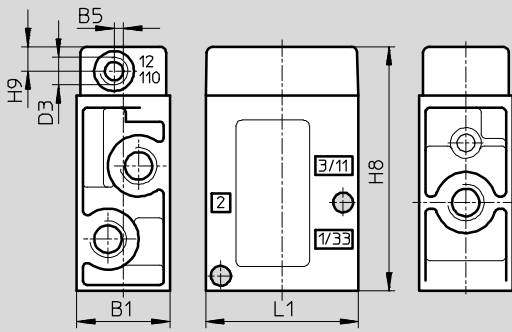
Technical data – 3/2-way valves

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## Dimensions

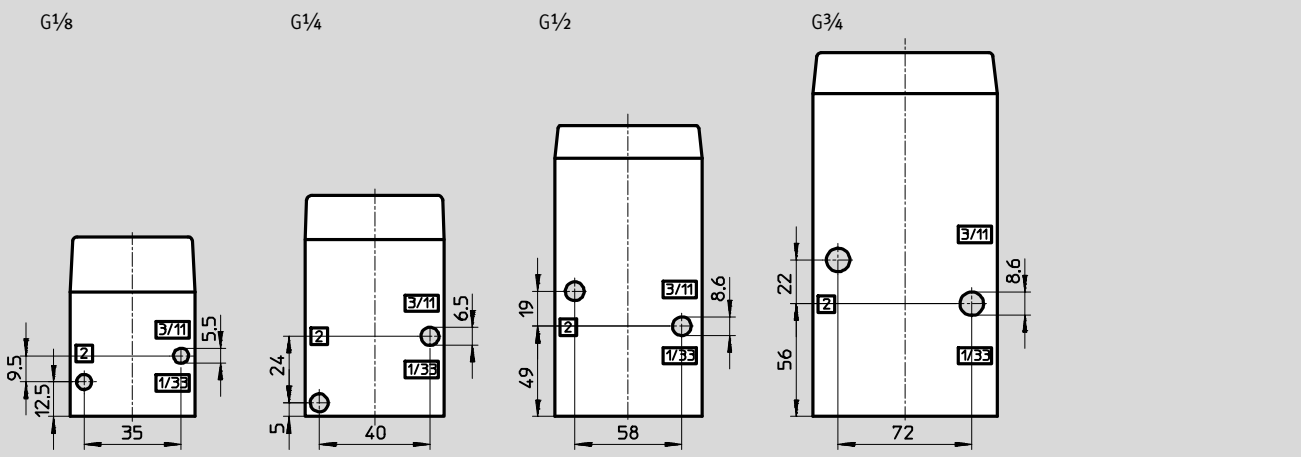
Download CAD data → [www.festo.com](http://www.festo.com)

VL/O



Pneumatic connection	B1	B5	D3	H8	H9	L1
G $\frac{1}{8}$	26	3	G $\frac{1}{8}$	65	8	45
G $\frac{1}{4}$	30.4	-	G $\frac{1}{8}$	80	8	50
G $\frac{1}{2}$	52	-	G $\frac{1}{4}$	118	10	80
G $\frac{3}{4}$	68	-	G $\frac{1}{4}$	138	10	92

## Attachment diagram



## Ordering data

Circuit symbol	Description	Pneumatic connection	Part No.	Type
	Mechanical reset, optionally normally open or closed	G $\frac{1}{8}$	7803	VL/O-3- $\frac{1}{8}$ -B
		G $\frac{1}{4}$	9984	VL/O-3- $\frac{1}{4}$
		G $\frac{1}{2}$	9983	VL/O-3- $\frac{1}{2}$
		G $\frac{3}{4}$	10049	VL/O-3- $\frac{3}{4}$


## Ordering data – Wearing parts kits

Pneumatic connection	Part No.	Type
G $\frac{1}{8}$	104222	VL/O-3- $\frac{1}{8}$ -B
G $\frac{1}{4}$	104207	VL/O-3- $\frac{1}{4}$
G $\frac{1}{2}$	104208	VL/O-3- $\frac{1}{2}$



# Pneumatic valves VL, Tiger Classic

Technical data – 5/2-way valves

-  - Flow rate  
500 ... 3700 l/min

Wearing parts kits → 35



General technical data				
Pneumatic connection		G1/8	G1/4	G1/2
Valve function		5/2-way, single pilot		
Constructional design		Poppet valve		
Sealing principle		Soft		
Actuation type		Pneumatic		
Type of reset		Mechanical spring		
Type of pilot control		Direct		
Direction of flow		Non reversible		
Manual override		None		
Exhaust function		With flow control		
Type of mounting		Via through holes		
Mounting position		Any		
Nominal size	[mm]	5	7	14
Standard nominal flow rate	[l/min]	500	800	3700
Product weight	[g]	180	220	1070

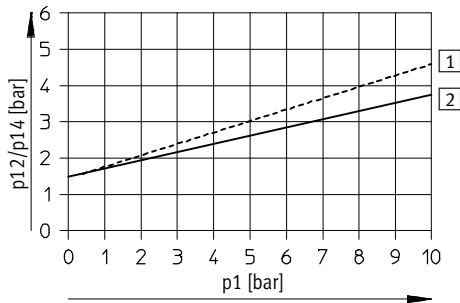
Operating and environmental conditions				
Pneumatic connection		G1/8	G1/4	G1/2
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]		
Note on operating/pilot medium		Operation with lubricated medium possible (in which case lubricated operation will always be required)		
Operating pressure	[bar]	0 ... 10	0 ... 8	0 ... 10
Pilot pressure	[bar]	See diagram (max. 10 bar)		
Ambient temperature	[°C]	-10 ... +60		
Note on materials		RoHS-compliant		

# Pneumatic valves VL, Tiger Classic

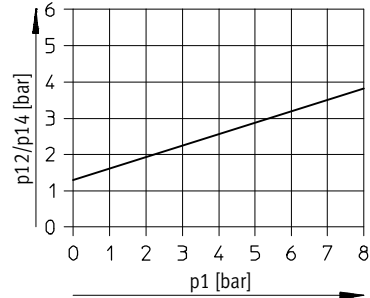
Technical data – 5/2-way valves

## Minimal pilot pressure $p_{12}/p_{14}$ as a function of operating pressure $p_1$

VL-5-1/8

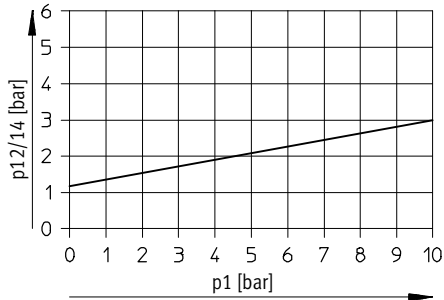


VL-5-1/4



----- Exhaust throttled  
 ———— Exhaust unthrottled

VL-5-1/2

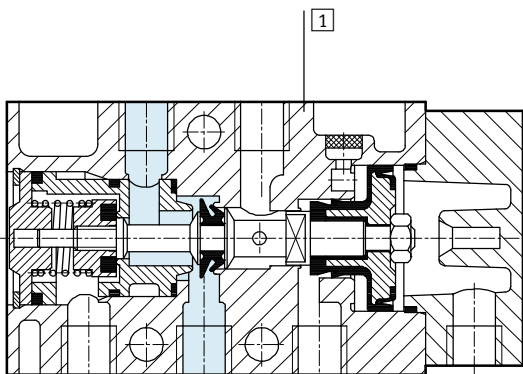


## Valve response times [ms]

Pneumatic connection	G1/8	G1/4	G1/2
On	5	8	6
Off	16	12	27

## Materials

Sectional view



1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber

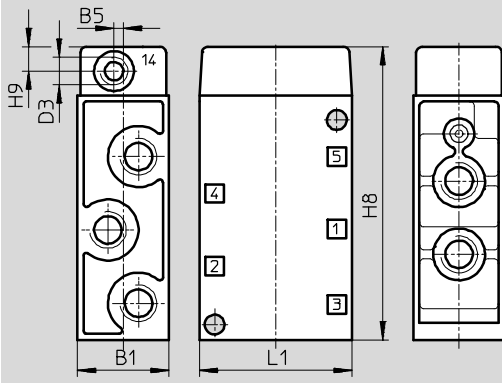
# Pneumatic valves VL, Tiger Classic

Technical data – 5/2-way valves

## Dimensions

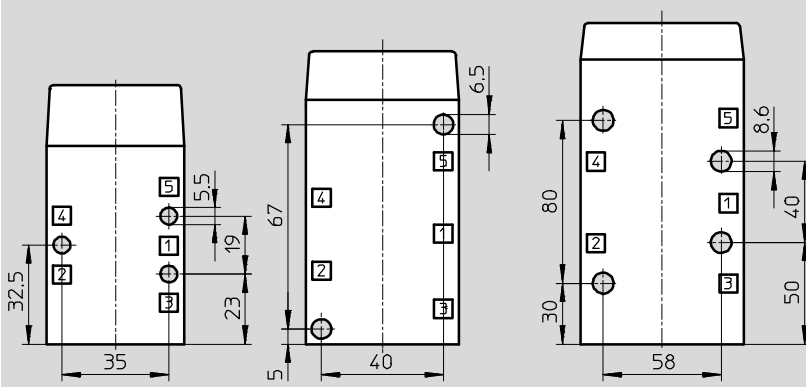
Download CAD data → [www.festo.com](http://www.festo.com)

VL



Pneumatic connection	B1	B5	D3	H8	H9	L1
G $\frac{1}{8}$	26	3	G $\frac{1}{8}$	85	8	45
G $\frac{1}{4}$	30.4	-	G $\frac{1}{8}$	96	8	50
G $\frac{1}{2}$	52	-	G $\frac{1}{4}$	159	10	80

## Attachment diagram



## Ordering data

Circuit symbol	Description	Pneumatic connection	Part No.	Type
	Mechanical reset	G $\frac{1}{8}$	9764	VL-5- $\frac{1}{8}$
		G $\frac{1}{4}$	9199	VL-5- $\frac{1}{4}$
		G $\frac{1}{2}$	9445	VL-5- $\frac{1}{2}$

## Ordering data – Wearing parts kits


Pneumatic connection	Part No.	Type
G $\frac{1}{8}$	104209	VL-5- $\frac{1}{8}$ <sup>1)</sup>
G $\frac{1}{4}$	104211	VL-5- $\frac{1}{4}$ <sup>2)3)</sup>
G $\frac{1}{2}$	104212	VL-5- $\frac{1}{2}$

- 1) Order mounting sleeves 228 389 separately
- 2) Order mounting sleeves 229 363 separately
- 3) Use from 1/81 series

# Pneumatic valves JH, Tiger Classic

FESTO

Technical data – 5/2-way valves, double pilot valves

-  - Flow rate  
600 ... 4500 l/min

Wearing parts kits → 39



General technical data				
Pneumatic connection	G1/8	G1/4	G1/2	
Valve function	5/2-way, double pilot			
Constructional design	Poppet valve			
Sealing principle	Soft			
Actuation type	Pneumatic			
Type of pilot control	Direct			
Direction of flow	Non reversible			
Exhaust function	With flow control			
Manual override	Resetting			
Type of mounting	Via through holes			
Mounting position	Any			
Nominal size	[mm]	5	7	14
Standard nominal flow rate	[l/min]	600	1100	4500
Product weight	[g]	245	330	1130

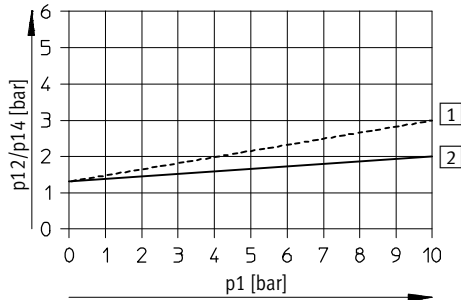
Operating and environmental conditions				
Pneumatic connection	G1/8	G1/4	G1/2	
Operating medium	Compressed air in accordance with ISO 8573-1:2010 [7:4:4]			
Note on operating/pilot medium	Operation with lubricated medium possible (in which case lubricated operation will always be required)			
Operating pressure	[bar]	0 ... 10	0 ... 8	0 ... 10
Pilot pressure	[bar]	See diagram (max. 10 bar)		
Ambient temperature	[°C]	-10 ... +60		
Note on materials	RoHS-compliant			

# Pneumatic valves JH, Tiger Classic

Technical data – 5/2-way valves, double pilot valves

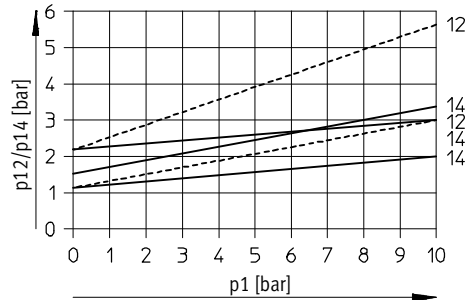
## Minimal pilot pressure $p_{12}/p_{14}$ as a function of operating pressure $p_1$

JH-5-1/8



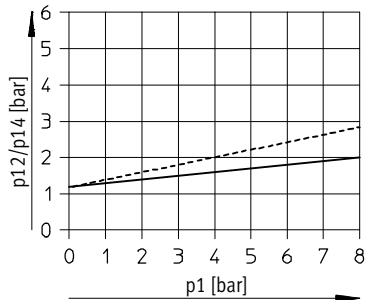
----- Exhaust throttled  
 ————— Exhaust unthrottled

JDH-5-1/8



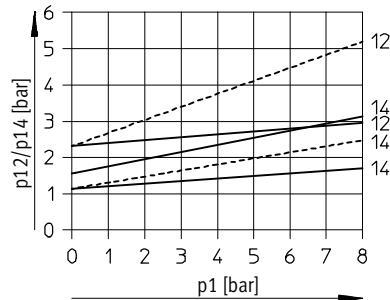
----- Exhaust throttled  
 ————— Exhaust unthrottled

JH-5-1/4



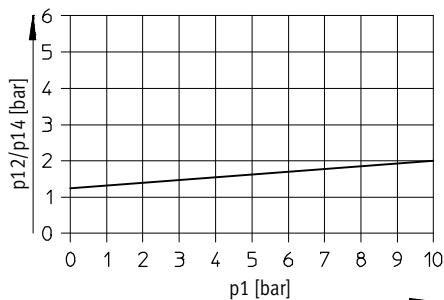
----- Exhaust throttled  
 ————— Exhaust unthrottled

JDH-5-1/4



----- Exhaust throttled  
 ————— Exhaust unthrottled

JH-5-1/2



## Valve response times [ms]

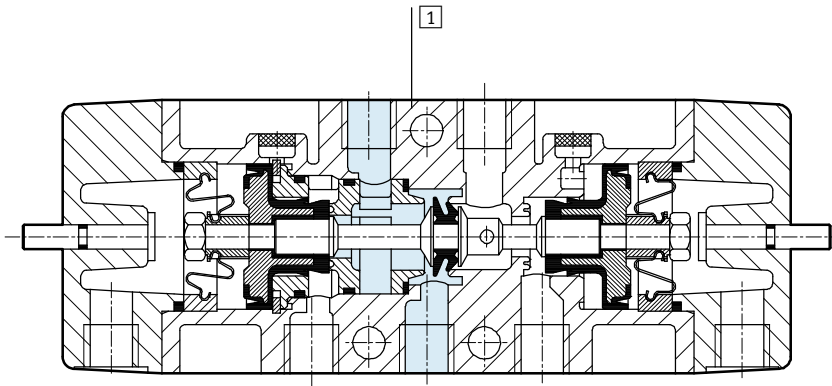
Pneumatic connection	G1/8		G1/4		G1/2
		Dominating signal at 14		Dominating signal at 14	
On/changeover	–	9	–	7	–
Off/changeover	2	16	7	16	3

# Pneumatic valves JH, Tiger Classic

Technical data – 5/2-way valves, double pilot valves

## Materials

Sectional view

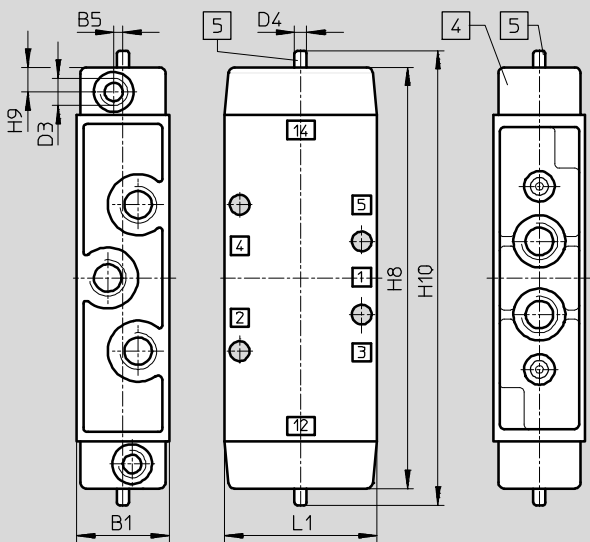


1	Housing	Aluminium die-cast, anodised
-	Seals	Nitrile rubber

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

JH, JDH



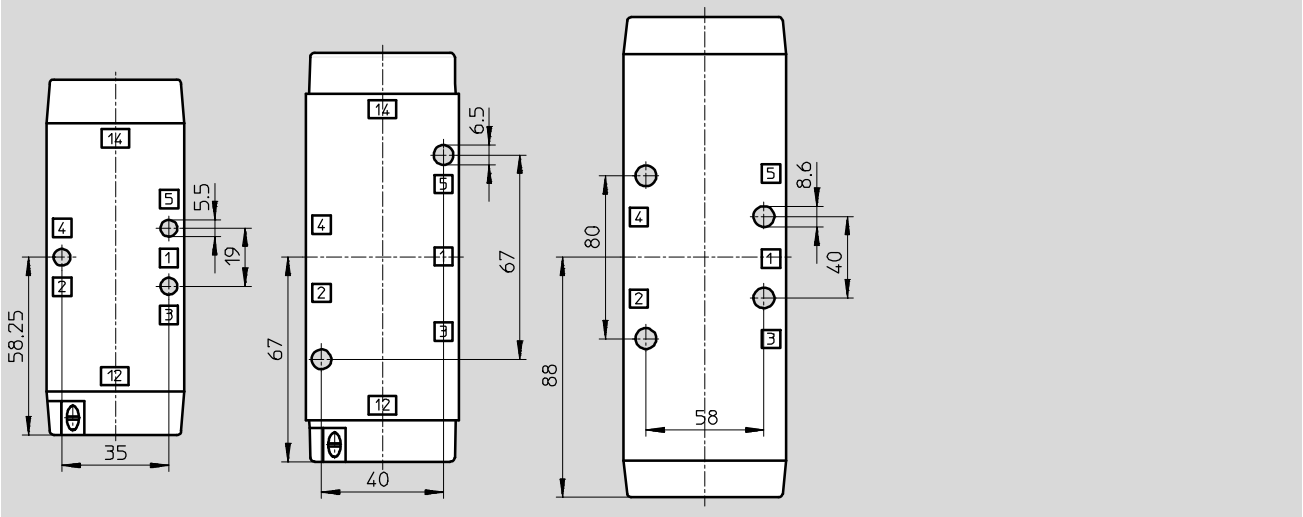
- 4 Cover can be repositioned by 180°
- 5 Manual override

Pneumatic connection	B1	B5	D3	D4 Ø	H8	H9	H10	L1
G <sup>1</sup> / <sub>8</sub>	26	3	G <sup>1</sup> / <sub>8</sub>	5	120	8	132	45
G <sup>1</sup> / <sub>4</sub>	30.4	-	G <sup>1</sup> / <sub>8</sub>	5	138	8	149	50
G <sup>1</sup> / <sub>2</sub>	52	-	G <sup>1</sup> / <sub>4</sub>	9.9	178	10	193	80

# Pneumatic valves JH, Tiger Classic

Technical data – 5/2-way valves, double pilot valves

Attachment diagram



Ordering data				
Circuit symbol	Description	Pneumatic connection	Part No.	Type
		G1/8	8823	JH-5-1/8
		G1/4	10408	JH-5-1/4
		G1/2	10165	JH-5-1/2
	With dominating signal at 14	G1/8	8824	JDH-5-1/8
		G1/4	10409	JDH-5-1/4

Ordering data – Wearing parts kits		
Pneumatic connection	Part No.	Type
G1/8	104891	JH-5-1/8 <sup>1)</sup>
G1/4	104892	JH-5-1/4 <sup>2)</sup>

1) Order mounting sleeves 228 389 separately  
 2) Order mounting sleeves 229 363 separately

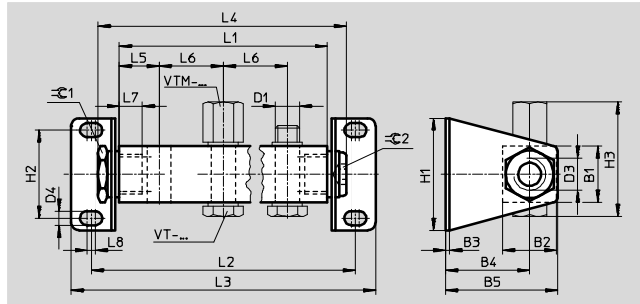
# Solenoid/pneumatic valves, Tiger Classic



Accessories

## Manifold strip PAL

Materials:  
Manifold: anodised aluminium  
Mounting bracket: galvanised steel



Dimensions and ordering data																	
Type	B1	B2	B3	B4	B5	D1	D3	D4	H1	H2	H3	L5	L6	L7	L8	$\varnothing 1$	$\varnothing 2$
PAL-1/8-...	20	21	2	33.5	44.5	G1/8	G1/4	5.2	44	32	43	18	34	12	4	19	8
PAL-1/4-...	28	27	2	42	56	G1/4	G3/8	7	56	44	56	20	32	14	4	24	10
PAL-1/2-...	40	40	3	73	93	G1/2	G3/4	11	80	60	75	35	69	16	5	36	17

Number of valve ports	L1	L2	L3	L4	Weight [g]	Part No.	Type
Pneumatic connection G1/8							
2	70	96	114	89	145	<b>8601</b>	<b>PAL-1/8-2</b>
3	104	130	148	123	170	<b>8602</b>	<b>PAL-1/8-3</b>
4	138	164	182	157	190	<b>8603</b>	<b>PAL-1/8-4</b>
5	172	198	216	191	215	<b>8604</b>	<b>PAL-1/8-5</b>
6	206	232	250	225	240	<b>9767</b>	<b>PAL-1/8-6</b>
Pneumatic connection G1/4 <sup>1)</sup>							
2	72	100	120	94	330	<b>9188</b>	<b>PAL-5-1/4-2</b>
3	104	132	152	126	405	<b>9189</b>	<b>PAL-5-1/4-3</b>
4	136	164	184	158	480	<b>9190</b>	<b>PAL-5-1/4-4</b>
5	168	196	216	190	555	<b>9191</b>	<b>PAL-5-1/4-5</b>
6	200	228	248	222	630	<b>9192</b>	<b>PAL-5-1/4-6</b>
Pneumatic connection G1/2							
2	139	181	213	164	770	<b>9492</b>	<b>PAL-1/2-2</b>
3	208	250	282	233	915	<b>9493</b>	<b>PAL-1/2-3</b>
4	277	319	351	302	1 060	<b>9494</b>	<b>PAL-1/2-4</b>
5	346	388	420	371	1 220	<b>9495</b>	<b>PAL-1/2-5</b>
6	415	457	489	440	1 370	<b>9496</b>	<b>PAL-1/2-6</b>

1) MOFH-3-1/4 is not suitable for manifold mounting



# Solenoid/pneumatic valves, Tiger Classic

Accessories

## Hollow bolt

### VT

For manifold strip PAL

Material:

anodised aluminium



Ordering data			
Pneumatic connection	Weight [g]	Part No.	Type
G $\frac{1}{8}$	6	8626	VT- $\frac{1}{8}$
G $\frac{1}{8}$	15	5928	VT- $\frac{1}{8}$ -1 <sup>1)2)</sup>
G $\frac{1}{4}$	15	206147	VT- $\frac{1}{4}$ -2
G $\frac{1}{2}$	30	9986	VT- $\frac{1}{2}$

1) For valves with G $\frac{1}{8}$  connection

2) Sealing rings included in scope of delivery

## Blanking cap

### VTM

For sealing vacant valve positions

Material:

wrought aluminium alloy



Ordering data			
Pneumatic connection	Weight [g]	Part No.	Type
G $\frac{1}{8}$	5	9768	VTM- $\frac{1}{8}$
G $\frac{1}{4}$	5	9768	VTM- $\frac{1}{8}$ <sup>1)</sup>
G $\frac{1}{4}$	7	3099	VTM- $\frac{1}{4}$
G $\frac{1}{2}$	28	9987	VTM- $\frac{1}{2}$

1) For valves with G $\frac{1}{8}$  connection

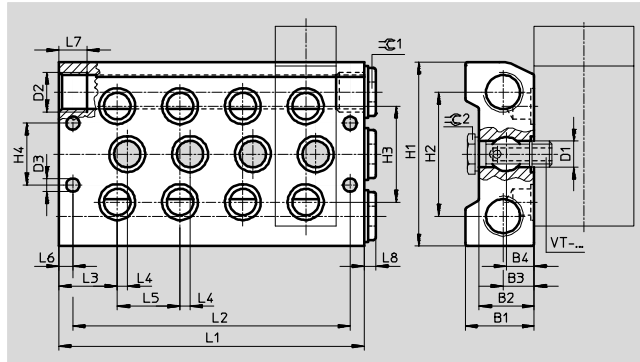
# Solenoid/pneumatic valves, Tiger Classic



Accessories

## Manifold block PRS

Material:  
anodised aluminium



Dimensions and ordering data																				
Type	B1	B2	B3	B4	D1	D2	D3	H1	H2	H3	H4	L3	L4	L5	L6	L7	L8	≈C 1	≈C 2	
PRS-1/8-...	28.5	22	12.5	10.8	G1/8	G3/8	6.6	80	56	38	28	23.5	7	27	7	12	5	8	14	
PRS-1/4-...	34.5	27.5	14	14	G1/4	G1/2	6.6	92	62	48	31	29.2	5	31.4	7	14	6	10	17	

Number of valve ports	L1	L2	Weight [g]	Part No.	Type
Pneumatic connection G1/8					
2	81	67	360	11898	PRS-1/8-2
3	108	94	460	11899	PRS-1/8-3
4	135	121	625	11900	PRS-1/8-4
5	162	148	650	11901	PRS-1/8-5
6	189	175	750	11902	PRS-1/8-6
Pneumatic connection G1/4					
2	89.8	75.8	590	10185	PRS-1/4-2
3	121.2	107.2	750	10186	PRS-1/4-3
4	152.6	138.6	900	10187	PRS-1/4-4
5	184	170	1070	10188	PRS-1/4-5
6	215.4	201.4	1 230	1089	PRS-1/4-6

## Hollow bolt VT

For manifold block PRS

Material:  
anodised aluminium



Ordering data			
Pneumatic connection	Weight [g]	Part No.	Type
G1/8	17	11539	VT-1/8-PRSK
G1/4	32	9499	VT-1/4-PRS

## Solenoid/pneumatic valves, Tiger Classic

FESTO

Accessories

### Blanking plate

#### PRSB

For sealing vacant valve positions

Material:  
aluminium



Ordering data			
Pneumatic connection	Weight [g]	Part No.	Type
G $\frac{1}{8}$	55	11687	PRSB- $\frac{1}{8}$
G $\frac{1}{4}$	80	11688	PRSB- $\frac{1}{4}$

### Hollow bolt

#### VT

For separate compressed air supply on valve

Material:  
anodised aluminium



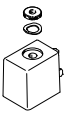
Ordering data			
Pneumatic connection	Weight [g]	Part No.	Type
G $\frac{1}{8}$	16	12634	VT- $\frac{1}{8}$ -AJK-P
G $\frac{1}{4}$	24	12910	VT- $\frac{1}{8}$ -AJS-P <sup>1)</sup>
G $\frac{1}{4}$	45	12635	VT- $\frac{1}{4}$ -AJ-P



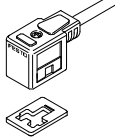
1) For valves with G $\frac{1}{8}$  connection


# Solenoid/pneumatic valves, Tiger Classic

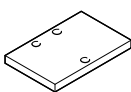
Accessories

FESTO

Ordering data – Solenoid coils		Technical data → Internet: msgf, msfw	
	Voltage	Part No.	Type
<b>F solenoid coils</b>			
	12 V DC	34410	MSFG-12-OD
	24 V DC and 42 V AC, 50 ... 60 Hz	34411	MSFG-24/42-50/60-OD
	42 V DC	34413	MSFG-42-OD
	24 V AC	34415	MSPW-24-50/60-OD
	48 V AC, 50 ... 60 Hz	34418	MSPW-48-50/60-OD
	110 V AC, 50 ... 60 Hz and 120 V AC, 60 Hz	34420	MSPW-110-50/60-OD
	230 V AC, 50 ... 60 Hz and 240 V AC, 60 Hz	34422	MSPW-230-50/60-OD
	240 V AC, 50 ... 60 Hz	34424	MSPW-240-50/60-OD

Ordering data – Plug sockets/plug sockets with cable for F solenoid coils				
	Voltage	Cable length [m]	LED	Part No. Type
<b>Plug socket without cable</b>				
Technical data → Internet: mssd				
	–	–	–	34431 MSSD-F
	–	–	–	539710 MSSD-F-M16
<b>Plug socket without cable with insulation displacement technology</b>				
	–	–	–	192746 MSSD-F-S-M16
<b>Plug socket with cable</b>				
Technical data → Internet: kmf				
	24 V DC	2.5	■	30935 KMF-1-24DC-2,5-LED
		5	■	30937 KMF-1-24DC-5-LED
		10	■	193458 KMF-1-24DC-10-LED
	Up to 240 V	2.5	–	30936 KMF-1-230AC-2,5
		5	–	30938 KMF-1-230AC-5

Ordering data – Illuminating seal		Technical data → Internet: mf-ld	
	Voltage	Part No.	Type
<b>For F solenoid coils</b>			
	12 ... 24 V DC	19143	MF-LD-12-24DC
	230 V DC/V AC	19144	MF-LD-230AC

Ordering data – Plate				
	Description	Pneumatic connection	Part No.	Type
<b>For wide solenoid coils</b>				
	As spacer when using wider solenoid coils from other manufacturers (thickness: 6.35 mm)	For 3/2-way valves	G1/8	541667 MPL-TC-3-18
			G1/4	541669 MPL-TC-3-14
		For 5/2-way valves	G1/8	541668 MPL-TC-5-18
			G1/4	541670 MPL-TC-5-14