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Valves NPTF
Valves terminals

Air. Pressure. Motion.

Valves/06.15US

Alpha numeric index

Order number	Page	Description
23-M-09-19-…	1.026	Solenoid coil with manual override (HN)
28-ST-02-1	1.026	Plug socket
28-ST-09-1-…	1.026	Plug socket with LED, EN 175301-803 C
28-ST-10-1-…	1.026	Plug socket with LED and circuit protection, EN 175301-803 C
84-4HV-…	1.006	2 fixed positions and center position closed, 1/8 NPTF and 1/4 NPTF
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84-4FR-520-14-H	1.007	Foot pedal valve with protection cover
84-HPV-…	1.005	2 fixed positions, 5/2-way, 1/8 NPTF and 1/4 NPTF
86-4-AP-NAMUR	1.048	Converting plate for 5/2-way NAMUR valves
86-4-DR-NAMUR	1.048	Speed regulation plate for series 86-MN-4-14
86-MN-4-12-…	1.049	Electrically operated valves for sub-base, 5/2-way, 1/2 NPTF
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BME-91-…-HN	1.013	Electrically operated valves, 5/2-way, 5/3-way, 1/8 NPTF
BM-92-3…-HN	1.019	Electrically operated valves, 3/2-way, 2 x 3/2-way, 1/4 NPTF
BM-92-5…-HN	1.019	Electrically operated valves, 5/2-way, 5/3-way, 1/4 NPTF
BME-92-…-HN	1.020	Electrically operated valves, 5/2-way, 5/3-way, 1/4 NPTF
HF-98-310-…	1.002	Hand lever valve, 3/2-way, 1/8 NPT
HF-98-510-…	1.002	Hand lever valve, 5/2-way, 1/8 NPT
HF-98-530-…	1.002	Hand lever valve, 5/3-way, 1/8 NPT
HF-98-533-…	1.002	Hand lever valve, 5/3-way, 1/8 NPT
HR-98-320-…	1.003	Hand lever valve, 3/2-way, 1/8 NPT, with detent
HR-98-520-…	1.003	Hand lever valve, 5/2-way, 1/8 NPT, with detent
HR-98-530-…	1.003	Hand lever valve, 5/3-way, 1/8 NPT, with detent
HR-98-533-…	1.003	Hand lever valve, 5/3-way, 1/8 NPT, with detent
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KF-90-…	1.055	Valve for RE-99, 5/2-way and 5/3-way, 1/4 NPTF
KF-99-…	1.055	Valve for RE-99, 5/2-way, 1/8 NPTF
KM-90-…-HN	1.033	Electrically operated valves, 5/2-way and 5/3-way, 1/4 NPTF
KM-99-…-HN	1.027	Electrically operated valves, 5/2-way and 5/3-way, 1/8 NPTF
M-95-311-HN	1.040	Electrically operated valve, 3/2-way, 1/8 NPT
M-95-320-HN	1.040	Electrically operated valve, 3/2-way, 1/8 NPT
M-95-511-HN	1.041	Electrically operated valve, 5/2-way, 1/8 NPT
M-95-520-HN	1.041	Electrically operated valve, 5/2-way, 1/8 NPT
M-95-530-HN	1.041	Electrically operated valve, 5/3-way, 1/8 NPT
M-95-533-HN	1.041	Electrically operated valve, 5/3-way, 1/8 NPT
M-95-534-HN	1.041	Electrically operated valve, 5/3-way, 1/8 NPT
MO-95-311-HN	1.040	Electrically operated valves, 3/2-way, normally open, 1/8 NPTF
M-97-311-HN	1.043	Electrically operated valve, 3/2-way, 1/4 NPT
M-97-320-HN	1.043	Electrically operated valve, 3/2-way, 1/4 NPT
M-97-511-HN	1.044	Electrically operated valve, 5/2-way, 1/4 NPT
M-97-520-HN	1.044	Electrically operated valve, 5/2-way, 1/4 NPT
M-97-530-HN	1.044	Electrically operated valve, 5/3-way, 1/4 NPT
M-97-533-HN	1.044	Electrically operated valve, 5/3-way, 1/4 NPT
M-97-534-HN	1.044	Electrically operated valve, 5/3-way, 1/4 NPT
MO-97-311-HN	1.043	Electrically operated valves, 3/2-way, normally open, 1/4 NPTF
MS-98-…-HN	1.039	Electrically operated valves, 3/2-way, 1/8 NPTF
Plug sockets	1.036	for series BM-91, BM-92, KM-90, KM-99, M-95, M-97, MS-98
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RE-46/…	1.056	Valve terminal, 1/8 NPTF
RF-02-…	1.023	Accessories for series BM-02 and BME-02, 1/4 NPTF
RF-92-…	1.023	Accessories for series BM-02 and BME-02, 1/4 NPTF
RF-99-E	1.029 + 1.035	End plate for series RF-99, NPT
RF-09-…	1.029 + 1.035	for series KM-90 and KM-99, 1/8 NPTF
RF-10-…	1.029 + 1.035	for series KM-90 and KM-99, 1/8 NPTF
RF-19-01	1.029 + 1.035	Seal plate for two different pressures
RF-19-DT	1.029 + 1.035	Pressure separator
Solenoid coils, actuators	1.036	for series BM-91, BM-92, KM-90, KM-99, M-95, M-97, MS-98
Technical information	1.081	

Series HF
Hand lever valves with
spring return
3/2-, 5/2- and 5/3-way,
1/8 NPTF,
750 to 3.300 Nl/min
(0.762 – 3.354 Cv)

Technical data
and Dimensions 1.002

Series HR
Hand lever valves with detent
3/2-, 5/2- and 5/3-way,
1/8 NPTF to 1/2 NPTF,
750 to 3.300 Nl/min
(0.762 – 3.354 Cv)

Technical data
and Dimensions 1.003

Series 84-HPV
5/2-way,
1/8 NPTF and 1/4 NPTF,
750 to 980 Nl/min
(0.762 – 0.996 Cv)

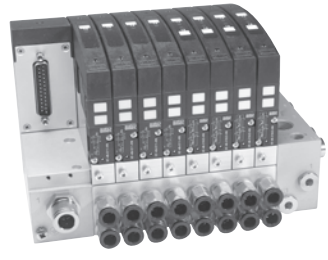
Technical data
and Dimensions 1.005

Series 84-4HV
4/2- and 4/3-way,
1/8 NPTF and 1/4 NPTF,
980 Nl/min (0.996 Cv)

Technical data
and Dimensions 1.006

Series 84-4F
5/2-way,
foot-operated valve
1/4 NPTF,
530 Nl/min (0.539 Cv)

Technical data
and Dimensions 1.007



Electrically operated valves 1.010

Valve terminals 1.050

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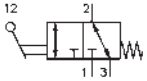
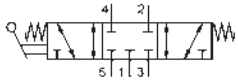
Technical information 1.081

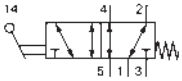
Series HF with spring return



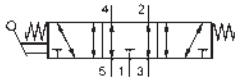
HF-98-310, HF-98-310-Q, HF-94-310



HF-98-530, HF-98-530-Q, HF-94-530



HF-98-510, HF-98-510-Q, HF-94-510



HF-98-533, HF-98-533-Q, HF-94-533

Design, function and technical data

Spool valve with spring return. All ports are interchangeable.

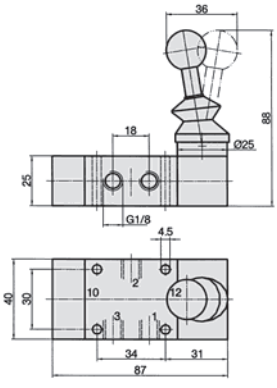
Valves of this series are available for use with vacuum (– 0.95 … 12 bar/–14 … 175 psi). Order number changes to HF-98-310-Q and HF-98-510-Q.

Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number	HF-98-310	HF-94-310	HF-98-510	HF-94-510
Function	3/2-way, spring return		5/2-way, spring return	
Connection	1/8 NPTF	1/4 NPTF	1/8 NPTF	1/4 NPTF
Nominal size	6 mm	9 mm	6 mm	9 mm
Flow rate	750 Nl/min (0.762 Cv)	1580 Nl/min (1.606 Cv)	750 Nl/min (0.762 Cv)	1580 Nl/min (1.606 Cv)
Pressure range	0 … 12 bar (0 … 175 psi)			
Actuating force at 6 bar	13 N	20 N	13 N	20 N
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)			
Materials	Body: Al (anodized), Inner parts: Al, stainless steel, Lever: stainless steel, Seals: NBR and POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Weight	0.266 kg (0.586 lb.)	0.480 kg (1.058 lbs.)	0.310 kg (0.683 lb.)	0.560 kg (1.234 lbs.)

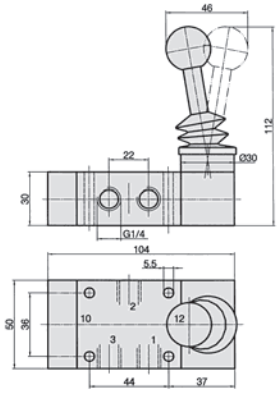
Order number	HF-98-530	HF-94-530	HF-98-533	HF-94-533
Function	5/3-way, center position closed		5/3-way, center position exhausted	
Connection	1/8 NPTF	1/4 NPTF	1/8 NPTF	1/4 NPTF
Nominal size	6 mm	9 mm	6 mm	9 mm
Flow rate	780 Nl/min (0.793 Cv)	1800 Nl/min (1.829 Cv)	780 Nl/min (0.793 Cv)	1800 Nl/min (1.829 Cv)
Pressure range	0 … 12 bar (0 … 175 psi)			
Actuating force at 6 bar	20 N	25 N	20 N	25 N
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)			
Materials	Body: Al, Lever: stainless steel; Bellows: Molerit®; Screws: steel zinc-plated/nickel-plated Inner parts: Al, stainless steel, brass; Seals: NBR, PU (at HF-98 and HF-94), NBR, POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Weight	0.320 kg (0.719 lb.)	0.580 kg (1.278 lbs.)	0.320 kg (0.719 lb.)	0.580 kg (1.278 lbs.)

HF-18-310, HF-18-310-Q



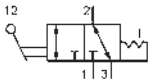
1 = pressure inlet
2 = outlet
3 = exhaust

HF-14-310

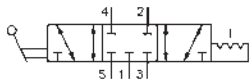


Further dimensions see page 1.004.

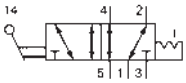
Series HR with detent function



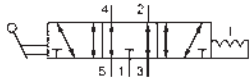
HR-98-320, HR-98-320-Q, HR-94-320



HR-98-530, HR-98-530-Q, HR-94-530



HR-98-520, HR-98-520-Q, HR-94-520



HR-98-533, HR-98-533-Q, HR-94-533

Design, function and technical data

Spool valve with two or three fixed positions. All ports are interchangeable.

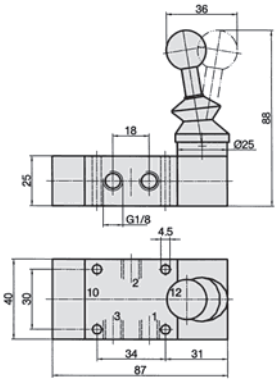
Valves of this series are available for use with vacuum (– 0.95 … 12 bar/–14 … 175 psi). Order number changes to HR-98-320-Q and HR-98-520-Q.

Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number	HR-98-320	HR-94-320	HR-98-520	HR-94-520
Function	3/2-way, 2 fixed positions		5/2-way, 2 fixed positions	
Connection	1/8 NPTF	1/4 NPTF	1/8 NPTF	1/4NPTF
Nominal size	6 mm	9 mm	6 mm	9 mm
Flow rate	750 Nl/min (0.762 Cv)	1580 Nl/min (1.606 Cv)	750 Nl/min (0.762 Cv)	1580 Nl/min (1.606 Cv)
Pressure range	0 … 12 bar (0 … 175 psi)			
Actuating force at 6 bar	16 N	24 N	16 N	24 N
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)			
Materials	Body: Al (anodized), Inner parts: Al, stainless steel, Lever: stainless steel, Seals: NBR and POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Weight	0.268 kg (0.591 lb.)	0.485 kg (1.069 lbs.)	0.312 kg (0.688 lb.)	0.564 kg (1.243 lbs.)

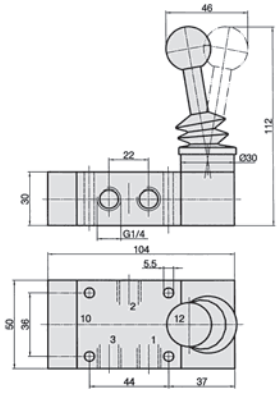
Order number	HR-98-530	HR-94-530	HR-98-533	HR-94-533
Function	5/3-way, center position closed		5/3-way, center position exhausted	
Connection	1/8 NPTF	1/4 NPTF	1/8 NPTF	1/4 NPTF
Nominal size	6 mm	9 mm	6 mm	9 mm
Flow rate	780 Nl/min (0.793 Cv)	1800 Nl/min (1.829 Cv)	780 Nl/min (0.793 Cv)	1800 Nl/min (1.829 Cv)
Pressure range	0 … 12 bar (0 … 175 psi)			
Actuating force at 6 bar	20 N	25 N	20 N	25 N
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)			
Materials	Body: Al, Lever: stainless steel; Bellows: Molerit®; Screws: steel zinc-plated/nickel-plated Inner parts: Al, stainless steel, brass; Seals: NBR, PU (at HF-98 and HF-94), NBR, POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Weight	0.320 kg (0.719 lb.)	0.580 kg (1.278 lbs.)	0.320 kg (0.719 lb.)	0.580 kg (1.278 lbs.)

HR-18-320, HR-18-320-Q



1 = pressure inlet
2 = outlet
3 = exhaust

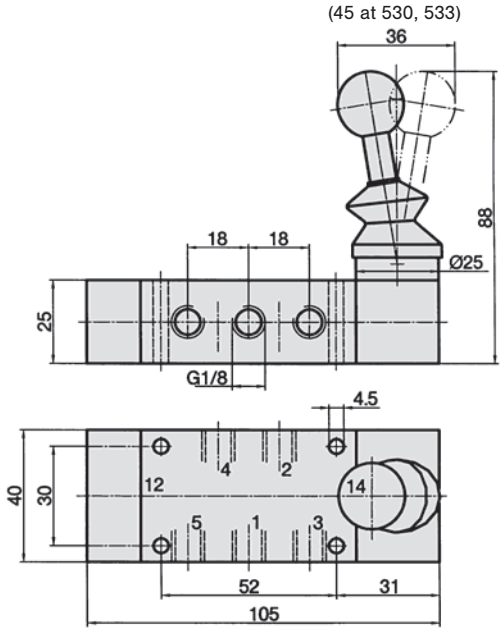
HR-14-320



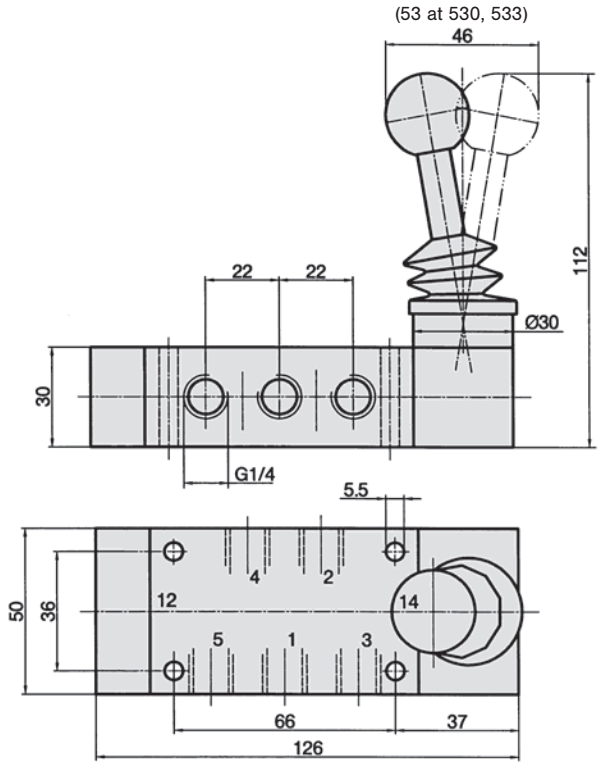
Further dimensions see page 1.004.

Dimensions for series HF, HR

HF-98-510, HF-98-530, HF-98-533, HR-98-520, HR-98-530, HR-98-533,
HF-98-510-Q, HF-98-530-Q, HF-98-533-Q, HR-98-520-Q, HR-98-530-Q, HR-98-533-Q



HF-94-510, HF-94-530, HF-94-533, HR-94-520, HR-94-530, HR-94-533



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
All ports are interchangeable.

Manually operated valves

Series 84-HPV, 5/2-way

1/8 NPTF and 1/4 NPTF, 750 – 980 Nl/min (0.762 – 0.996 Cv)

Order code

84-HPV-xx-520

Series and function

Connection

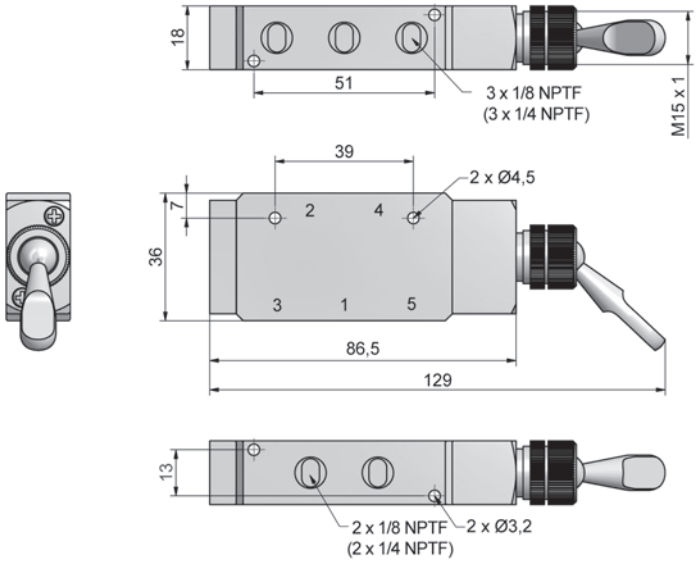
18 = 1/8 NPTF

14 = 1/4 NPTF

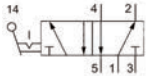
Design, function and technical data

Manually operated toggle lever spool valve.

84-HPV-18-520, 84-HPV-14-520



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts

Order number	84-HPV-18-520	84-HPV-14-520
Function	 5/2-way 2 fixed positions	
Connection	1/8 NPTF	1/4 NPTF
Nominal size	4 mm	5 mm
Flow rate	750 Nl/min (0.762 Cv)	980 Nl/min (0.996 Cv)
Pressure range	0 … 8 bar (0 … 116 psi)	
Temperature range	0 °C … + 60 °C (+ 32 °F … + 140 °F)	
Materials	Body: Al (anodized); Seals: NBR; Inner parts: Al, stainless steel and brass	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Weight	0.170 kg (0.375 lb.)	0.160 kg (0.353 lb

Manually operated valves

Series 84-4HV, 4/2- and 4/3-way

1/8 NPTF and 1/4 NPTF, 980 Nl/min (0.996 Cv)

Order code

84-4HV-xx-5xx-S

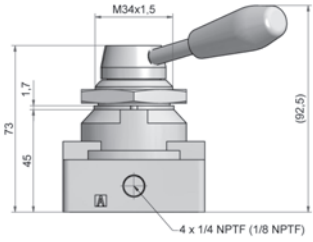
Series and function

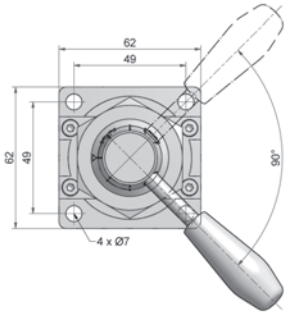
Connection	Function with nut
18 = 1/8 NPTF	520 = 4/2-way, 2 fixed positions
14 = 1/4 NPTF	530 = 4/3-way, center position closed

Design, function and technical data

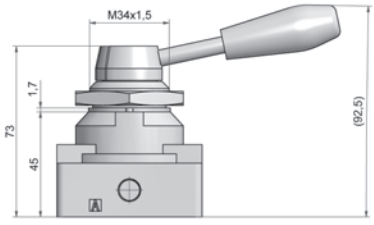
Manually operated rotary lever valve.

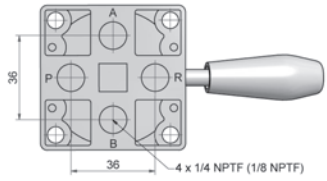
84-4HV-18-520-S, 84-4HV-14-520-S

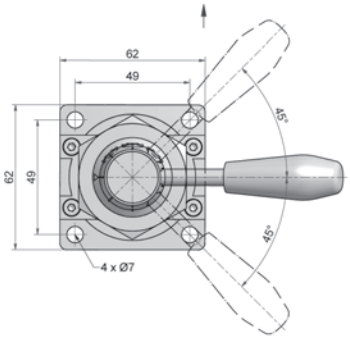




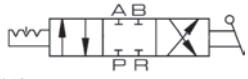
84-4HV-18-530-S, 84-4HV-14-530-S







P = pressure inlet
A, B = outlets
R = exhaust

Order number	84-4HV-18-520-S	84-4HV-14-520-S	84-4HV-18-530-S	84-4HV-14-530-S
Function	 4/2-way 2 fixed positions		 4/3-Wege center position closed	
Connection	1/8 NPTF	1/4 NPTF	1/8 NPTF	1/4 NPTF
Nominal size	5 mm			
Flow rate	980 Nl/min (0.996 Cv)			
Pressure range	0 … 8 bar (0 … 116 psi)			
Temperature range	0 °C … + 70 °C (+ 32 °F … + 158 °F)			
Materials	Body: Al (anodized); Seals: NBR, Ceramic (only 84-4HV-18); Inner parts: Al, stainless steel			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Weight	0.390 kg (0.860 lb.)	0.683 kg (1.506 lb.)	0.392 kg (0.864 lb)	0.672 kg (1.481 lb.)

Manually operated valves

Series 84-4F, 5/2-way, foot-pedal valve
1/4 NPTF, 530 Nl/min (0.539 Cv)

Order code

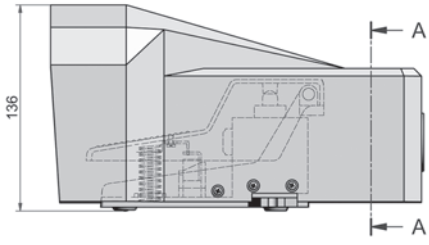
84-4Fx-5xx

Series and function	Pedal	Function
	F = with spring return	11 = single acting
	R = with mechanical detend	20 = 2 fixed positions

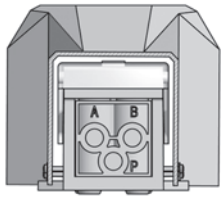
Design, function and technical data

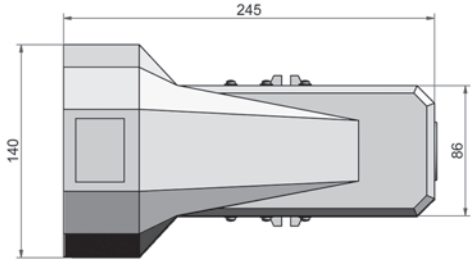
Manually operated foot-pedal spool valve.
The valve can be used as 3/2-way valve by closing either port A or B. Silencers are mounted at port 5 and 3.
The protection cover is included.

84-4FF-511-14-H, 84-4FR-520-14-H



A-A



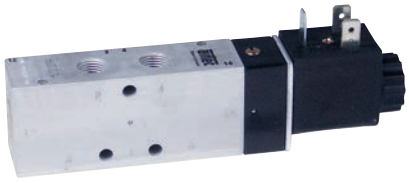


P = pressure inlet
A, B = outlets

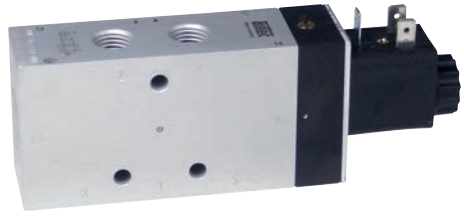
Order number	84-4FF-511-14-H	84-4FR-520-14-H
Function	5/2-way single acting	 5/2-way 2 fixed positions
Connection	1/4 NPTF	
Nominal size	9 mm	
Flow rate	530 Nl/min (0.539 Cv)	
Pressure range	0 … 8 bar (0 … 116 psi)	
Temperature range	0 °C … + 60 °C (+ 32 °F … + 140 °F)	
Materials	Body: Al (anodized), plastic; Seals: NBR	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Weight	0.900 kg (1.984 lbs.)	0.900 kg (1.984 lbs.)

Series BM-91
2 x 3/2-, 5/2- and 5/3-way,
1/8 NPTF,
750 Nl/min (0.762 Cv)

Series BM-92
2 x 3/2-, 5/2- and 5/3-way,
1/4 NPTF,
1400 Nl/min (1.423 Cv)



Series KM-99
5/2- and 5/3-way,
1/8 NPTF,
950 Nl/min (0.966 Cv)



Series KM-90
5/2- and 5/3-way,
1/4 NPTF,
2100 Nl/min (2.134 Cv)

Series MS-98
3/2-way poppet valves,
1/8 NPTF,
56 Nl/min (0.057 Cv)

Series M-95
3/2-, 5/2- and 5/3-way,
1/8 NPTF,
750 Nl/min (0.762 Cv)

Series M-97
3/2-, 5/2- and 5/3-way,
1/4 NPTF,
1580 Nl/min (1.606 Cv)

Accessories for valves
Solenoids and sockets

Series 86-MN-4
5/2-way, for sub-base

86-MN-4-18	1.046
86-MN-4-14	1.047
86-MN-4-12	1.049

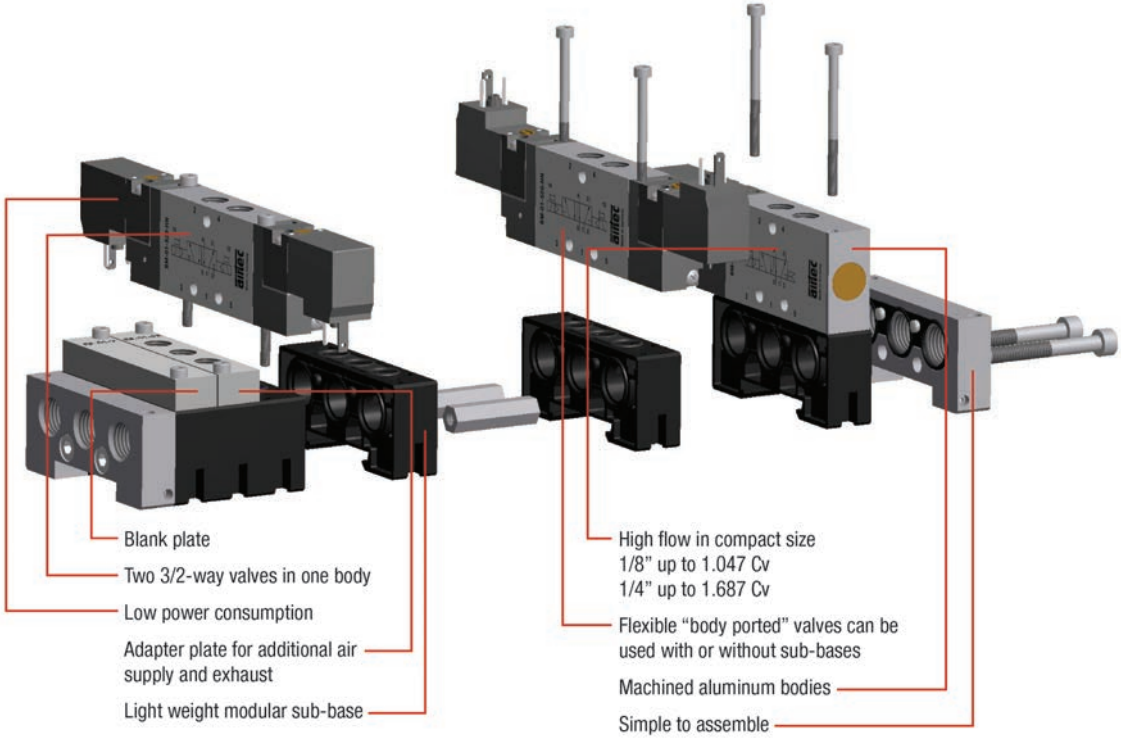
Series 86-4-...

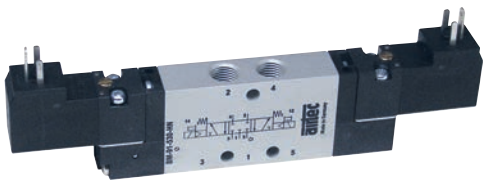
Accessories 1.048

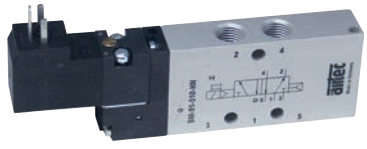
BM Series Valves

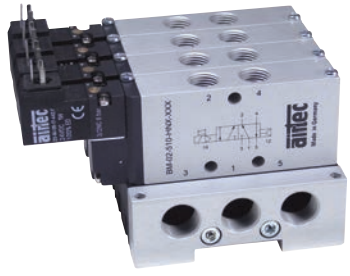
Designed with features and benefits to make your products better

Here's why electrically operated valves made by AIRTEC make your product simply better:









Electrically operated valves

Series BM-91, 3/2-way and 2 x 3/2-way
1/8 NPTF • 550 to 660 Nl/min (0.559 to 0.671 Cv)

Order code

BM-91-310-HNR-462

Series and function
BM = Standard

Manual override
HNT = non-detented manual override
HNR = detented manual override

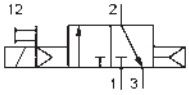
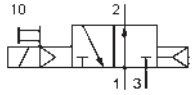
The requested plug socket must be purchased seperately.
Plug sockets see page 1.036.

Coil options

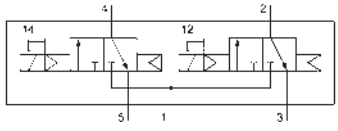
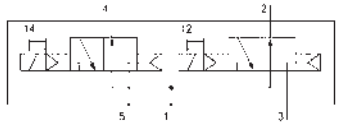
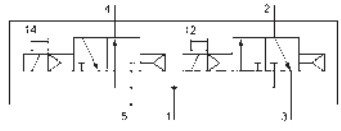
Standard voltage	*Plug socket upward*	*Plug socket downward*	*M12 connections upward*
12 V DC, 1 W	461	431	
24 V DC, 1 W	462	432	N62
24 V AC, 3 VA	452	422	
115 V AC, 3 VA	456	426	
230 V AC, 3 VA	457	427	

Design, function and technical data
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.

3/2-way valve

Order number Please complete according to order code.	**BM-91-310-HN**	**BM-91-312-HN**
Function	 3/2-way NC	 3/2-way NO
Connection	1/8 NPTF	
Nominal size	5 mm	
Flow rate	660 Nl/min (0.671 Cv)	600 Nl/min (0.610 Cv)
Pressure range	2 … 8 bar (29 … 116 psi)	
Control pressure	Control pressure is identical to main pressure range	
Response time at 6 bar	on 19 ms off 32 ms	on 16 ms off 30 ms
Temperature range	– 5 °C … + 50 °C (+ 23 °F … + 122 °F)	
Materials	Body: Al (anodized) and PA, Seals: NBR and PU, Inner parts: Al, brass and POM	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.108 kg (0.238 lb.)	0.110 kg (0.242 lb.)

2 x 3/2-way valves

Order number Please complete according to order code.	**BM-91-310/2-HN**	**BM-91-312/2-HN**	**BM-91-314/2-HN**
Function	 2 x 3/2-way NC	 2 x 3/2-way NO	 2 x 3/2-way NO/NC
Connection	1/8 NPTF		
Nominal size	5 mm		
Flow rate	650 Nl/min (0.661 Cv)	550 Nl/min (0.559 Cv)	580 Nl/min (0.589 Cv)
Pressure range	2 … 8 bar (29 … 116 psi)		
Control pressure	Control pressure is identical to main pressure range		
Response time at 6 bar	on 18 ms off 34 ms		on 19 ms off 32 ms
Temperature range	– 5 °C … + 50 °C (+ 23 °F … + 122 °F)		
Materials	Body: Al (anodized) and PA, Seals: NBR and PU, Inner parts: Al, brass and POM		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives		
Degree of protection	IP 65 according to EN 60529		
Weight	0,154 kg (0.339 lb.)		

Electrically operated valves

Series BM-91 (BME-91), 5/2-way and 5/3-way
1/8 NPTF • 670 to 1030 Nl/min (0.681 to 1.047 Cv)

Order code

BM-91-511-HNR-462

Series and function
BM = Standard
BME = Valves with external pilot supply

Manual override
HNT = non-detented manual override
HNR = detented manual override

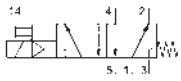
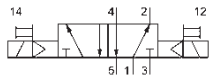
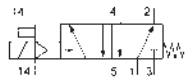
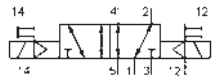
Coil options

Standard voltage	*Plug socket upward*	*Plug socket downward*	*M12 connections upward*
12 V DC, 1 W	461	431	
24 V DC, 1 W	462	432	N62
24 V AC, 3 VA	452	422	
115 V AC, 3 VA	456	426	
230 V AC, 3 VA	457	427	

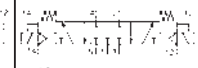
The requested plug socket must be purchased seperately.
Plug sockets see page 1.036.

Design, function and technical data
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.

5/2-way valve

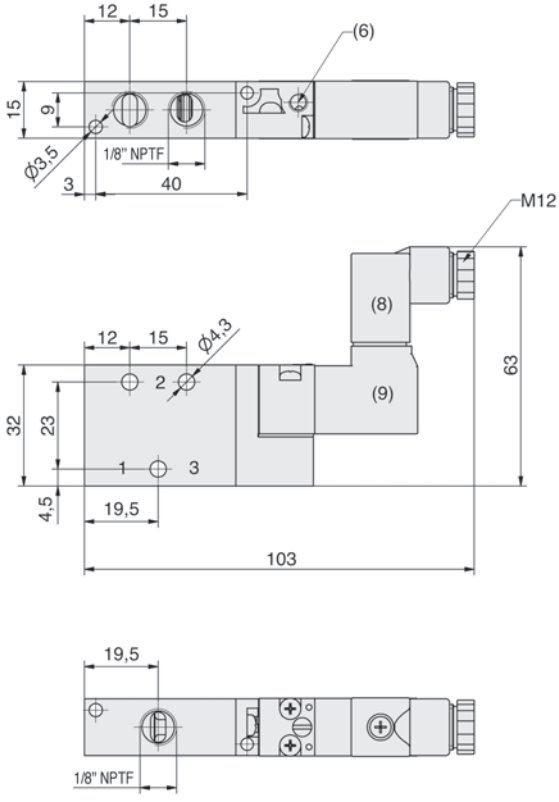
Order number Please complete according to order code.	**BM-91-511-HN**	**BM-91-520-HN**	**BME-91-511-HN**	**BME-91-520-HN**
				
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/2-way single solenoid ext. pilot supply	5/2-way double solenoid ext. pilot supply
Connection	1/8 NPTF			
Nominal size	5 mm			
Flow rate	800 Nl/min (0.813 Cv)	790 Nl/min (0.803 Cv)	800 Nl/min (0.813 Cv)	790 Nl/min (0.803 Cv)
Pressure range	3…8 bar (43.5 … 116 psi)	2 … 8 bar (29 … 116 psi)	– 0,95 … 8 bar (– 14 … + 116 psi)	
Control pressure	Control pressure is identical to main pressure range		3 … 8 bar (43.5 … 116 psi)	2 … 8 bar (29 … 116 psi)
Response time at 6 bar	on 15 ms off 35 ms	13 ms	on 15 ms off 35 ms	13 ms
Temperature range	– 5 °C … + 50 °C (+ 23 °F … + 122 °F)			
Materials	Body: Al (anodized) and PA, Seals: NBR and PU, Inner parts: Al, brass and POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Degree of protection	IP 65 according to EN 60529			
Weight	0.120 kg (0.264 lb.)	0.156 kg (0.344 lb.)	0.126 kg (0.278 lb.)	0.168 kg (0.370 lb.)

5/3-way valve

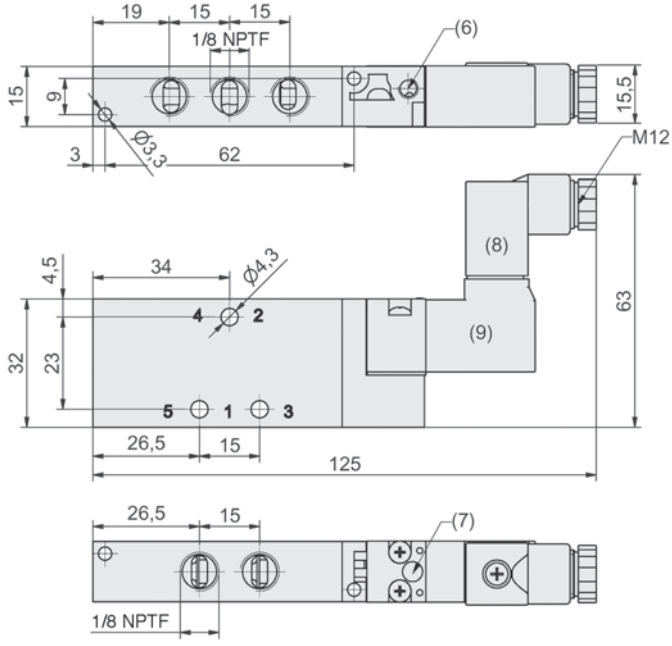
Order number Please complete according to order code.	**BM-91-530-HN**	**BM-91-533-HN**	**BM-91-534-HN**	**BME-91-530-HN**	**BME-91-533-HN**	**BME-91-534-HN**
						
Function	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized	5/3-way center position closed ext. pilot supply	5/3-way center position exhausted ext. pilot supply	5/3-way center position pressurized ext. pilot supply
Connection	1/8 NPTF					
Nominal size	5 mm					
Flow rate	690 Nl/min (0.701 Cv)	670 Nl/min (0.681 Cv)	1030 Nl/min (1.047 Cv)	690 Nl/min (0.701 Cv)	670 Nl/min (0.681 Cv)	1030 Nl/min (1.047 Cv)
Pressure range	3 … 8 bar (43.5 … 116 psi)			– 0,95 … 8 bar (– 14 … + 116 psi)		
Control pressure	Control pressure is identical to main pressure range			3 … 8 bar (43.5 … 116 psi)		
Response time at 6 bar	17 ms	on 16 ms off 43 ms	on 17 ms off 49 ms	17 ms	on 16 ms off 43 ms	on 17 ms off 49 ms
Temperature range	– 5 °C … + 50 °C (+ 23 °F … + 122 °F)					
Materials	Body: Al (anodized) and PA, Seals: NBR and PU, Inner parts: Al, brass and POM					
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives					
Degree of protection	IP 65 according to EN 60529					
Weight	0.154 kg (0.339 lb.)			0.166 kg (0.366 lb.)		

BM-91-310-HN, BM-91-312-HN

Note:
Plug socket(s) not included in scope of delivery.

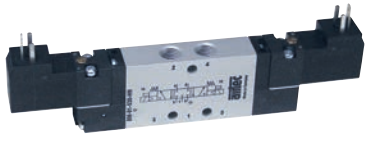


BM-91-511-HN



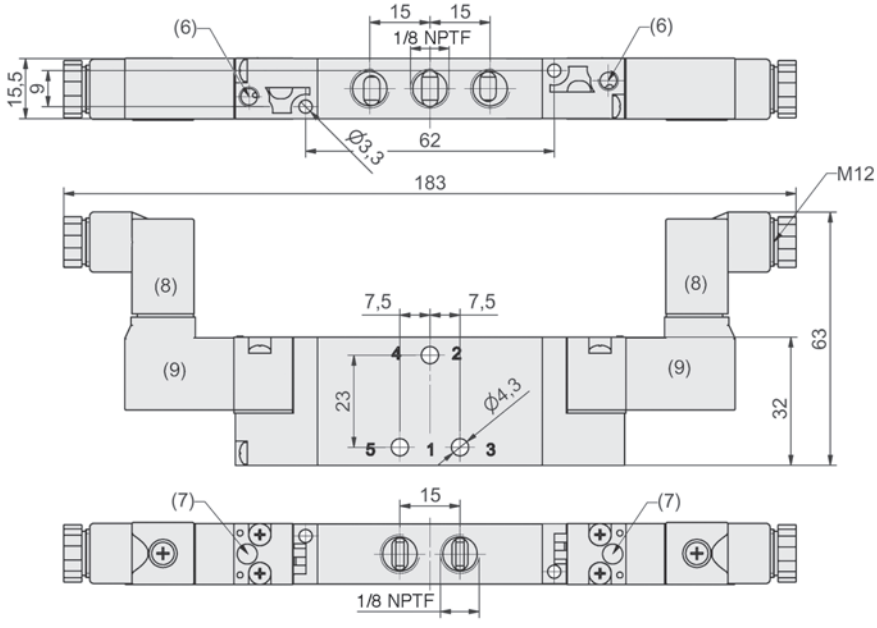
1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

BM-91-310/2-HN, BM-91-312/2-HN, BM-91-314/2-HN, BM-91-520-HN, BM-91-530-HN, BM-91-533-HN, BM-01-534-HN

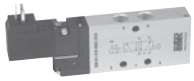


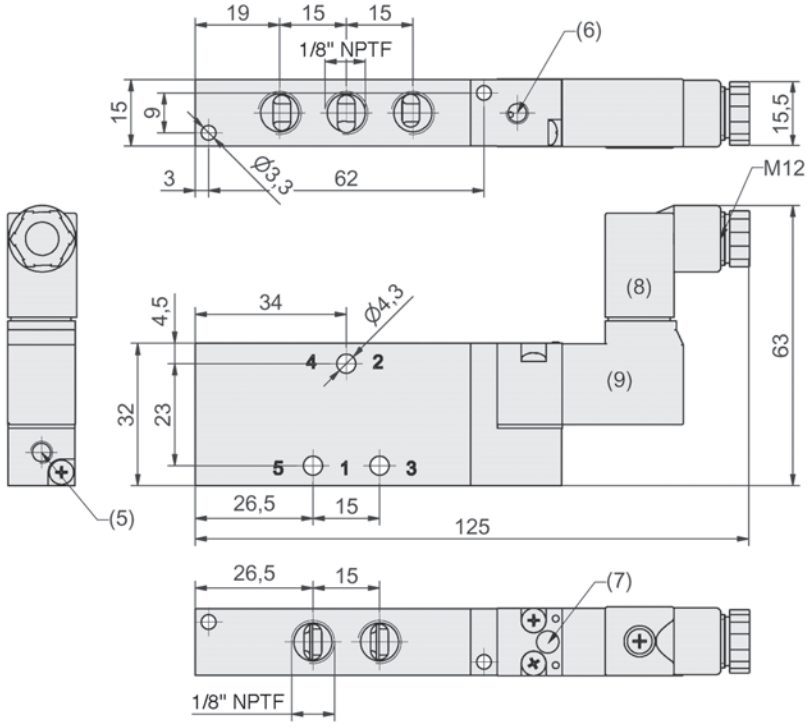
Note:
Plug socket(s) not included in scope of delivery.

1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward



BME-91-511-HN

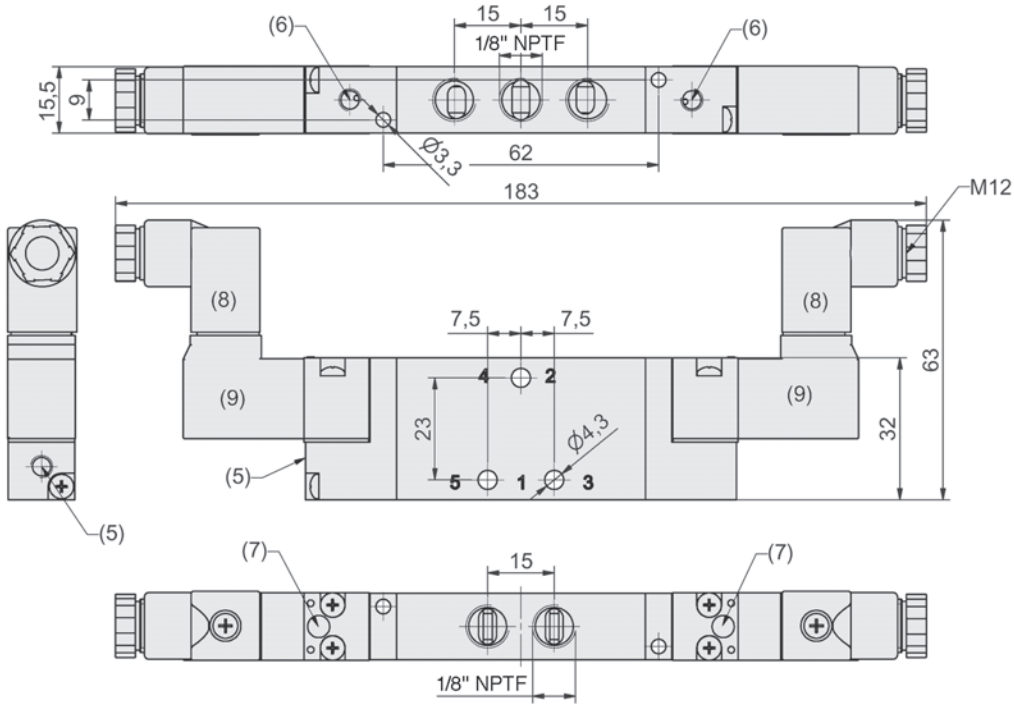




Note:
Plug socket(s) not included in scope of delivery.

1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(5) = ext. pilot supply, M5
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

BME-91-520-HN, BME-91-530-HN, BME-91-533-HN, BME-91-534-HN

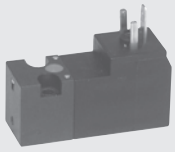


Note:
Plug socket(s) not included in scope of delivery.

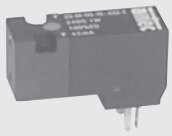
1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(5) = ext. pilot supply, M5
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented

(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

Solenoid

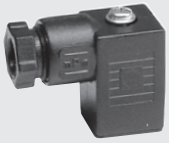


Solenoid with pins for plug socket connection on the same side as manual override (upward).
23-M-09-19-…
page 1.038



Solenoid with pins for plug socket connection on the opposite side of the manual override (downward).
23-M-09-19-…
page 1.038

Plug sockets

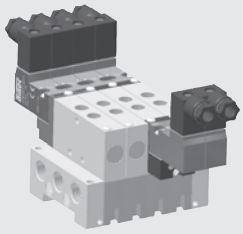


Standard plug socket
28-ST-02-1
page 1.026

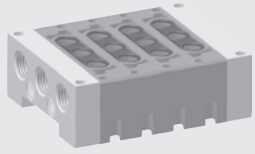
Plug socket with LED
28-ST-09-1-…
page 1.026

Plug socket with LED and circuit protection
28-ST-10-1-…
page 1.026

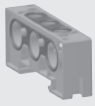
Manifolds



Manifold will be delivered completely assembled with valves if requested.

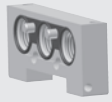


Manifold with n/stations.
Ports on the side.
RF-91-AB/n



One station element.
RF-01-Z

Blind plate for blank valve station.
RF-01-V



End plate A
with side ports.
RF-91-EA

End plate B
with side ports.
RF-91-EB

Additional single elements:

RF-01-ZE	“Add-on” element to add one valve station.
RF-01-DT	Seal plate for two different pressures.
RE-46-RSV	Check valve for dynamic exhaust pressures.

User information

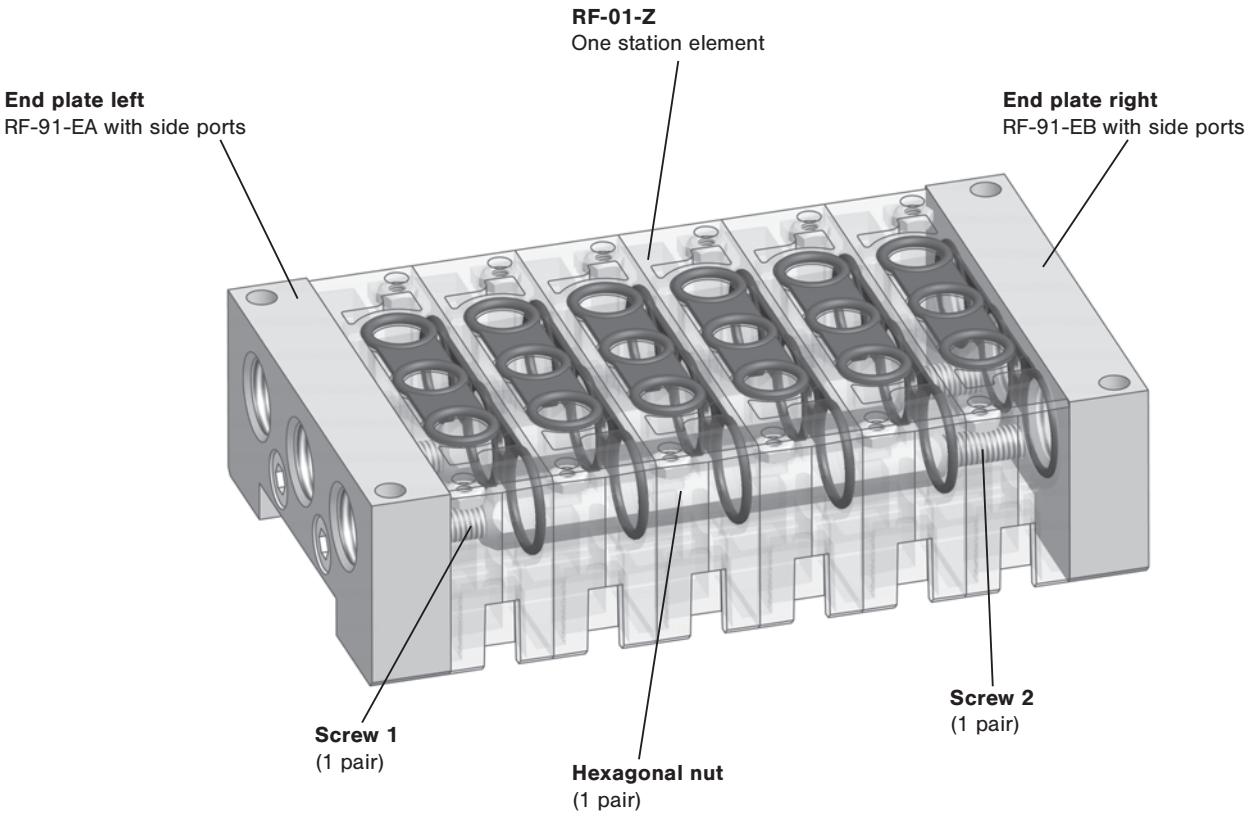
Modular manifold system for valve series BM-01. The assembled manifold consists of one station element (RF-01-Z) and end plates with common supply and exhaust ports. The end plates contain ports to the side (RF-91-EA, RF-91-EB) or at the top and the side (RF-01-EC, RF-01-ED).

The manifolds are quickly assembled with the 4 screws and a hexagonal nut. Adding or removing stations is possible at any time.

The manifold can be either DIN-rail mounted, screw on by 4 M5 screws or flange mounting via M4 screws.

The necessary seals and screws for valve mounting are included in the scope of delivery.

Manifold design

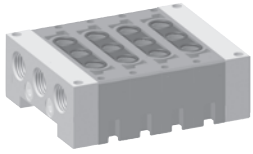


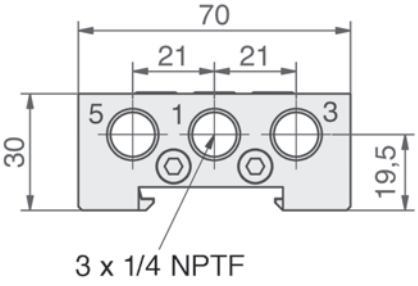
User information

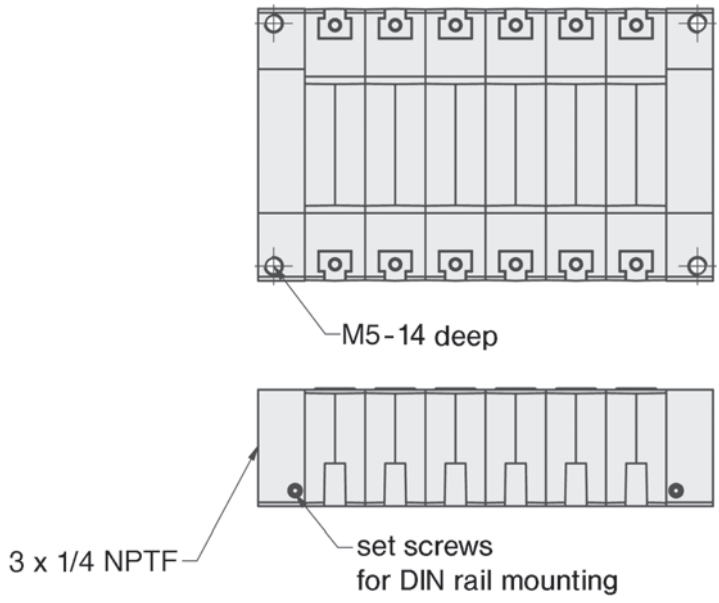
To add stations to the manifold without changing screws and nut, the set RF-01-ZE is available. This contains a one station element, a screw to extend the hexagonal nut and seals and screws for valve mounting.

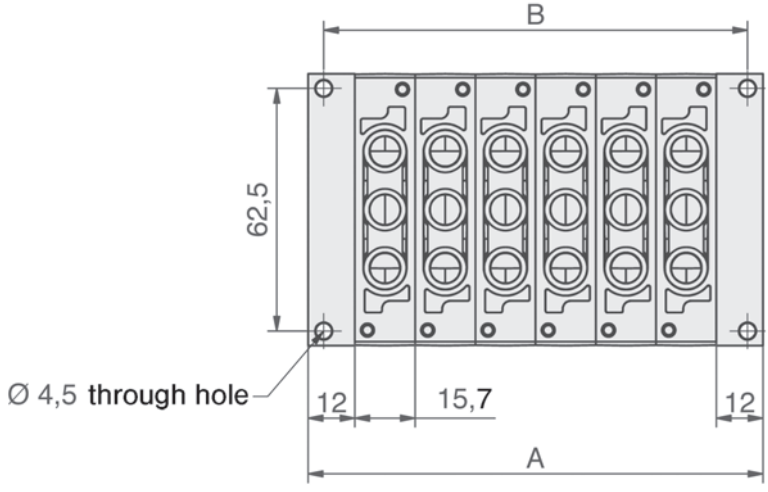
Order number	Hexagonal nut	Screw 1	Screw 2
RF-01-AB/02	21-R-07-07/05	M5 x 16	M5 x 16
RF-01-AB/03	21-R-07-07/05	M5 x 25	M5 x 25
RF-01-AB/04	21-R-07-07/05	M5 x 30	M5 x 30
RF-01-AB/05	21-R-07-07/2	M5 x 20	M5 x 20
RF-01-AB/06	21-R-07-07/2	M5 x 25	M5 x 25
RF-01-AB/07	21-R-07-07/2	M5 x 35	M5 x 35
RF-01-AB/08	21-R-07-07/2	M5 x 40	M5 x 40
RF-01-AB/09	21-R-07-07/4	M5 x 16	M5 x 16
RF-01-AB/10	21-R-07-07/4	M5 x 25	M5 x 25
RF-01-AB/11	21-R-07-07/4	M5 x 35	M5 x 35
RF-01-AB/12	21-R-07-07/4	M5 x 40	M5 x 40

RF-91-AB









Materials: End plate Al (anodized), 1 station element PA,
Seals NBR, Screws steel zinc plated

Order number	A	B	Weight
RF-91-AB/02	55.4 + 0.3 /– 0.2	47.2 + 0.2 /– 0.1	0.150 kg (0.331 lb.)
RF-91-AB/03	71.1 + 0.35/– 0.2	63.1 + 0.25/– 0.1	0.190 kg (0.419 lb.)
RF-91-AB/04	86.8 + 0.4 /– 0.2	78.8 + 0.3 /– 0.1	0.230 kg (0.507 lb.)
RF-91-AB/05	102.5 + 0.45/– 0.2	94.5 + 0.35/– 0.1	0.270 kg (0.595 lb.)
RF-91-AB/06	118.2 + 0.5 /– 0.2	110.2 + 0.4 /– 0.1	0.310 kg (0.683 lb.)
RF-91-AB/07	133.9 + 0.55/– 0.2	125.9 + 0.45/– 0.1	0.350 kg (0.772 lb.)
RF-91-AB/08	149.6 + 0.6 /– 0.2	141.6 + 0.5 /– 0.1	0.390 kg (0.860 lb.)
RF-91-AB/09	165.3 + 0.65/– 0.2	157.3 + 0.55/– 0.1	0.430 kg (0.948 lb.)
RF-91-AB/10	181 + 0.7 /– 0.2	173 + 0.6 /– 0.1	0.470 kg (1.036 lbs.)
RF-91-AB/11	196.7 + 0.75/– 0.2	188.7 + 0.65/– 0.1	0.510 kg (1.124 lbs.)
RF-91-AB/12	212.4 + 0.8 /– 0.2	204.4 + 0.7 /– 0.1	0.550 kg (1.212 lbs.)

Electrically operated valves

Series BM-92, 3/2-way and 2 x 3/2-way

1/4 NPTF • 920 to 1090 Nl/min (0.935 to 1.001 Cv)

Order code

BM-92-310-HNR-462

Series and function
BM = Standard

Manual override
HNT = non-detented manual override
HNR = detented manual override

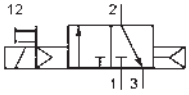
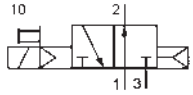
The requested plug socket must be purchased seperately.
Plug sockets see page 1.036.

Coil options

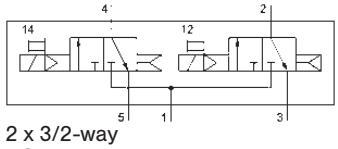
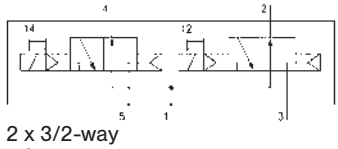
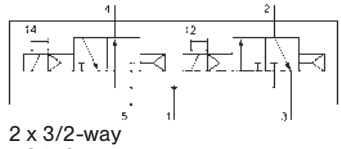
Standard voltage	*Plug socket upward*	*Plug socket downward*	*M12 connections-upward*
12 V DC, 1 W	461	431	
24 V DC, 1 W	462	432	N62
24 V AC, 3 VA	452	422	
115 V AC, 3 VA	456	426	
230 V AC, 3 VA	457	427	

Design, function and technical data
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.

3/2-way valve

Order number Please complete according to order code.	**BM-92-310-HN**	**BM-92-312-HN**
Function	 3/2-way NC	 3/2-way NO
Connection	1/4 NPTF	
Nominal size	8 mm	
Flow rate	1090 Nl/min (1.001 Cv)	920 Nl/min (0.935 Cv)
Pressure range	2 … 8 bar (29 … 116 psi)	
Control pressure	Control pressure is identical to main pressure range	
Response time at 6 bar	on 19 ms off 23 ms	on 25 ms off 23 ms
Temperature range	– 5 °C … + 60 °C (+ 23 °F … + 140 °F)	
Materials	Body: Al (anodized) and PA-GF, Seals: NBR and PU, Inner parts: Al, brass and POM	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.150 kg (0.331 lb.)	

2 x 3/2-way valve

Order number Please complete according to order code.	**BM-92-310/2-HN**	**BM-92-312/2-HN**	**BM-92-314/2-HN**
Function	 2 x 3/2-way NC	 2 x 3/2-way NO	 2 x 3/2-way NO/NC
Connection	1/4 NPTF		
Nominal size	7 mm		
Flow rate	1050 Nl/min (1.067 Cv)	1030 Nl/min (1.047 Cv)	NC 1050 Nl/min, NO 920 Nl/min (NC 1.067 Cv, NO 0.935 Cv)
Pressure range	2 … 8 bar (29 … 116 psi)		
Control pressure	Control pressure is identical to main pressure range		
Response time at 6 bar	on 22 ms off 24 ms		
Temperature range	– 5 °C … + 60 °C (+ 23 °F … + 140 °F)		
Materials	Body: Al (anodized) and PA-GF, Seals: NBR and PU, Inner parts: Al, brass and POM		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives		
Degree of protection	IP 65 according to EN 60529		
Weight	0.250 kg (0.551 lb.)		

Electrically operated valves

Series BM-92 (BME-92), 5/2-way and 5/3-way
1/4 NPTF • 1300 to 1700 Nl/min (1.321 to 1.728 Cv)

Order code

BM-92-511-HNR-462

Series and function
BM = Standard
BME = Valves with external pilot supply

Manual override
HNT = non-detented manual override
HNR = detented manual override

Coil options

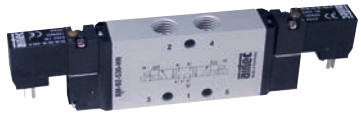
Standard voltage	*Plug socket upward*	*Plug socket downward*	*M12 connections-upward*
12 V DC, 1 W	461	431	
24 V DC, 1 W	462	432	N62
24 V AC, 3 VA	452	422	
115 V AC, 3 VA	456	426	
230 V AC, 3 VA	457	427	

The requested plug socket must be purchased seperately.
Plug sockets see page 4.283.

Design, function and technical data
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.

5/2-way valve

Order number Please complete according to order code.	**BM-92-511-HN**	**BM-92-520-HN**	**BME-92-511-HN**	**BME-92-520-HN**
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/2-way single solenoid ext. pilot supply	5/2-way double solenoid ext. pilot supply
Connection	1/4 NPTF			
Nominal size	7 mm			
Flow rate	1600 Nl/min (1.626 Cv)	1540 Nl/min (1.565 Cv)	1600 Nl/min (1.626 Cv)	1540 Nl/min (1.565 Cv)
Pressure range	3 … 8 bar (43.5 … 116 psi)	2 … 8 bar (29 … 116 psi)	– 0,95 … 8 bar (– 14 … + 116 psi)	
Control pressure	Control pressure is identical to main pressure range		3 … 8 bar (43.5 … 116 psi)	2 … 8 bar (29 … 116 psi)
Response time at 6 bar	on 13 ms off 35 ms	11 ms	on 13 ms off 35 ms	11 ms
Temperature range	– 5 °C … + 60 °C (+ 23 °F … + 140 °F)			
Materials	Body: Al (anodized) and PA-GF, Seals: NBR and PU, Inner parts: Al, brass and POM			
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives			
Degree of protection	IP 65 according to EN 60529			
Weight	0.220 kg (0.485 lb.)	0.270 kg (0.595 lb.)	0.220 kg (0.485 lb.)	0.270 kg (0.595 lb.)

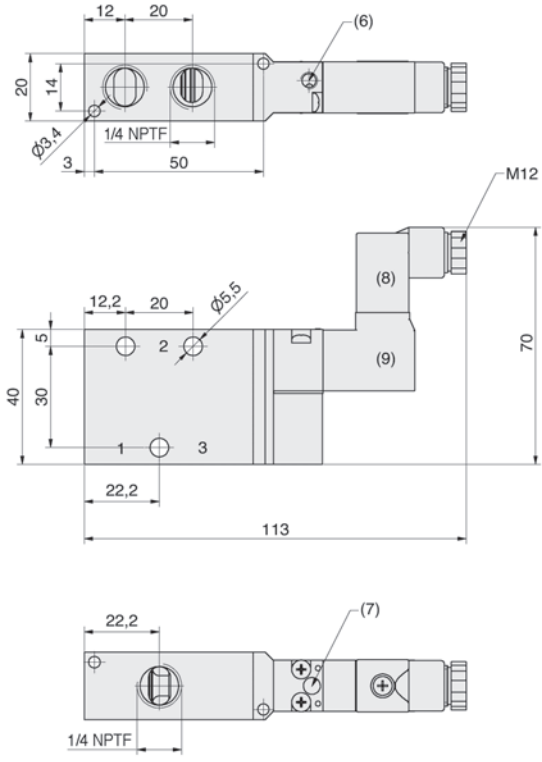


5/3-way valve

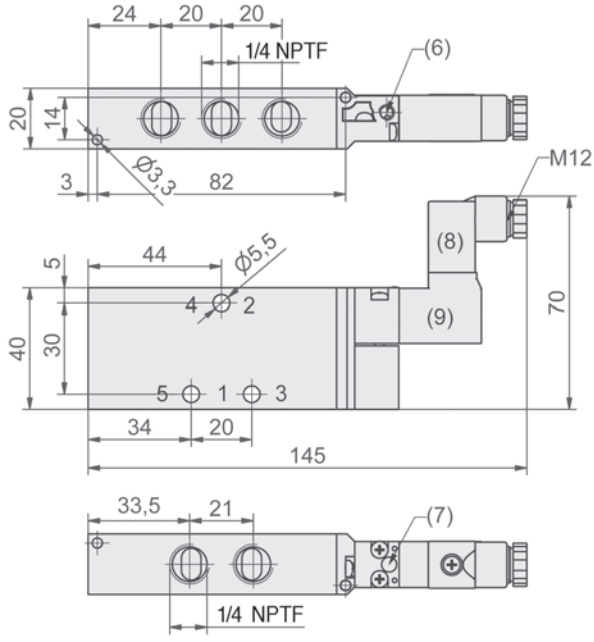
Order number Please complete according to order code.	**BM-92-530-HN**	**BM-92-533-HN**	**BM-92-534-HN**	**BME-92-530-HN**	**BME-92-533-HN**	**BME-92-534-HN**
Function	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized	5/3-way center position closed ext. pilot supply	5/3-way center position exhausted ext. pilot supply	5/3-way center position pressurized ext. pilot supply
Connection	1/4 NPTF					
Nominal size	7 mm					
Flow rate	1300 Nl/min (1.321 Cv)	1470 Nl/min (1.494 Cv)	1660 Nl/min (1.687 Cv)	1300 Nl/min (1.321 Cv)	1470 Nl/min (1.494 Cv)	1660 Nl/min (1.687 Cv)
Pressure range	3 … 8 bar (43.5 … 116 psi)			– 0,95 … 8 bar (– 14 … + 116 psi)		
Control pressure	Control pressure is identical to main pressure range			3 … 8 bar (43.5 … 116 psi)		
Response time at 6 bar	on 20 ms off 26 ms	on 26 ms off 28 ms	on 26 ms off 33 ms	on 20 ms off 26 ms	on 26 ms off 28 ms	on 26 ms off 33 ms
Temperature range	– 5 °C … + 60 °C (+ 23 °F … + 140 °F)					
Materials	Body: Al (anodized) and PA-GF, Seals: NBR and PU, Inner parts: Al, brass and POM					
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives					
Degree of protection	IP 65 according to EN 60529					
Weight	0.260 kg (0.573 lb.)					

BM-92-310-HN, BM-92-312-HN

Note:
Plug socket(s) not included in scope of delivery.



BM-92-511-HN

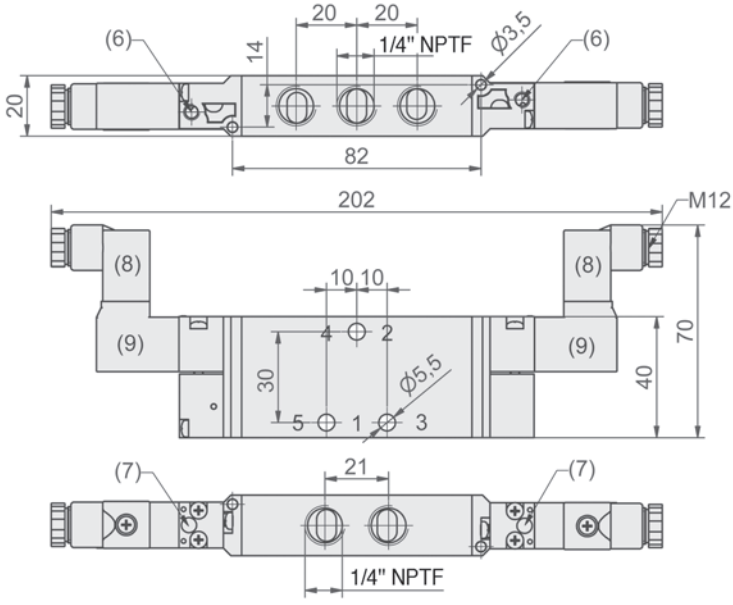


1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

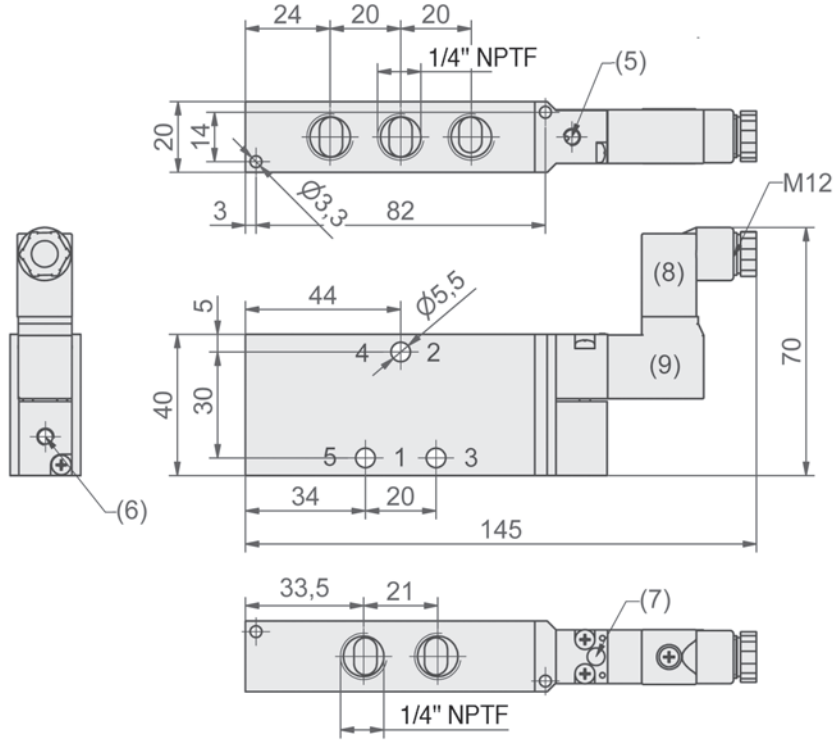
BM-92-310/2-HN, BM-92-312/2-HN, BM-92-314/2-HN, BM-92-520-HN, BM-92-530-HN, BM-92-533-HN, BM-92-534-HN

Note:
Plug socket(s) not included in scope of delivery.

1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward



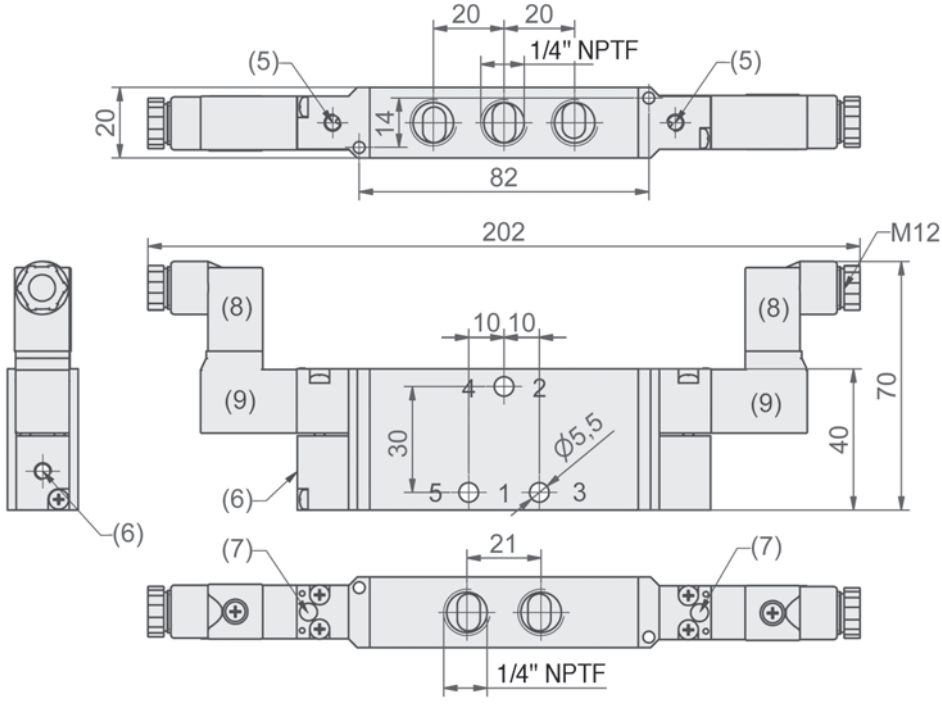
BME-02-511-HN



Note:
Plug socket(s) not included in scope of delivery.

1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(5) = ext. pilot supply, M5
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

BME-92-520-HN, BME-92-530-HN, BME-92-533-HN, BME-92-534-HN

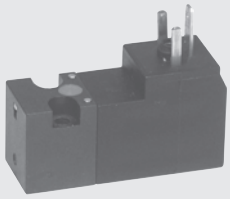


Note:
Plug socket(s) not included in scope of delivery.

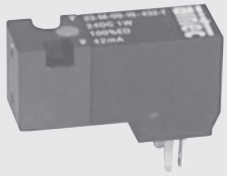
1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(5) = ext. pilot supply, M5
(6) = Pilot air exhaust, M5
(7) = Manual override, detented or non-detented
(8) = plug socket can be repositioned by 180°
(9) = Solenoid, pins for plug socket connection upward or downward

Accessories for electrically operated valves
Series BM-92 and BME-92

Solenoid

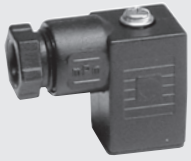


Solenoid with pins for plug socket connection on the same side as manual override (upward).
23-M-09-19-...
page 1.026



Solenoid with pins for plug socket connection on the opposite side of the manual override (downward).
23-M-09-19-...
page 1.026

Plug sockets

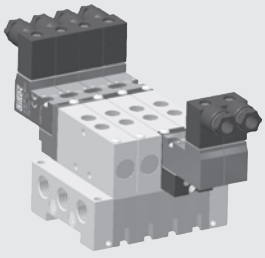


Standard plug socket
28-ST-02-1
page 1.026

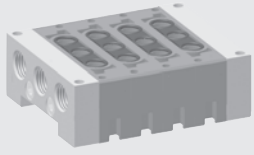
Plug socket with LED
28-ST-09-1-...
page 1.026

Plug socket with LED and circuit protection
28-ST-10-1-...
page 1.026

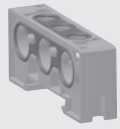
Manifolds



Manifold will be delivered completely assembled with valves if requested.



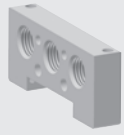
Manifold with n/stations.
Ports on the side.
RF-92-AB/n



One station element.
RF-02-Z

Blind plate for blank valve station.
RF-02-V

End plate A
with side ports.
RF-92-EA



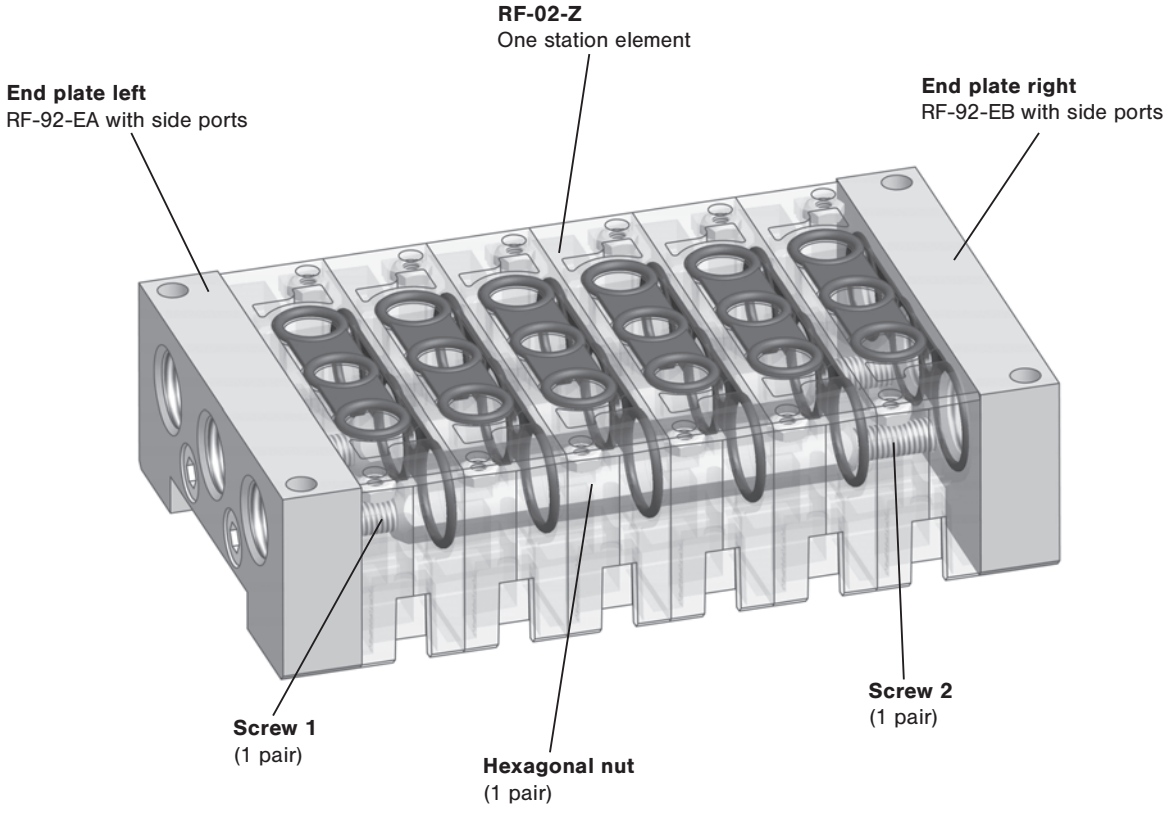
End plate B
with side ports.
RF-92-EB

Additional single elements:

RF-02-ZE	“Add-on” element to add one valve station.
RF-02-DT	Seal plate for two different pressures.
RF-02-RSV	Check valve for dynamic exhaust pressures.
RF-01-M5	Mounting bolt (1 pair)

User information
Modular manifold system for valve series BM-92. The assembled manifold consists of one station elements (RF-02-Z) and end plates with common supply and exhaust ports. The end plates contain ports to the side (RF-92-EA, RF-92-EB).
The manifolds are quickly assembled with the 4 screws and a hexagonal nut. Adding or removing stations is possible at any time.
The manifold can be either DIN-rail mounted, screw on by 4 M5 screws or flange mounting via M4 screws.
The necessary seals and screws for valve mounting are included in the scope of delivery.

Manifold design

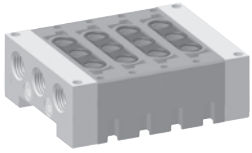


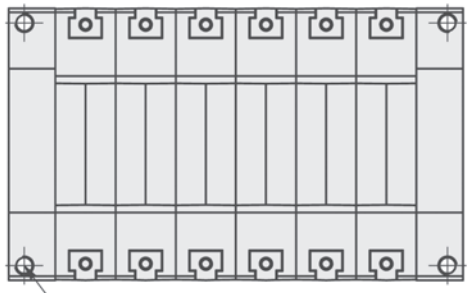
User information

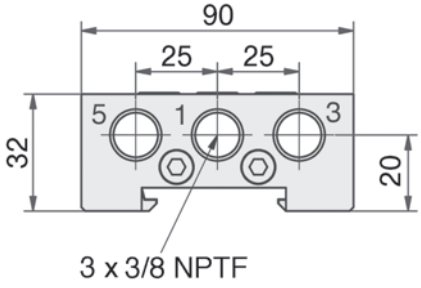
To add stations to the manifold without changing screws and nut, the set RF-02-ZE is available. This contains a one station element, a screw to extend the hexagonal nut and seals and screws for valve mounting.

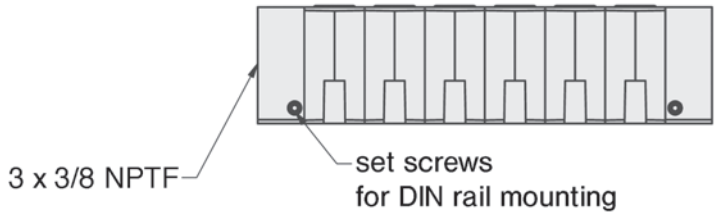
Order number	Hexagonal nut	Screw 1	Screw 2
RF-92-AB/02	21-R-07-07/05	M 5 x 20	M 5 x 20
RF-92-AB/03	21-R-07-07/05	M 5 x 30	M 5 x 30
RF-92-AB/04	21-R-07-07/2	M 5 x 20	M 5 x 20
RF-92-AB/05	21-R-07-07/2	M 5 x 30	M 5 x 30
RF-92-AB/06	21-R-07-07/2	M 5 x 40	M 5 x 40
RF-92-AB/07	21-R-07-07/4	M 5 x 20	M 5 x 20
RF-92-AB/08	21-R-07-07/4	M 5 x 30	M 5 x 30
RF-92-AB/09	21-R-07-07/4	M 5 x 40	M 5 x 40
RF-92-AB/10	21-R-07-07/6	M 5 x 16	M 5 x 16
RF-92-AB/11	21-R-07-07/6	M 5 x 25	M 5 x 25
RF-92-AB/12	21-R-07-07/6	M 5 x 35	M 5 x 35

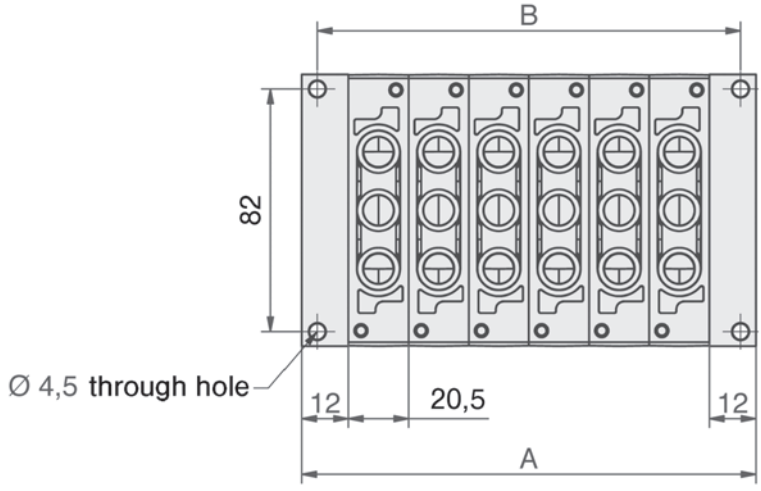
RF-92-AB







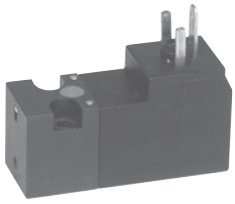




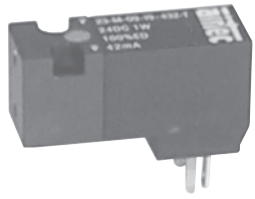
Materials: End plate Al (anodized), 1 station element PA,
Seals NBR, Screws steel zinc plated

Order number	A	B	Weight
RF-92-AB/02	65 ± 0.3	57 ± 0.3	0.230 kg (0.507 lb.)
RF-92-AB/03	85.5 ± 0.35	77.5 ± 0.35	0.270 kg (0.595 lb.)
RF-92-AB/04	106 ± 0.4	98 ± 0.4	0.310 kg (0.683 lb.)
RF-92-AB/05	126.5 ± 0.45	118.5 ± 0.45	0.350 kg (0.772 lb.)
RF-92-AB/06	147 ± 0.5	139 ± 0.5	0.390 kg (0.860 lb.)
RF-92-AB/07	167.5 ± 0.55	159.5 ± 0.55	0.430 kg (0.948 lb.)
RF-92-AB/08	188 ± 0.6	180 ± 0.6	0.470 kg (1.036 lbs.)
RF-92-AB/09	208.5 ± 0.65	200.5 ± 0.65	0.510 kg (1.124 lbs.)
RF-92-AB/10	229 ± 0.7	221 ± 0.7	0.550 kg (1.212 lbs.)
RF-92-AB/11	249.5 ± 0.75	241.5 ± 0.75	0.590 kg (1.301 lbs.)
RF-92-AB/12	270 ± 0.8	262 ± 0.8	0.630 kg (1.389 lbs.)

Solenoid coil 23-M-09-19 (Contact distance 8 mm)



Solenoid pins at the same side as the manual override (HN).



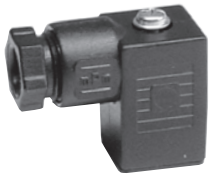
Solenoid pins at the opposite side as the manual override (HN).

The connection patten of the pins is according to EN 175301-803 form C.

Duty cycle 100 %.

Order number	Standard voltage	Power consumption	Manual override (HN)	Position contact pins
23-M-09-19-461-T	12 V DC	1 W	Non detented	same side as HN
23-M-09-19-431-T				opposite side as HN
23-M-09-19-461-R			Detented	same side as HN
23-M-09-19-431-R				opposite side as HN
23-M-09-19-462-T	24 V DC	1 W	Non detented	same side as HN
23-M-09-19-432-T				opposite side as HN
23-M-09-19-462-R			Detented	same side as HN
23-M-09-19-432-R				opposite side as HN
23-M-09-19-452-T	24 V AC	3 VA	Non detented	same side as HN
23-M-09-19-422-T				opposite side as HN
23-M-09-19-452-R			Detented	same side as HN
23-M-09-19-422-R				opposite side as HN
23-M-09-19-456-T	115 V AC	3 VA	Non detented	same side as HN
23-M-09-19-426-T				opposite side as HN
23-M-09-19-456-R			Detented	same side as HN
23-M-09-19-426-R				opposite side as HN
23-M-09-19-457-T	230 V AC	3 VA	Non detented	same side as HN
23-M-09-19-427-T				opposite side as HN
23-M-09-19-457-R			Detented	same side as HN
23-M-09-19-427-R				opposite side as HN

Plug socket 28-ST-02-1 (Pin distance 8 mm)



AIRTEC solenoid sockets with seal type 28-ST-02-1 are a standard feature of all solenoid valves series using coil type 23-M-09-19-…

Cable-⌀: max. 6.5 mm (0.26 in).

Conductor size: max. is 0.75 mm² (8 gauge).

Degree of protection: IP 65 according to VDE 0470/EN 60529.

Useable for all available coil voltages.

Plug socket 28-ST-09 and 28-ST-10 (Contact distance 8 mm)

AIRTEC solenoid sockets type 28-ST-09-1 and 28-ST-10-1 have a green LED.

28-ST-10-1 has an additional integrated circuit to protect against voltage peaks.

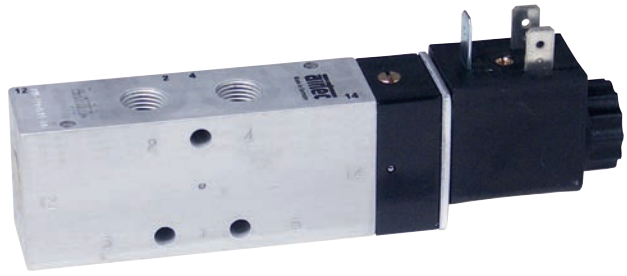
Please indicate requested voltage with order.

Order number	28-ST-09-1-112	28-ST-09-1-127	28-ST-10-1-112	28-ST-10-1-127
Standard voltage	24 V AC/DC	230 V AC	24 V AC/DC	230 V AC

Electrically operated valves

Series KM-99, 5/2- and 5/3-way

1/8 NPTF • 680 to 950 Nl/min (0.691 to 0.966 Cv)



Order code

KM-99-511-HN-442

Series and function

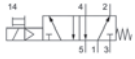
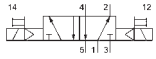
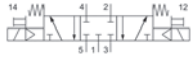
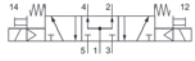
Coil options[1)]

Standard coils			*Without coil and plug socket*		
HN at ports 2 + 4		**HN at ports 1, 3 + 5**	**HN at ports 2 + 4**		**HN at ports 1, 3 + 5**
441	12 V DC, 4,2 W	**411**	**570**	Power consumption 4.2 W, 7/4 VA	**500**
442	24 V DC, 4,2 W	**412**	**560**	Power consumption 2.2 W[2)]	**530**
452	24 V AC, 7/4 VA	**422**			
456	115 V AC, 7/4 VA	**426**	*Coil with M12 connector and LED*		
457	230 V AC, 7/4 VA	**427**	**HN at ports 2 + 4**		**HN at ports 1, 3 + 5**
461	12 V DC, 2,2 W[2)]	**431**	**O42**	24 V DC, 4.8 W	**O12**
462	24 V DC, 2,2 W[2)]	**432**	**O62**	24 V DC, 2.5 W[2)]	**O32**

[1)] Manual override (HN) is on the side of ports 2 and 4 by default. It can be easily repositioned by 180° (side of ports 1, 3 and 5).
Plug socket(s) not included in scope of delivery.

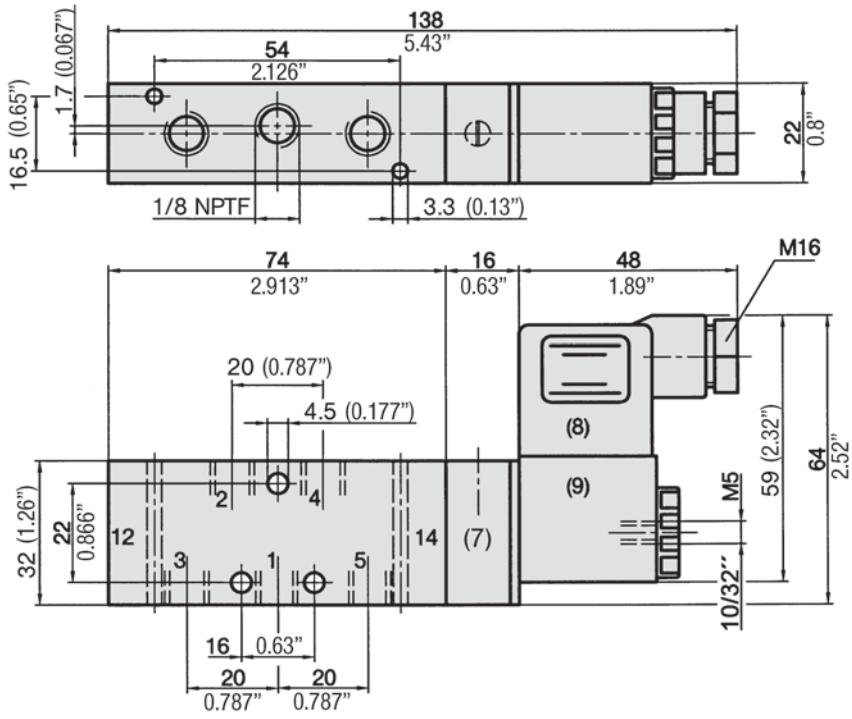
Design and function

Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**KM-99-511-HN**	**KM-99-520-HN**	**KM-99-530-HN**	**KM-99-533-HN**	**KM-99-534-HN**
					
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized
Connection	1/8 NPTF				
Nominal size	6 mm (0.236")				
Flow rate	810 Nl/min (0.823 Cv)	950 Nl/min (0.966 Cv)	680 Nl/min (0.691 Cv)		
Pressure range	3 … 10 bar (43 … 145 psi)[2)]				
Response time at 6 bar	on 13 ms off 28 ms	15 ms	on 14 ms off 16 ms		
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Materials	Body: Al (anodized), Seals: NBR, Inner parts: Al, stainless steel and brass				
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives				
Degree of protection	IP 65 according to EN 60529				
Weight	0.231 kg (0.509 lb.)	0.330 kg (0.727 lb.)			

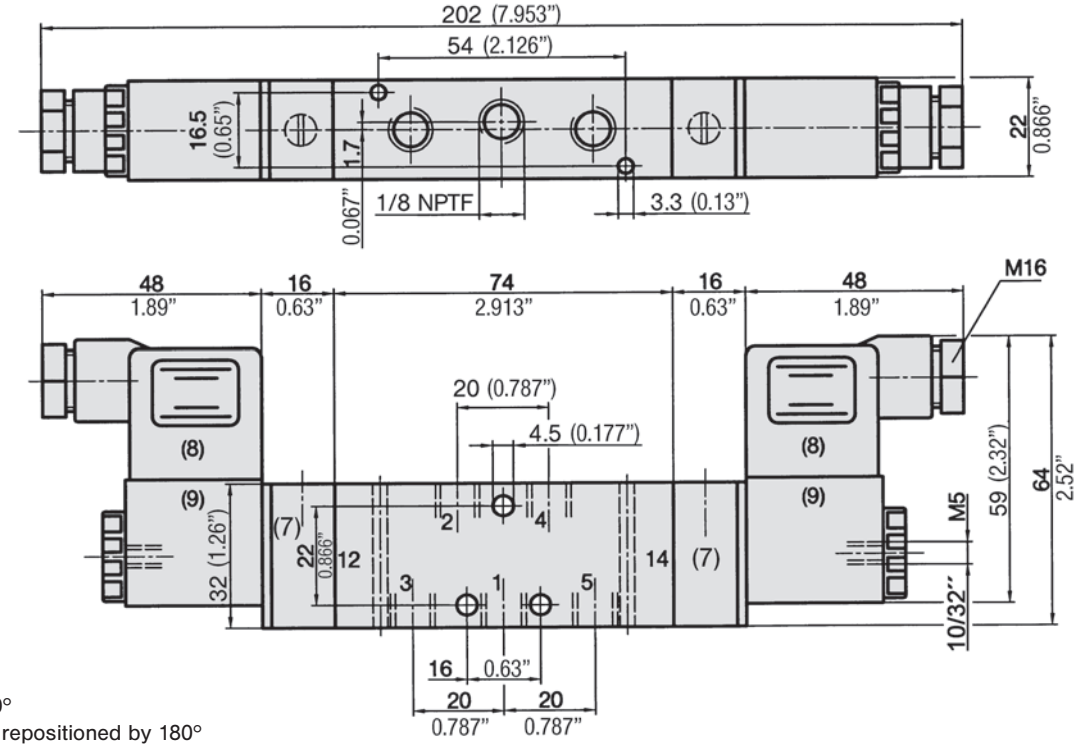
[2)] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

KM-99-511-HN



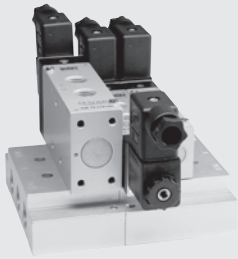
1 = pressure inlet
2, 4 = outlet
3, 5 = exhaust
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

KM-99-520-HN, KM-99-530-HN, KM-99-533-HN, KM-99-534-HN



1 = pressure inlet
2, 4 = outlet
3, 5 = exhaust
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

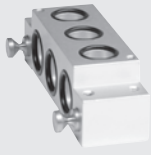
Manifolds



Manifold will be delivered completely assembled with valves if requested.

End plate 3/8 NPTF for valve size 1/8” and 1/4”.
RF-99-E
page 1.032

One station element for 1/8” valve.
RF-09-Z1
page 1.032



One station element for 1/4” valve.
RF-10-Z1
page 1.032

Four station element for 1/8” valve.
RF-09-Z4
page 1.032

Four station element for 1/4” valve.
RF-10-Z4
page 1.032

Blind plate for blank valve station 1/8”.
RF-09-V
page 1.030

Blind plate for blank valve station 1/4”.
RF-10-V
page 1.031

Seal plate (two different pressures).
RF-19-01

Pressure separator.

RE-19-DT

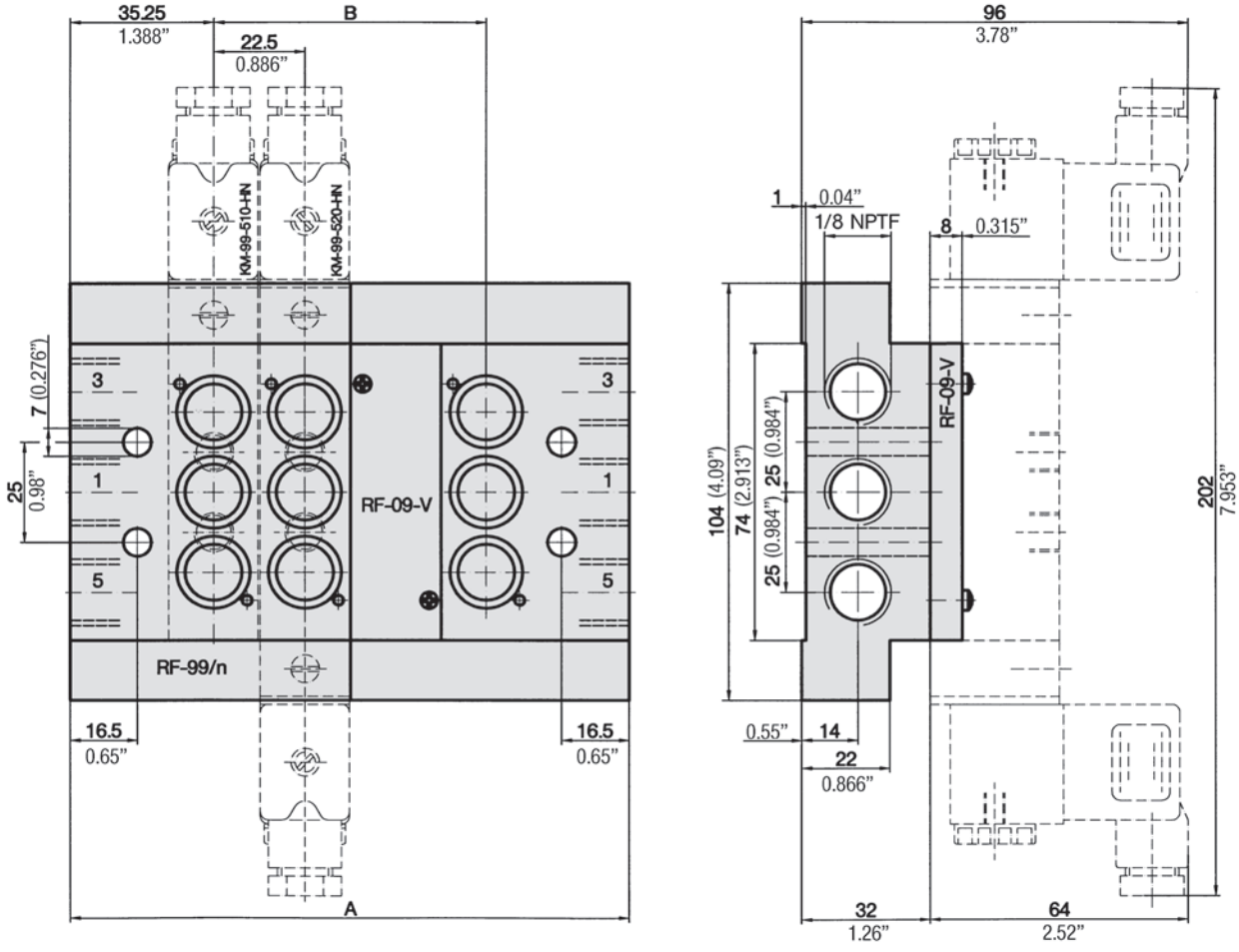
Further single elements: **RF-19-02** Assembly kit, 2 grub screws, O-rings, studs.
RF-19-03 3 x O-rings for valve assembly G 1/8 and G 1/4.

User information

Modular manifold system suitable for combined mounting of 1/8 NPTF and 1/4 NPTF valves. Any number of stations is possible if proper supply and exhaust of air is guaranteed. Adding or removing stations is possible at any time.

The necessary seals, mounting screws, grub screws and studs are included when ordering plates. The manifold system is delivered pre-assembled and function-tested. If not specified with the order, valve configuration is as follows: The valves are mounted according to their order number, starting with high numbers on the left, ending with low numbers on the right, followed by blind plates (if ordered).

Dimensions for manifolds RF-99



1 = pressure inlet 3, 5 = exhaust

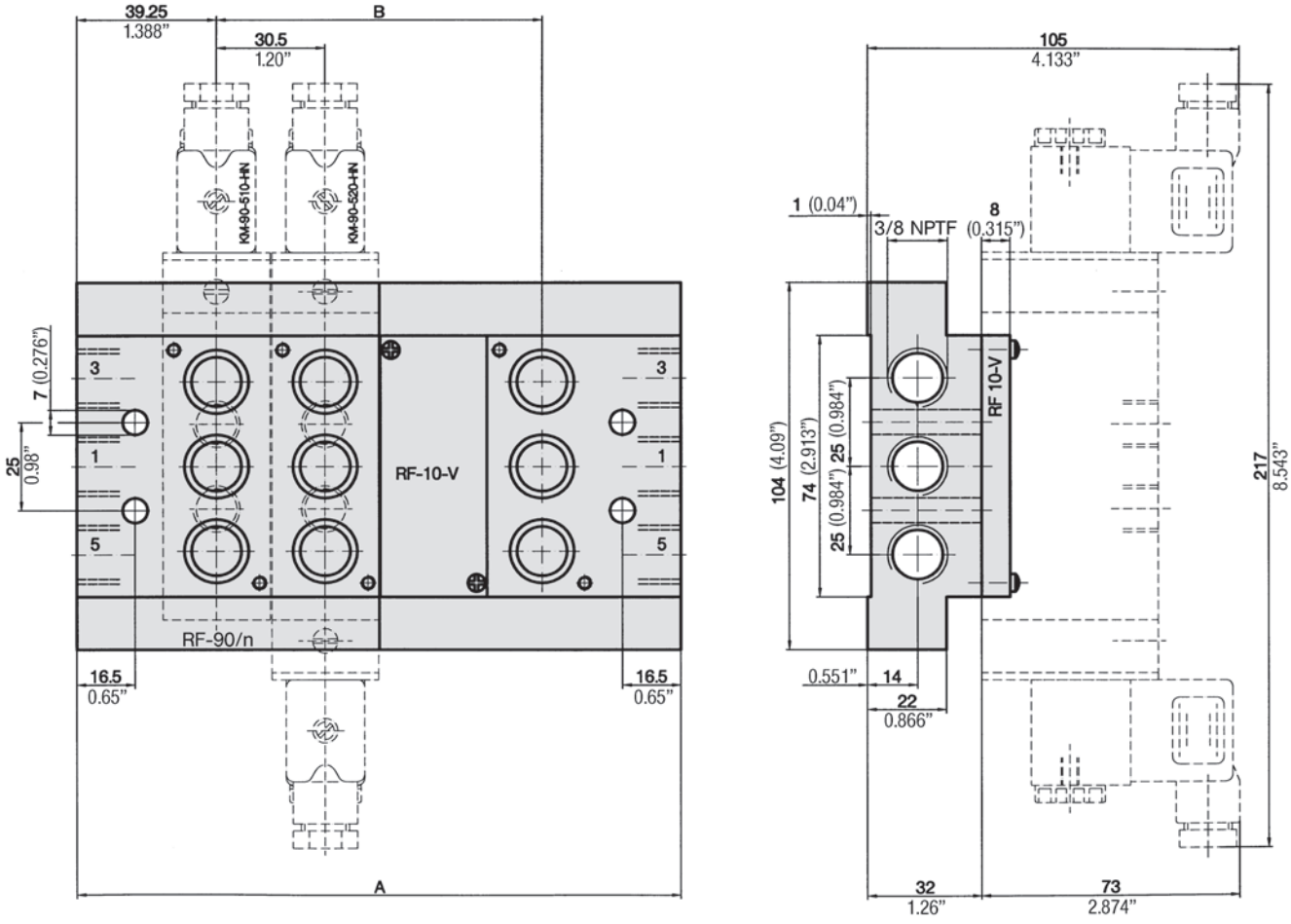
Material: Al (anodized), Studs and grub screws: Stainless steel, Screws: Steel (nickel-plated), O-rings: NBR.

Completely assembled manifolds for valve series KM-99 (1/8 NPTF) will be supplied with order number RF-99/n. The letter “n” indicates the number of stations. The single elements can be used for any configuration. For combined mounting of valve series KM-99 (1/8 NPTF) and series KM-90 (1/4 NPTF), the system has to be built up from single elements (see page 1.032).

Order number	A	B	Weight	Consist of single elements
RF-99/1	64.5 (2.539”)	– –	0.415 kg (0.915 lb.)	2 x RF-99-E, 1 x RF-09-Z1
RF-99/2	87 (3.425”)	22.5 (0.886”)	0.550 kg (5.159 lbs.)	2 x RF-99-E, 2 x RF-09-Z1
RF-99/3	109.5 (4.311”)	45 (1.772”)	0.680 kg (1.499 lbs.)	2 x RF-99-E, 3 x RF-09-Z1
RF-99/4	132 (5.197”)	67.5 (2.657”)	0.810 kg (1.786 lbs.)	2 x RF-99-E, 1 x RF-09-Z4
RF-99/5	154.5 (6.083”)	90 (3.543”)	0.990 kg (2.182 lbs.)	2 x RF-99-E, 1 x RF-09-Z4, 1 x RF-09-Z1
RF-99/6	177 (6.968”)	112.5 (4.429”)	1.060 kg (2.337 lbs.)	2 x RF-99-E, 1 x RF-09-Z4, 2 x RF-09-Z1
RF-99/7	199.5 (7.854”)	135 (5.315”)	1.190 kg (2.623 lbs.)	2 x RF-99-E, 1 x RF-09-Z4, 3 x RF-09-Z1
RF-99/8	222 (8.740”)	157.5 (6.200”)	1.320 kg (2.910 lbs.)	2 x RF-99-E, 2 x RF-09-Z4
RF-99/9	244.5 (9.626”)	180 (7.087”)	1.500 kg (3.307 lbs.)	2 x RF-99-E, 2 x RF-09-Z4, 1 x RF-09-Z1
RF-99/10	267 (10.512”)	202.5 (7.972”)	1.565 kg (3.450 lbs.)	2 x RF-99-E, 2 x RF-09-Z4, 2 x RF-09-Z1
RF-99/11	289.5 (11.38”)	225 (8.858”)	1.700 kg (3.748 lbs.)	2 x RF-99-E, 2 x RF-09-Z4, 3 x RF-09-Z1
RF-99/12	312 (12.28”)	247.5 (9.744”)	1.830 kg (4.034 lbs.)	2 x RF-99-E, 3 x RF-09-Z4
RF-99/13	334.5 (13.17”)	270 (10.63”)	2.010 kg (4.431 lbs.)	2 x RF-99-E, 3 x RF-09-Z4, 1 x RF-09-Z1
RF-99/14	357 (14.055”)	292.5 (11.516”)	2.075 kg (4.574 lbs.)	2 x RF-99-E, 3 x RF-09-Z4, 2 x RF-09-Z1
RF-99/15	379.5 (14.94”)	315 (12.402”)	2.210 kg (4.872 lbs.)	2 x RF-99-E, 3 x RF-09-Z4, 3 x RF-09-Z1
RF-99/16	402 (15.827”)	337.5 (13.287”)	2.340 kg (5.159 lbs.)	2 x RF-99-E, 4 x RF-09-Z4

Additional numbers of stations are available.

Dimensions for manifolds RF-90



1 = pressure inlet 3, 5 = exhaust

Material: Al (anodized), Studs and grub screws: Stainless steel, Screws: Steel (nickel-plated), O-rings: NBR.

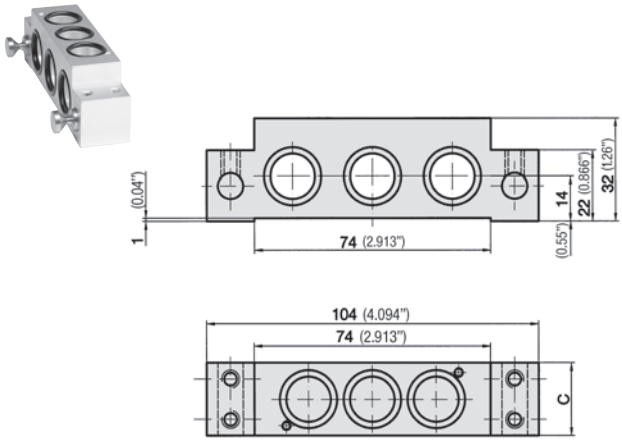
Completely assembled manifolds for valve series KM-90 (1/4 NPTF) will be supplied with order number RF-90/n. The letter “n” indicates the number of stations. The single elements can be used for any configuration. For combined mounting of valve series KM-99 (1/8 NPTF) and series KM-90 (1/4 NPTF), the system has to be built up from single elements (see page 1.032).

Order number	A	B	Weight	Consist of single elements
RF-90/1	78.5 (3.091”)	– –	0.470 kg (1.036 lbs.)	2 x RF-99-E, 1 x RF-10-Z1
RF-90/2	109 (4.291”)	30.5 (1.200”)	0.660 kg (7.055 lbs.)	2 x RF-99-E, 2 x RF-10-Z1
RF-90/3	139.5 (5.492”)	61 (2.402”)	0.850 kg (1.874 lbs.)	2 x RF-99-E, 3 x RF-10-Z1
RF-90/4	170 (6.693”)	91.5 (3.602”)	1.040 kg (2.293 lbs.)	2 x RF-99-E, 1 x RF-10-Z4
RF-90/5	200.5 (7.893”)	122 (4.803”)	1.250 kg (2.756 lbs.)	2 x RF-99-E, 1 x RF-10-Z4, 1 x RF-10-Z1
RF-90/6	231 (9.094”)	152.5 (6.004”)	1.380 kg (3.042 lbs.)	2 x RF-99-E, 1 x RF-10-Z4, 2 x RF-10-Z1
RF-90/7	261.5 (10.295”)	183 (7.205”)	1.570 kg (3.461 lbs.)	2 x RF-99-E, 1 x RF-10-Z4, 3 x RF-10-Z1
RF-90/8	292 (11.496”)	213.5 (8.406”)	1.760 kg (3.880 lbs.)	2 x RF-99-E, 2 x RF-10-Z4
RF-90/9	322.5 (12.697”)	244 (9.606”)	1.970 kg (4.343 lbs.)	2 x RF-99-E, 2 x RF-10-Z4, 1 x RF-10-Z1
RF-90/10	353 (13.897”)	274.5 (10.807”)	2.100 kg (4.630 lbs.)	2 x RF-99-E, 2 x RF-10-Z4, 2 x RF-10-Z1
RF-90/11	383.5 (15.098”)	305 (12.008”)	2.290 kg (5.048 lbs.)	2 x RF-99-E, 2 x RF-10-Z4, 3 x RF-10-Z1
RF-90/12	414 (16.30”)	335.5 (13.208”)	2.480 kg (5.467 lbs.)	2 x RF-99-E, 3 x RF-10-Z4
RF-90/13	444.5 (17.50”)	366 (14.409”)	2.690 kg (5.930 lbs.)	2 x RF-99-E, 3 x RF-10-Z4, 1 x RF-10-Z1
RF-90/14	475 (18.70”)	396.5 (15.610”)	2.820 kg (6.217 lbs.)	2 x RF-99-E, 3 x RF-10-Z4, 2 x RF-10-Z1
RF-90/15	505.5 (19.902”)	427 (16.811”)	3.010 kg (6.636 lbs.)	2 x RF-99-E, 3 x RF-10-Z4, 3 x RF-10-Z1
RF-90/16	536 (21.102”)	457.5 (18.012”)	3.200 kg (7.055 lbs.)	2 x RF-99-E, 4 x RF-10-Z4

Additional number of stations are available.

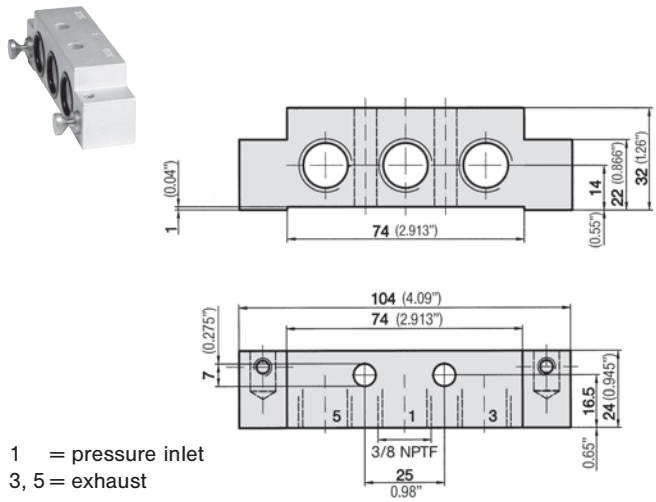
Dimensions for manifolds (single elements)

RF-09-Z1, RF-10-Z1



Material: Al (anodized),
Studs and
grub screws: Stainless steel,
Screws: Steel (nickel-plated),
O-rings: NBR.

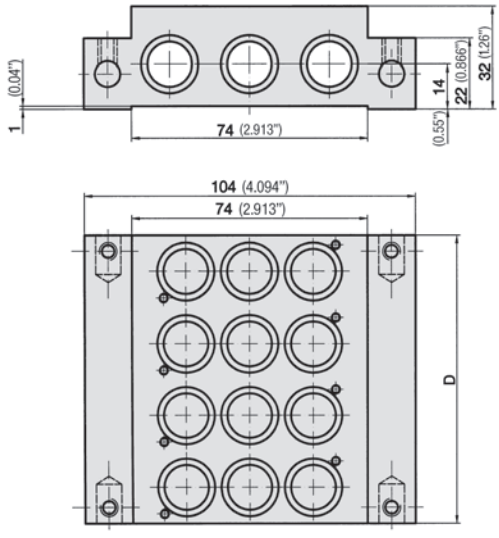
RF-99-E



1 = pressure inlet
3, 5 = exhaust

Material: Al (anodized),
Studs and
grub screws: Stainless steel,
Screws: Steel (nickel-plated),
O-rings: NBR.

RF-09-Z4, RF-10-Z4



Material: Al (anodized),
Studs and
grub screws: Stainless steel,
Screws: Steel (nickel-plated),
O-rings: NBR.

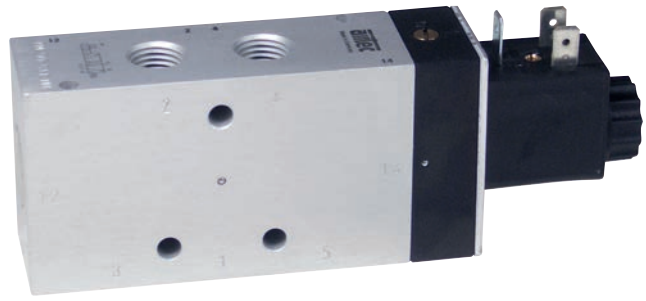
Studs, O-rings and grub screws are included when ordering plates.

Order number	C	D	Weight
RF-09-Z1	22.5 (0.886)	–	0.180 kg (0.397 lb.)
RF-09-Z4	–	90 (3.543)	0.510 kg (1.124 lbs.)
RF-10-Z1	30.5 (1.20)	–	0.210 kg (0.463 lb.)
RF-10-Z4	–	122 (4.803)	0.720 kg (1.587 lbs.)
RF-99-E	–	–	0.140 kg (0.308 lb.)

Electrically operated valves

Series KM-90, 5/2- and 5/3-way

1/4 NPTF • 1500 to 2100 Nl/min (1.524 to 2.134 Cv)



Order code

KM-90-511-HN-442

Series and function

Coil options[1)]

Standard coils

HN at ports 2 + 4		HN at ports 1, 3 + 5
441	12 V DC, 4.2 W	**411**
442	24 V DC, 4.2 W	**412**
452	24 V AC, 7/4 VA	**422**
456	115 V AC, 7/4 VA	**426**
457	230 V AC, 7/4 VA	**427**
461	12 V DC, 2.2 W[2)]	**431**
462	24 V DC, 2.2 W[2)]	**432**

Without coil and plug socket

HN at ports 2 + 4		HN at ports 1, 3 + 5
570	Power consumpt. 4.2 W, 7/4 VA	**500**
560	Power consumption 2.2 W[2)]	**530**

Coil with M12 connector and LED

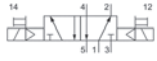
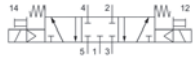
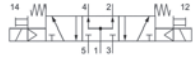
HN at ports 2 + 4		HN at ports 1, 3 + 5
O42	24 V DC, 4.8 W	**O12**
O62	24 V DC, 2.5 W[2)]	**O32**

[1)] HN = Manual override. It can be repositioned by 180°. Standard valve is supplied with HN on the same side as port 2.

Further plug sockets see page 1.036.

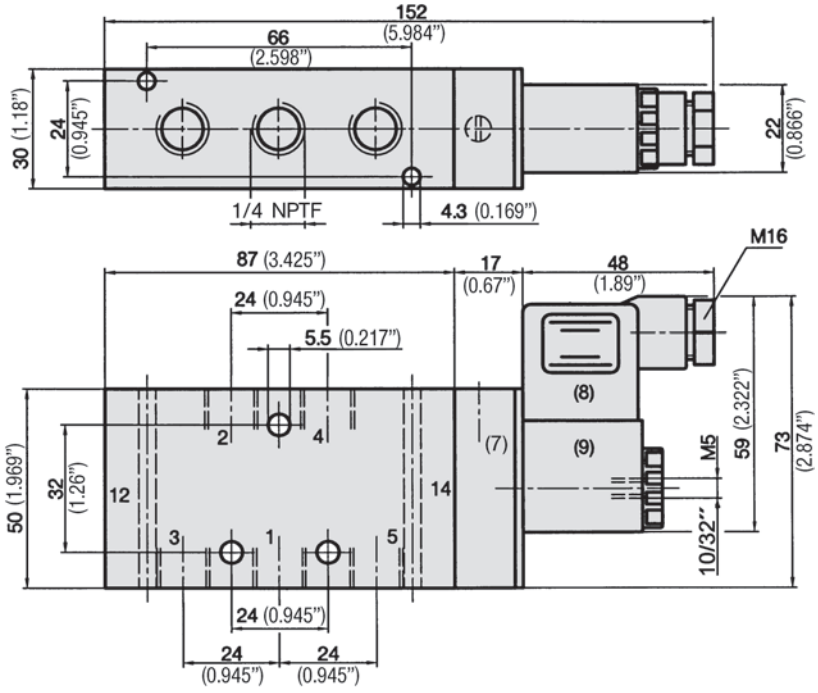
Design and function

Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**KM-90-511-HN**	**KM-90-520-HN**	**KM-90-530-HN**	**KM-90-533-HN**	**KM-90-534-HN**
					
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized
Connection	1/4 NPTF				
Nominal size	9 mm (0.354")				
Flow rate	1800 Nl/min (1.830 Cv)	2100 Nl/min (2.134 Cv)	1500 Nl/min (1.524 Cv)		
Pressure range	2.5 … 10 bar (8 bar at 2.2 W) 36 … 145 psi (116 psi at 2.2 W)		3 … 10 bar (8 bar at 2.2 W) 43 … 145 psi (116 psi at 2.2 W)		
Response time at 6 bar	on 16 ms off 27 ms	18 ms	on 16 ms off 22 ms		
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Materials	Body: Al (anodized), Seals: NBR, Inner parts: Al, stainless steel and brass				
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives				
Degree of protection	IP 65 according to EN 60529				
Weight	0.470 kg (1.034 lbs.)	0.630 kg (1.386 lbs.)			

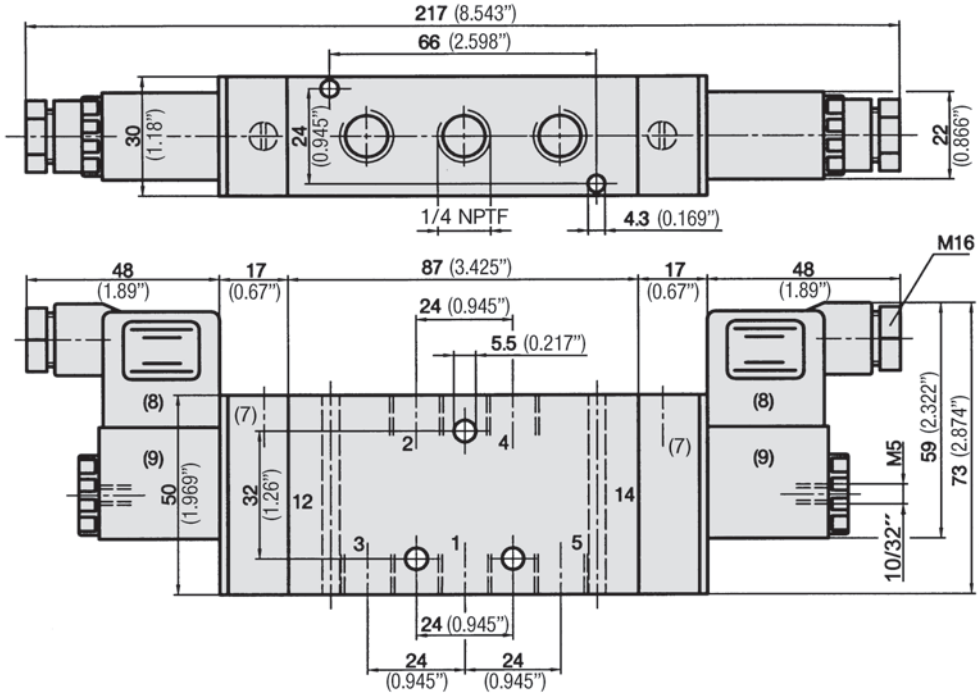
[2)] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

KM-90-511-HN



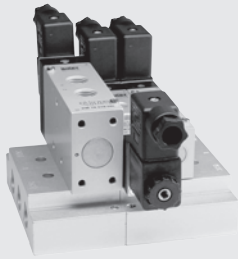
1 = pressure inlet
2, 4 = outlet
3, 5 = exhaust
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

KM-90-520-HN, KM-90-530-HN, KM-90-533-HN, KM-90-534-HN



1 = pressure inlet
2 = outlet
3 = exhaust
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

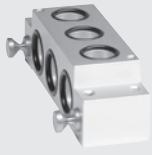
Manifolds



Manifold will be delivered completely assembled with valves if requested.

End plate 3/8 NPTF for valve size 1/8” and 1/4”.
RF-99-E
page 1.032

One station element for 1/8” valve.
RF-09-Z1
page 1.032



One station element for 1/4” valve.
RF-10-Z1
page 1.032

Four station element for 1/8” valve.
RF-09-Z4
page 1.032

Four station element for 1/4” valve.
RF-10-Z4
page 1.032

Blind plate for blank valve station 1/8”.
RF-09-V
page 1.030

Blind plate for blank valve station 1/4”.
RF-10-V
page 1.031

Seal plate (two different pressures).
RF-19-01

Pressure separator.

RE-19-DT

Further single elements: **RF-19-02** Assembly kit, 2 grub screws, O-rings, studs.
RF-19-03 3 x O-rings for valve assembly G 1/8 and G 1/4.

User information

Modular manifold system suitable for combined mounting of 1/8 NPTF and 1/4 NPTF valves. Any number of stations is possible if proper supply and exhaust of air is guaranteed. Adding or removing stations is possible at any time.

The necessary seals, mounting screws, grub screws and studs are included when ordering plates. The manifold system is delivered pre-assembled and function-tested. If not specified with the order, valve configuration is as follows: The valves are mounted according to their order number, starting with high numbers on the left, ending with low numbers on the right, followed by blind plates (if ordered).

Solenoid coils, actuators

Standard coil
23-SP-011-…
page 1.037

Coil with 2.2 W
power consumption
23-SP-012-…
page 1.037

Coil with M-12 plug
connection, 4.8 W, LED
and circuit protection
23-SP-011-5-O12
page 1.037

Coil with M-12 plug
connection, 2.5 W, LED
and circuit protection
23-SP-012-5-O32
page 1.037

Valves with explosion
proof actuator see
page 1.070.

Standard
actuator
23-R-013

Low power
actuator
23-R-014

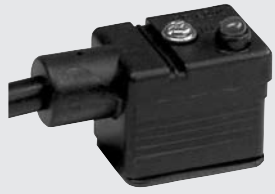
Actuator
for normally open
type
23-R-015

Plug sockets

Standard plug socket
28-ST-01
page 1.038

Plug socket with LED
28-ST-04-…
page 1.038

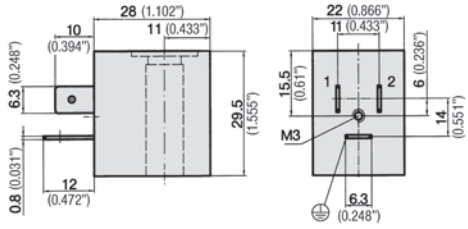
Plug socket with LED and
circuit protection
28-ST-06-…
page 1.038



Plug socket with LED,
circuit protection and cable
28-ST-06-K3-…
page 1.038

User information
Low power consumption coils (2.2 W or 2.5 W) are for pressures up to 8 bar (116 psi) only. Valve actuator 23-R-014 is required. The actuator 23-R-014 is nickel plated. Make sure that the coils with the right power consumption are used.
When using explosion proof coils the dimensions of the corresponding valve change.
For outdoor applications or in areas with high humidity use coil 23-SP-011-1-… or 23-SP-012-1-….

The following types are available on request
Coils and sockets with contacts according to DIN EN 175301-803 type B (U-form).
Plug sockets with molded cable.



Solenoid coils with connection pattern pursuant to DIN EN 175301-803 Shape B

Order number	23-SP-011-411	23-SP-011-412	23-SP-011-422	23-SP-011-426	23-SP-011-427	23-SP-012-431	23-SP-012-432
Standard voltage	12 V DC	24 V DC	24 V AC	115 V AC	230 V AC	12 V DC	24 V DC
Power consumption DC	4.2 W	4.2 W				2.2 W	2.2 W
Power consumption 50 Hz			4 VA	4 VA	4 VA		
Degree of protection	IP 65 according to EN 60529 with connected plug socket						
Duty cycle	100 %						
Temperature range	– 20 °C … + 50 °C						
Voltage tolerance	± 10 %						
Standard for series	MS-18, M-04, M-05, M-07, M-22, KM-09. KM-10, MF-05, MF-07, MN-06, KN-05, MI-01, MI-02, MI-03						

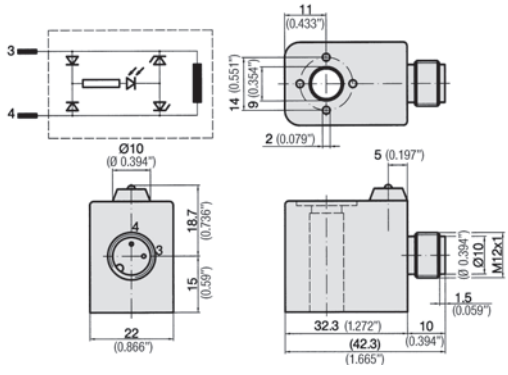
Other voltages on request.

Solenoid coils with connection pattern pursuant to DIN EN 175301-803 Shape B
(with enhanced humidity resistance)

Order number	23-SP-011-1-711	23-SP-011-1-712	23-SP-011-1-712	23-SP-011-1-722	23-SP-011-1-725	23-SP-011-1-727	23-SP-012-1-732
Standard voltage	12 V DC	24 V DC	48 V AC	24 V AC	110 V AC	230 V AC	24 V DC
Power consumption DC	4.6 W	4.8 W					2.5 W
Power consumption 50 Hz			7.7 VA	8.9 VA	8.5 VA	7.9 VA	
Degree of protection	IP 65 according to EN 60529 with connected plug socket *1						
Duty cycle	100 %						
Temperature range	– 20 °C … + 50 °C						
Voltage tolerance	± 10 %						
Standard for series	KMX-09, KMX-10, ICK-09, ICK-10, KN-55, KNX-55, ICKN-55						

*1: IP67 pursuant to EN 60529 with plug socket and sealing set 20-SP-011/012-02

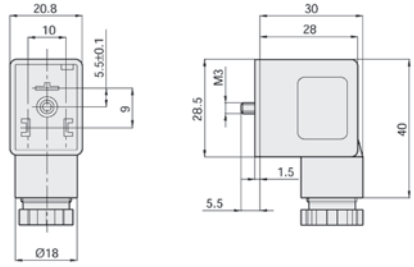
Solenoid coils with M12 connection, with LED and protective circuit.



Order number	23-SP-011-5-O12	23-SP-012-5-O32
Standard voltage	24 V DC	24 V DC
Power consumption	4.8 W	2.5 W
Degree of protection	IP 65 according to EN 60529 with connected cable	
Duty cycle	100 %	
Temperature range	– 20 °C … + 50 °C	
Voltage tolerance	± 10 %	

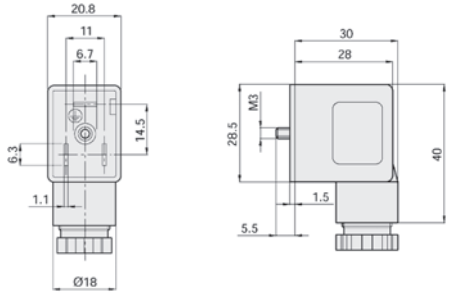
Plug socket for solenoid coil 23-SP-011, 23-SP-012, 23-SP-011-1, 23-SP-012-1

Plug sockets pursuant to DIN EN 175301-803 Shape B with cranked contacts (2pol. + PE, 21 x 28 mm, Contact distance 10 mm)



Order number	28-ST-01-G
Standard voltage	all
Protective circuit	no
Status indicator	without
Degree of protection	IP 65 pursuant to EN 60529 requires a flat gasket
Connecting cable	without
Ø Connecting cable	6 – 8 mm
Max. wire cross section	1,5 mm²
for coil	23-SP-011-G

Plug sockets pursuant to DIN EN 175301-803 Shape B
(2pol. + PE, 21 x 28 mm, Contact distance 11 mm)



Order number	28-ST-01	28-ST-04-112	28-ST-04-127	28-ST-06-112	28-ST-06-127	28-ST-06-K3-112	28-ST-06-K3-127
Standard voltage	all	24 V DC	230 V AC	24 V DC	230 V AC	24 V DC	230 V AC
Protective circuit	no	no	no	yes	yes	yes	yes
Status indicator	without	yes	yes	yes	yes	yes	yes
Degree of protection	IP 65 pursuant to EN 60529 requires a flat gasket						
Connecting cable	without					3 m	3m
Ø Connecting cable	6 – 8 mm					–	–
Max. wire cross section	1,5 mm²					–	–
for coil	23-SP-011, 23-SP-011-1						

Electrically operated valves

Series MS-98, 3/2-way

1/8 NPTF • 56 Nl/min (0.057 Cv)

MS-98-310-HN
MSO-98-310-HN

Order code

MS-98-310-HN-412

Series and function

Coil options

Standard coil [1]
411 = 12 V DC, 4,2 W
412 = 24 V DC, 4,2 W
422 = 24 V AC, 7/4 VA
426 = 115 V AC, 7/4 VA
427 = 230 V AC, 7/4 VA
431 = 12 V DC, 2,2 W [2]
432 = 24 V DC, 2,2 W [2]

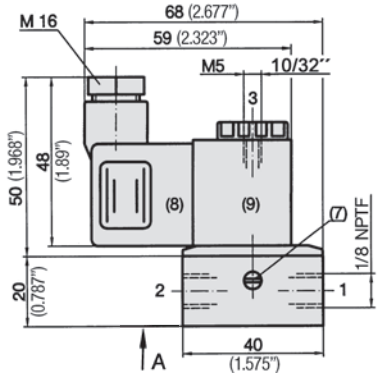
Without coil and plug socket
500 = Power consumption 4.2 W, 7/4 VA
530 = Power consumption 2.2 W [2]

Coils with M12 connector and LED
O12 = 24 V DC, 4.8 W
O32 = 24 V DC, 2.5 W [2]

[1] Plug socket(s) not included in scope of delivery. See below for more versions.

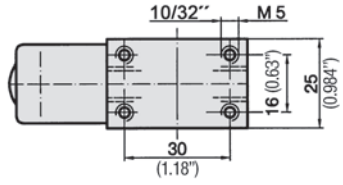
MS-98-310-HN, MSO-98-310-HN

1 = pressure inlet (exhaust)
2 = outlet
3 = exhaust (pressure inlet)
(7) = manual override (detent)
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°



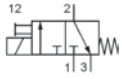
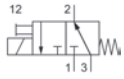
Note:
Plug socket(s) not included in scope of delivery.

view A



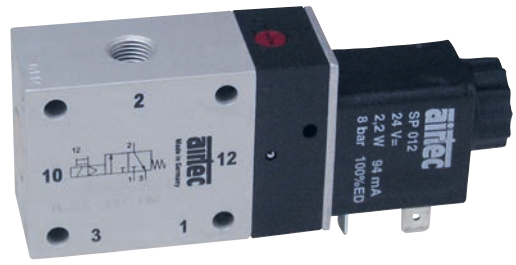
Design and function

Directly operated poppet valve with spring return. Actuated by a permanent electrical signal.
The valves can be changed to a 2/2-way function by closing the exhaust port 3.
For type MSO (Normally open) pressure supply at port 3 (M5 or 10/32 UNF at actuator 23-R-015).
The single valve MS-98-310 is available without a manual override. Please cancel the letters HN from the number when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**MS-98-310-HN**	**MSO-98-310-HN**
Function	 3/2-way, normally closed	 3/2-way, normally open
Connection	1/8 NPTF at 1 and 2, M5 (10/32 UNF) at 3	
Nominal size	1.4 mm (0.055")	
Flow rate	56 Nl/min (0.057 Cv)	
Pressure range	– 0.95 … 10 bar (8 bar at 2.2 W) / – 14 … 145 psi (116 psi at 2.2 W)	
Response time at 6 bar	on 10 ms off 12 ms	
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)	
Materials	Body: Al (anodized), plastic, Seals: NBR, Inner parts: stainless steel and brass	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.150 kg (0.33 lb.)	

[2] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

Electrically operated valves
Series M-95, 3/2-way
1/8 NPTF • 750 Nl/min (0.762 Cv)



Order code

M-95-311-HN-442

Series and function

Coil options[1]

Standard coils[3]

HN at port 2		HN at ports 1 + 3
441	12 V DC, 4.2 W	**411**
442	24 V DC, 4.2 W	**412**
452	24 V AC, 7/4 VA	**422**
456	115 V AC, 7/4 VA	**426**
457	230 V AC, 7/4 VA	**427**
461	12 V DC, 2.2 W[2]	**431**
462	24 V DC, 2.2 W[2]	**432**

Without coil and plug socket

HN at port 2		HN at ports 1 + 3
570	Power consumpt. 4.2 W, 7/4 VA	**500**
560	Power consumption 2.2 W[2]	**530**

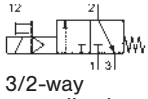
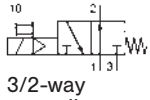
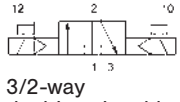
Coil with M12 connector and LED

HN at port 2		HN at ports 1 + 3
O42	24 V DC, 4.8 W	**O12**
O62	24 V DC, 2.5 W[2]	**O32**

[1] HN = Manual override. It can be repositioned by 180°. Standard valve is supplied with HN on the same side as port 2.

[3] When the valve is requested without the plug socket, the first digit of the order code for standard coils must be changed from 1 to 4. If optional plug sockets are required they may be ordered separately.

Design and function
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**M-95-311-HN**	**MO-95-311-HN**	**M-95-320-HN**
Function	 3/2-way normally closed spring return	 3/2-way normally open spring return	 3/2-way double solenoid
Connection	1/8 NPTF		
Nominal size	6 mm (0.236")		
Flow rate	750 Nl/min (0.762 Cv)		
Pressure range	3 … 10 bar[2] (43 … 145 psi)		2 … 10 bar[2] (29 … 145 psi)
Control pressure	Control pressure is identical to main pressure range		
Response time at 6 bar	on 13 ms off 16 ms		12 ms
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)		
Materials	Body: Al (anodized), Seals: NBR and POM, Inner parts: Al, stainless steel and brass		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives		
Degree of protection	IP 65 according to EN 60529		
Weight	0.260 kg (0.572 lb.)		0.400 kg (0.88 lb.)

[2] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

Electrically operated valves

Series M-95, 5/2- and 5/3-way
1/8 NPTF • 750 Nl/min (0.762 Cv)

Order code

M-95-511-HN-442

Series and function

Coil options[1]

Standard coils[3]
(with plug socket 28-ST-01)

HN at ports 2 + 4		HN at ports 1, 3 + 5
441	12 V DC, 4.2 W	**411**
442	24 V DC, 4.2 W	**412**
452	24 V AC, 7/4 VA	**422**
456	115 V AC, 7/4 VA	**426**
457	230 V AC, 7/4 VA	**427**
461	12 V DC, 2.2 W[2]	**431**
462	24 V DC, 2.2 W[2]	**432**

Without coil and plug socket

HN at ports 2 + 4		HN at ports 1, 3 + 5
570	Power consumpt. 4.2 W, 7/4 VA	**500**
560	Power consumption 2.2 W[2]	**530**

Coil with M12 connector and LED

HN at ports 2 + 4		HN at ports 1, 3 + 5
O42	24 V DC, 4.8 W	**O12**
O62	24 V DC, 2.5 W[2]	**O32**

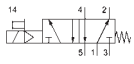
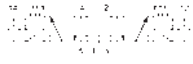
[1] HN = Manual override. It can be repositioned by 180°. Standard valve is supplied with HN on the same side as port 2.

[3] When the valve is requested without the plug socket, the first digit of the order code for standard coils must be changed from 1 to 4. If optional plug sockets are required they may be ordered separately.

Further plug sockets see page 1.036.

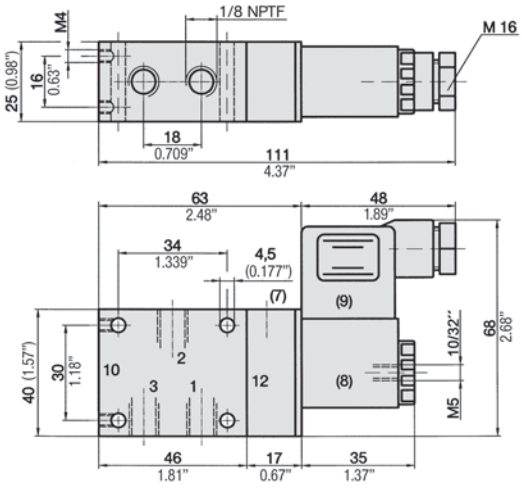
Design and function

Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**M-95-511-HN**	**M-95-520-HN**	**M-95-530-HN**	**M-95-533-HN**	**M-95-534-HN**
					
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized
Connection	1/8 NPTF				
Nominal size	6 mm (0.236")			5 mm (0.197")	
Flow rate	750 Nl/min (0.762 Cv)			650 Nl/min (0.661 Cv)	
Pressure range	3 … 10 bar[2] (43 … 145 psi)	2 … 10 bar[2] (29 … 145 psi)	3 … 10 bar[2] (43 … 145 psi)		
Control pressure	Control pressure is identical to main pressure range				
Response time at 6 bar	on 13 ms off 18 ms	12 ms	on 13 ms off 18 ms		
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Materials	Body: Al (anodized), Seals: NBR and POM, Inner parts: Al, stainless steel and brass				
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives				
Degree of protection	IP 65 according to EN 6052				
Weight	0.300 kg (0.660 lb.)	0.440 kg (0.968 lb.)			

[2] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

M-95-311-HN, MO-95-311-HN

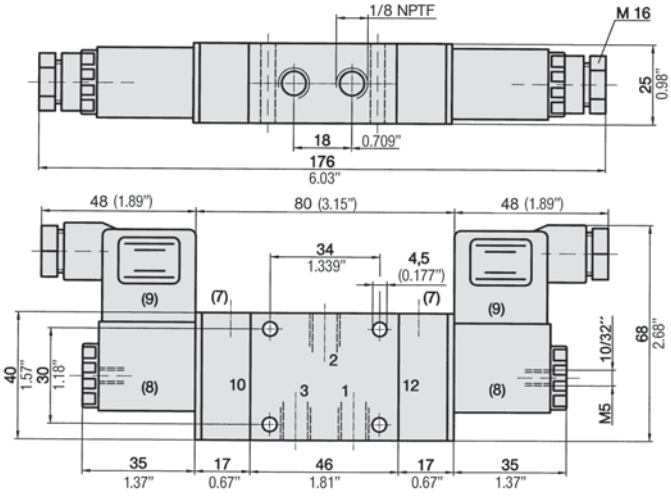


1 = pressure inlet
2 = outlets
3 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = solenoid coil can be repositioned by 4 x 90°
(9) = plug socket can be repositioned by 180°

Valve MO-95-311-HN carry the solenoid on the opposite side (at pilot 10).

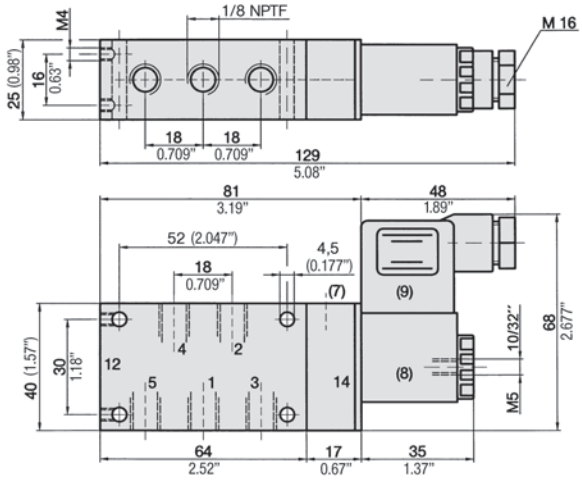
Note:
Plug socket(s) not included in scope of delivery.

M-95-320-HN



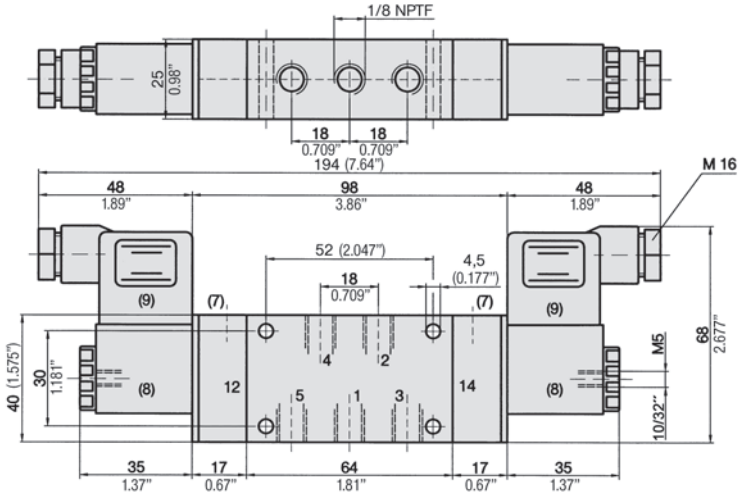
1 = pressure inlet
2 = outlets
3 = exhausts
(7) = manual override (detent) can be repositioned by 4 x 90°
(8) = solenoid coil can be repositioned by 4 x 90°
(9) = plug socket can be repositioned by 180°

M-95-511-HN



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = solenoid coil can be repositioned by 4 x 90°
(9) = plug socket can be repositioned by 180°

M-95-520-HN, M-95-530-HN, M-95-533-HN, M-95-534-HN



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = solenoid coil can be repositioned by 4 x 90°
(9) = plug socket can be repositioned by 180°

Electrically operated valves

Series M-97, 3/2-way

1/4 NPTF • 1580 Nl/min (1.606 Cv)

Order code

M-97-311-HN-442

Series and function

Coil options[1)]

Standard coils

HN at port 2		HN at port 1 + 3
441	12 V DC, 4.2 W	**411**
442	24 V DC, 4.2 W	**412**
452	24 V AC, 7/4 VA	**422**
456	115 V AC, 7/4 VA	**426**
457	230 V AC, 7/4 VA	**427**
461	12 V DC, 2.2 W[2)]	**431**
462	24 V DC, 2.2 W[2)]	**432**

Without coil and plug socket

HN at port 2		HN at port 1 + 3
570	Power consumpt. 4.2 W, 7/4 VA	**500**
560	Power consumption 2.2 W[2)]	**530**

Coil with M12 connector and LED

HN at port 2		HN at port 1 + 3
O42	24 V DC, 4.8 W	**O12**
O62	24 V DC, 2.5 W[2)]	**O32**

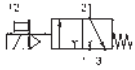
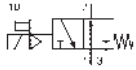
[1)] HN = Manual override. It can be repositioned by 180°. Standard valve is supplied with HN on the same side as port 2.

Further plug sockets see page 1.036.

Design and function

Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.

Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number Please complete according to order code.	**M-97-311-HN**	**MO-97-311-HN**	**M-97-320-HN**
			
Function	3/2-way normally closed, spring return	3/2-way normally open, spring return	3/2-way double solenoid
Connection	1/4 NPTF		
Nominal size	9 mm (0.354")		
Flow rate	1580 Nl/min (1.606 Cv)		
Pressure range	2.5 … 10 bar[2)] (36 … 145 psi)		1.5…10 bar[2)] (22…145 psi)
Control pressure	Control pressure is identical to main pressure range		
Response time at 6 bar	on 15 ms off 19 ms		14 ms
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)		
Materials	Body: Al (anodized), Seals: NBR and POM, Inner parts: Al, stainless steel and brass		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives		
Degree of protection	IP 65 according to EN 60529		
Weight	0.380 kg (0.838 lb.)		0.520 kg (1.146 lbs.)

[2)] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

Electrically operated valves

Series M-97, 5/2- and 5/3-way
1/4 NPTF • 1580 Nl/min (1.606 Cv)

Order code

M-97-511-HN-442

Series and function

Coil options[1)]

Standard coils

HN at ports 2 + 4		HN at ports 1, 3 + 5
441	12 V DC, 4.2 W	**411**
442	24 V DC, 4.2 W	**412**
452	24 V AC, 7/4 VA	**422**
456	115 V AC, 7/4 VA	**426**
457	230 V AC, 7/4 VA	**427**
461	12 V DC, 2.2 W[2)]	**431**
462	24 V DC, 2.2 W[2)]	**432**

Without coil and plug socket

HN at ports 2 + 4		HN at ports 1, 3 + 5
570	Power consumpt. 4.2 W, 7/4 VA	**500**
560	Power consumption 2.2 W[2)]	**530**

Coil with M12 connector and LED

HN at ports 2 + 4		HN at ports 1, 3 + 5
O42	24 V DC, 4.8 W	**O12**
O62	24 V DC, 2.5 W[2)]	**O32**

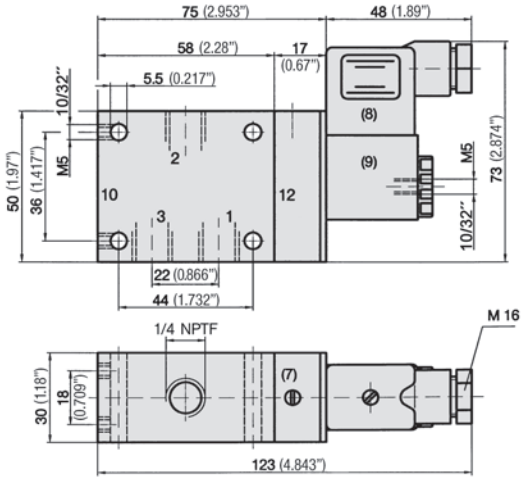
[1)] HN = Manual override. It can be repositioned by 180°. Standard valve is supplied with HN on the same side as port 2.
Further plug sockets see page 1.036.

Design and function
Spool valve actuated by an electrical signal. Please specify required control voltage when ordering.
Valves of this series are available in explosion proof design in accordance with 94/9/EG (ATEX). For further details see page 1.070.

Order number	**M-97-511-HN**	**M-97-520-HN**	**M-97-530-HN**	**M-97-533-HN**	**M-97-534-HN**
Please complete according to order code.					
Function	5/2-way single solenoid spring return	5/2-way double solenoid	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized
Connection	1/4 NPTF				
Nominal size	9 mm (0.354")				
Flow rate	1580 Nl/min (1.606 Cv)		1300 Nl/min (1.321 Cv)		
Pressure range	2.5…10 bar[2)] (36 … 145 psi)	2 … 10 bar[2)] (29 … 145 psi)	3 … 10 bar[2)] (43 … 145 psi)		
Control pressure	Control pressure is identical to main pressure range				
Response time at 6 bar	on 15 ms off 22 ms	14 ms	on 15 ms off 22 ms		
Temperature range	– 10 °C … + 70 °C (+ 14 °F … + 158 °F)				
Materials	Body: Al (anodized), Seals: NBR and POM, Inner parts: Al, stainless steel and brass				
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives				
Degree of protection	IP 65 according to EN 60529				
Weight	0.465 kg (1.025 lbs.)	0.620 kg (1.367 lbs.)			

[2)] max. 8 bar (max. 116 psi) at 2.2 W and 2.5 W.

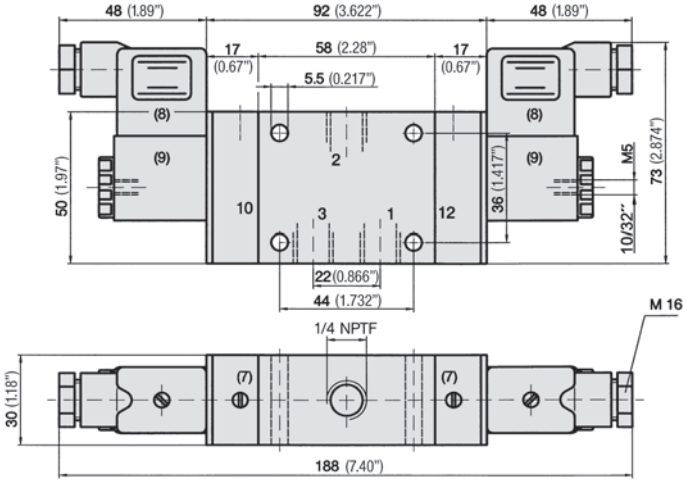
M-97-311-HN, MO-97-311-HN



1 = pressure inlet
2 = outlets
3 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

Valve MO-97-311-HN carry the solenoid on the opposite side (at pilot 10).

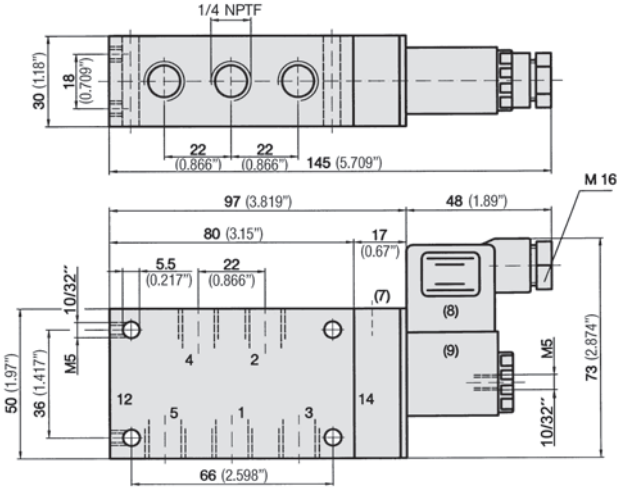
M-97-320-HN



1 = pressure inlet
2 = outlets
3 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

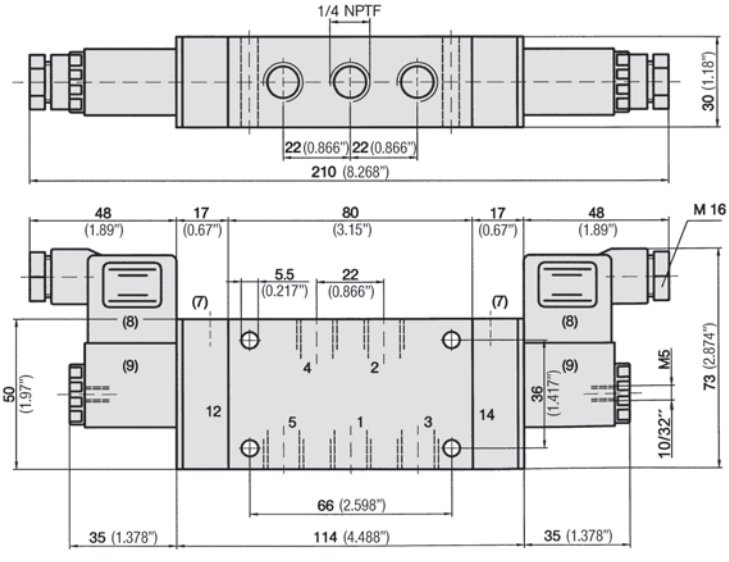
Note: Plug socket(s) not included in scope of delivery.

M-97-511-HN



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

M-97-520-HN, M-97-530-HN, M-97-533-HN, M-97-534-HN



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts
(7) = manual override (detent) can be repositioned by 180°
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

Electrically operated valves

Series 86-MN-4-18 for sub-base, 5/2-way
1/8 NPTF • 750 Nl/min (0.762 Cv)

Order code

86-MN-4-18-510-M42

Series and function

Coil options

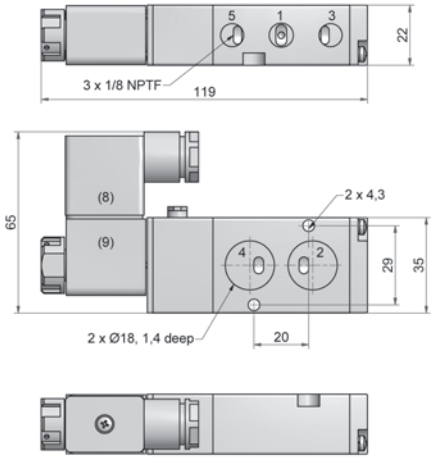
HN by 2 and 4
standard version
M42 = 24 V DC, 4,8 W, with plug socket and LED

other versions
457 = 230 V AC, //4 VA, without plug socket *2
M57 = 230 V AC, 5,5 VA, with plug socket and LED*1

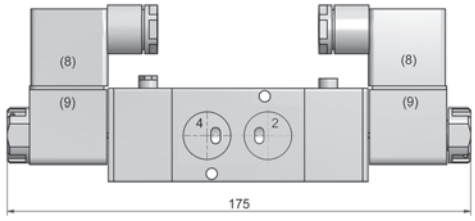
Design, function and technical data

Electrically operated spool valve with manual override (push and lock).

86-MN-4-18-510

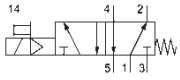
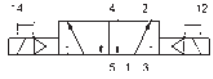


86-MN-4-18-520



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts

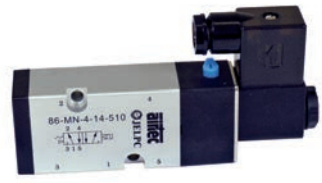
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

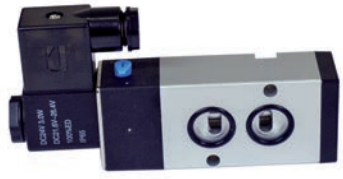
Order number	86-MN-4-18-510	86-MN-4-18-520
Function	 5/2-way single solenoid mechanical and air spring	 5/2-way double solenoid
Connection	1/8 NPTF	
Nominal size	4 mm	
Flow rate	750 Nl/min (0.762 Cv)	
Pressure range	1,5 … 8 bar (21.75 … 116 psi)	
Response time at 6 bar	20 ms	
Temperature range	+ 5 °C … + 50 °C (+ 41 °F … + 122 °F)	
Materials	Body: Al (anodized), steel, galvanized, plastic; Seals: NBR; Inner parts: Al, steel and plastic	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.220 kg (0.485 lb.)	0.334 kg (0.736 lb.)

*1 The versions only on request.
*2 Plug sockets please see page 1.036.

Electrically operated valves
Series 86-MN-4-14 for sub-base, 5/2-way
1/4 NPTF • 1300 Nl/min (1.321 Cv)

Suitable for NAMUR Base-plates





Order code

86-MN-4-14-510-M42

Series and function

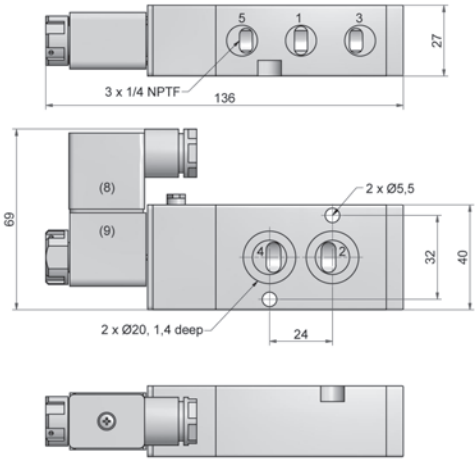
Coil options

HN by 2 and 4
standard version
M42 = 24 V DC, 4,8 W, with plug socket and LED

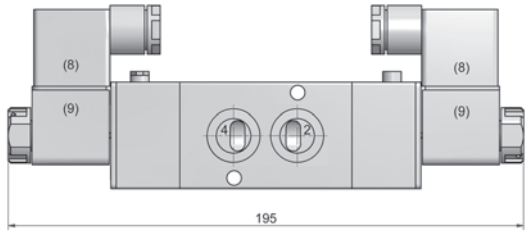
other versions
457 = 230 V AC, //4 VA, without plug socket *2
M57 = 230 V AC, 5,5 VA, with plug socket and LED*1

Design, function and technical data
Electrically operated spool valve with manual override (push and lock).

86-MN-4-14-510

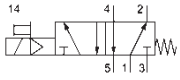
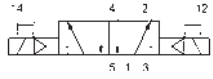


86-MN-4-14-520



1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts

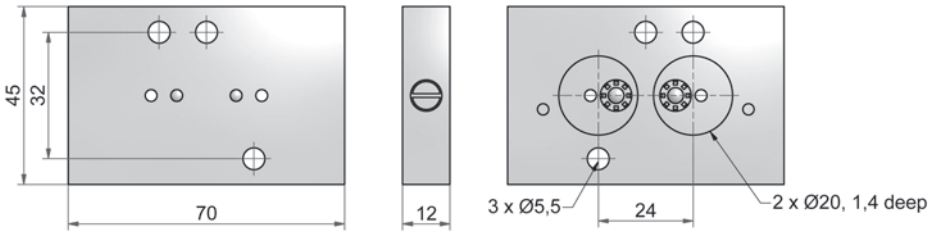
(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

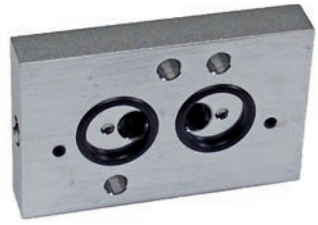
Order number	86-MN-4-14-510	86-MN-4-14-520
Function	 5/2-way single solenoid mechanical and air spring	 5/2-way double solenoid
Connection	1/4 NPTF	
Nominal size	6 mm	
Flow rate	1300 Nl/min (1.321 Cv)	
Pressure range	1,5 … 8 bar (21.75 … 116 psi)	
Response time at 6 bar	20 ms	
Temperature range	+ 5 °C … + 50 °C (+ 41 °F … + 122 °F)	
Materials	Body: Al (anodized), steel, galvanized, plastic; Seals: NBR; Inner parts: Al, steel and plastic	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.306 kg (0.675 lb.)	0.430 kg (0.948 lb.)

*1 The versions only on request.
*2 Plug sockets please see page 1.036.

Suitable for NAMUR Base-plates

Speed regulation plate (adjustable by tool)



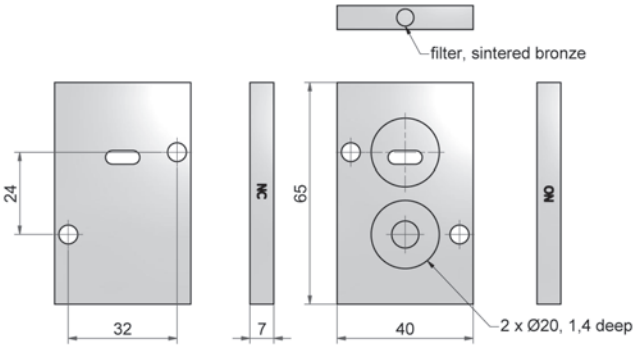


Design, function and technical data

Speed regulation plate for double acting actuators. The speed regulation plate can also be used for single acting actuators by using the converting plate 86-4-AP-NAMUR.
Adjustable by tool.

Order number	**86-4-DR-NAMUR**
Function	Speed regulation plate for double acting actuators
Nominal size	4 mm
Pressure range	1,5 … 8 bar (21.75 … 116 psi)
Temperature range	+ 5 °C … + 50 °C (+ 41 °F … + 122 °F)
Materials	Body: Al (anodized), steel, galvanized, plastic; Seals: NBR; Inner parts: Al, steel and plastic
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives
Weight	0.103 kg (0.227 lb.)

Converting plate to use a 5/2-way NAMUR valve as a 3/2-way valve



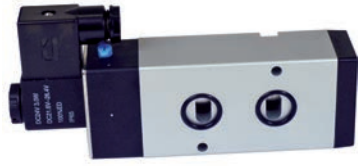
Design, function and technical data

Converting plate suitable obtain a 3/2-way function at a 5/2-way NAMUR valve.
Additional feature: Turning the plate by 180° you can suitel a NC to a NO function or nice versa.

Order number	**86-4-AP-NAMUR**
Function	Converting plate for 5/2-way NAMUR valves
Nominal size	4 mm
Pressure range	0 … 8 bar (0 … 116 psi)
Temperature range	+ 5 °C … + 50 °C (+ 41 °F … + 122 °F)
Materials	Body: Al (anodized), steel, galvanized, plastic; Seals: NBR; Inner parts: Al, steel and plastic
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives
Weight	0.043 kg (0.095 lb.)

Electrically operated valves

Series 86-MN-4-12 for sub-base, 5/2-way
1/2 NPTF • 2500 Nl/min (2.541 Cv)



Order code

86-MN-4-12-510-M42

Series and function

Coil options

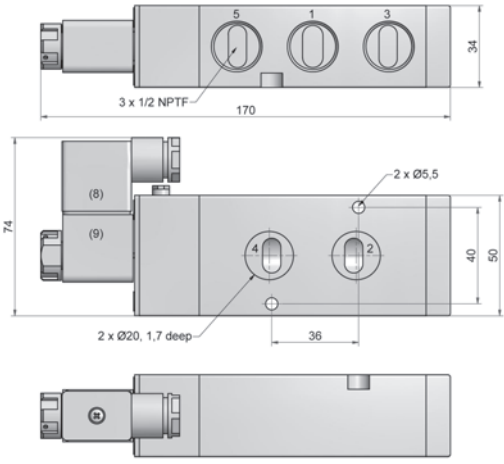
HN by 2 and 4
standard version
M42 = 24 V DC, 4,8 W, with plug socket and LED

other versions
457 = 230 V AC, //4 VA, without plug socket *2
M57 = 230 V AC, 5,5 VA, with plug socket and LED*1

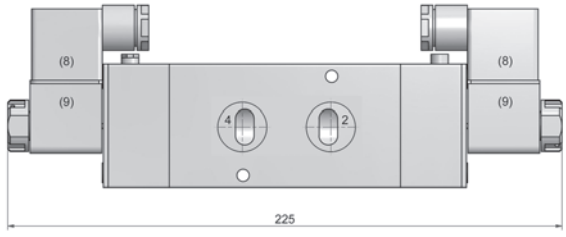
Design, function and technical data

Electrically operated spool valve with manual override (push and lock).

86-MN-4-12-510

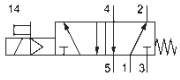
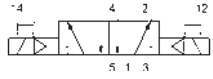


86-MN-4-12-520

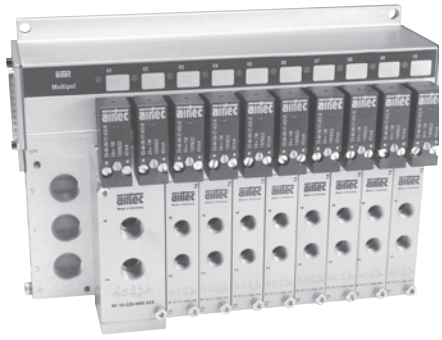


1 = pressure inlet
2, 4 = outlets
3, 5 = exhausts

(8) = plug socket can be repositioned by 180°
(9) = solenoid coil can be repositioned by 4 x 90°

Order number	86-MN-4-12-510	86-MN-4-12-520
Function	 5/2-way single solenoid mechanical and air spring	 5/2-way double solenoid
Connection	1/2 NPTF	
Nominal size	8 mm	
Flow rate	2500 Nl/min (2.541 Cv)	
Pressure range	1,5 … 8 bar (21.75 … 116 psi)	
Response time at 6 bar	20 ms	
Temperature range	+ 5 °C … + 50 °C (+ 41 °F … + 122 °F)	
Materials	Body: Al (anodized), steel, galvanized, plastic; Seals: NBR; Inner parts: Al, steel and plastic	
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives	
Degree of protection	IP 65 according to EN 60529	
Weight	0.537 kg (1.184 lbs.)	0.658 kg (1.451 lbs.)

*1 The versions only on request.
*2 Plug sockets please see page 1.036.

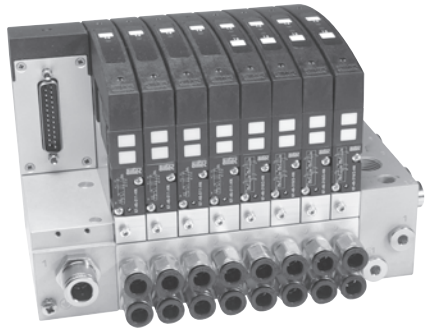


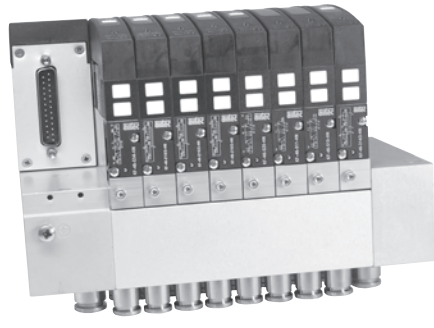
Series RE-19

Multi-pin, AS-Interface,
or fieldbus connection,
4 – 24 valve stations,
950 and 2100 Nl/min
(0.965 and 2.134 Cv)

Series RE-46

Multi-pin, AS-Interface,
or fieldbus connection,
4 – 24 valve stations,
950 Nl/min (0.965 Cv)

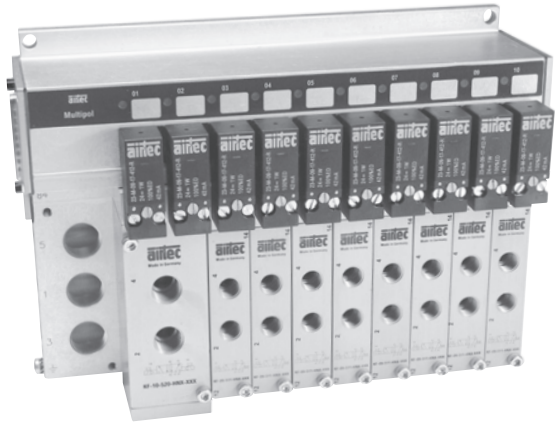




Valve terminal RE-99

with Multi-pin, AS-Interface or Profibus

4 – 24 valve stations, 1/8 NPTF and 1/4 NPTF, 810 – 2100 Nl/min (0.823 – 2.134 Cv)



Order code

RE-19 / 08 – M

Series

Number of stations

Electrical options

M-1 = Multi-pin
B1-1 = Profibus DP
AS3 = AS-Interface with addressable socket

Design and function

Manifold system with integrated electrical connection including LED indicators, manual override and built-in circuit protection.
Valves with connection G1/4 (2100 Nl/min / 2.134 Cv) require 2 stations on the manifold.
The above order code covers only the manifold. The multi-pin plug with cable must be ordered separately.
The valve terminal is delivered pre-assembled and function-tested. If not specified with the order, valve configuration is as follows: Valves are mounted according to their order number, starting with high numbers at the side of the multi-pin, ending with low numbers on the opposite side, followed by blind plates (if ordered).

Technical data		Multi-pin	AS-Interface	Profibus-DP
Number of stations		4, 6, 8, 10 … 22	4, 8, 12 und 16	6, 8, 10 … 24
Working pressure range		3 … 8 bar (44 … 116 psi)		
Temperature range		– 10 °C … + 50 °C (+ 14 °F … + 122 °F)		0 °C … +50 °C (+32 °F … +122 °F)
Degree of protection		IP 65 pursuant to EN 60529 with connection cable 28-ST-68-M-… for multi-pin. IP65 for AS Interface requires a correctly installed cable. For Profibus, correctly installed M12 sockets/plugs are required.		
Voltage		24 V DC ± 10 %	Bus 18,5 … 31,6 V DC Power 24 V DC ± 10 %	24 V DC ± 10 %
Power consumption each solenoid		1 Watt		
Output signal		Polarized circuit protection, built-in surge protection		
Status display	LED yellow	Valve solenoid energized		
	LED green	–	Power Voltage	Power Voltage
	LED green	–	Bus active	PWR Bus active
	LED green	–	–	–
	LED red	–	Bus error	ERR Bus error
Connector		25-pin D-Sub	Bus AS-Interface connector	Bus 9-pin D-SUB (bushing)
			Power AS-Interface connector	Power plug 4-pin M 12

Technical data	Profibus-DP
Address selection	Selection by 2 decimal coded rotary switches
Bus termination resistance	Switchable ON - OFF
Baud rate	Selectable between 9600 bit/s and 12 Mbit/s

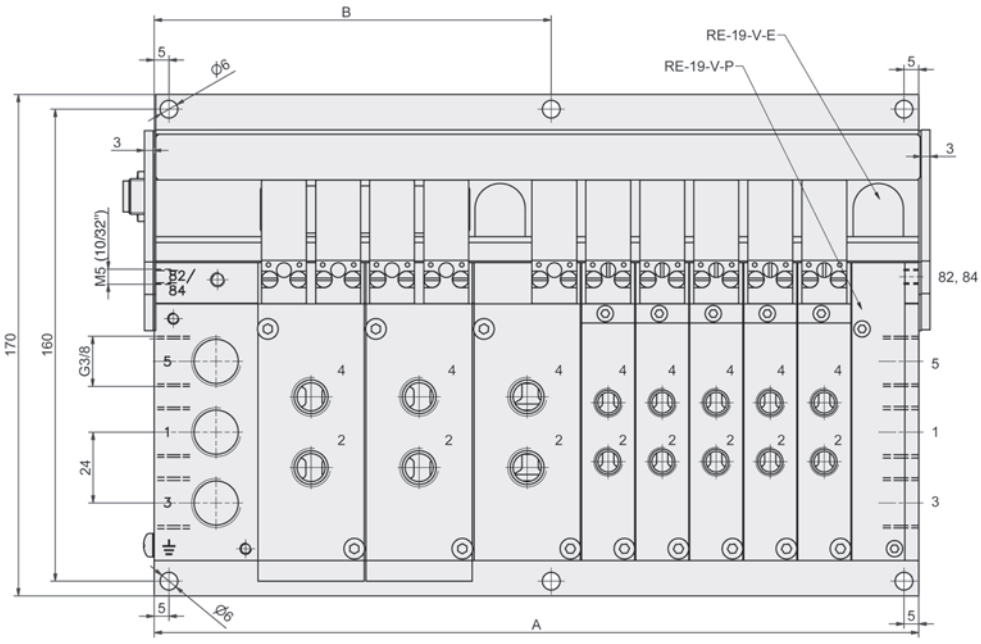
Addressing for AS Interface: 1 addressable socket per slave IC (max. 4 valves) = 1 address

Valve terminal RE-99

with Multi-pin, AS-Interface or Profibus

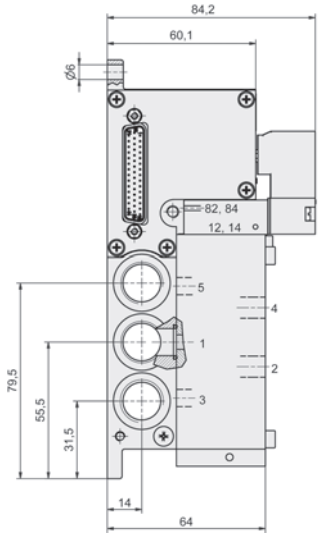
4 – 24 valve stations, 1/8 NPTF and 1/4 NPTF, 810 – 2100 Nl/min (0.823 – 2.134 Cv)

Multi-pin, Profibus-DP

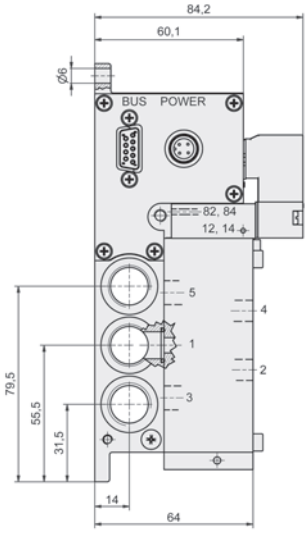


1 = pressure supply
2, 4 = outlets
3, 5 = exhausts
82, 84 = solenoid exhaust

Side view Multi-pin



Side view Profibus-DP



Order number	A		B		Weight (without valves)	
RE-99/4	113	(4.449")	–		0.93 kg	(2.05 lbs.)
RE-99/6	149	(5.866")	–		1.26 kg	(2.78 lbs.)
RE-99/8	186	(7.323")	–		1.59 kg	(3.51 lbs.)
RE-99/10	222	(8.740")	–		1.92 kg	(4.23 lbs.)
RE-99/12	259	(10.197")	129.5	(5.098")	2.25 kg	(4.96 lbs.)
RE-99/14	295	(11.614")	147.5	(5.807")	2.58 kg	(5.69 lbs.)
RE-99/16	332	(13.071")	166	(6.535")	2.91 kg	(6.42 lbs.)
RE-99/18	369	(14.528")	184.5	(7.263")	3.24 kg	(7.14 lbs.)
RE-99/20	405	(15.945")	202.5	(7.972")	3.57 kg	(7.87 lbs.)
RE-99/22	442	(17.402")	221	(8.701")	3.90 kg	(8.60 lbs.)
RE-99/24	478	(18.819")	239	(9.409")	4.23 kg	(9.33 lbs.)

Valve terminal RE-99

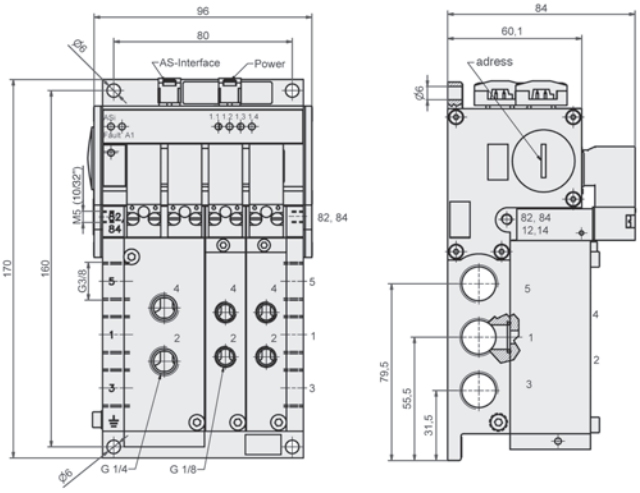
with Multi-pin, AS-Interface or Profibus

4 – 24 valve stations, 1/8 NPTF and 1/4 NPTF, 810 – 2100 Nl/min (0.823 – 2.134 Cv)

RE-99/04-AS3

1 = pressure supply
2, 4 = outlets
3, 5 = exhausts
82, 84 = solenoid exhaust

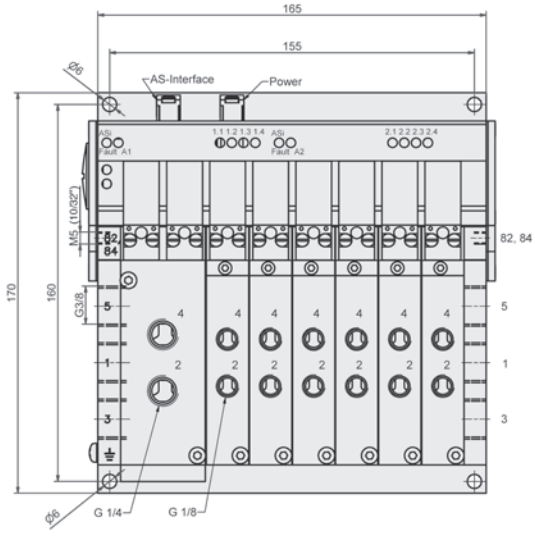
Weight 0.820 kg (1.81 lbs.)



RE-99/08-AS3

1 = pressure supply
2, 4 = outlets
3, 5 = exhausts
82, 84 = solenoid exhaust

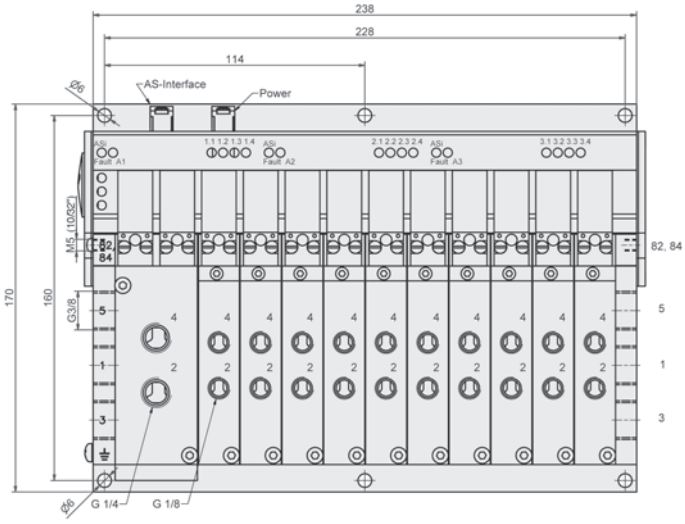
Weight 1.480 kg (3.26 lbs.)



RE-99/12-AS3

1 = pressure supply
2, 4 = outlets
3, 5 = exhausts
82, 84 = solenoid exhaust

Weight 2.140 kg (4.72 lbs.)



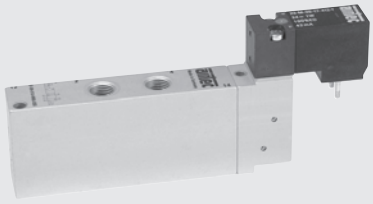
Valve terminal RE-99

with Multi-pin, AS-Interface or Profibus

4 – 24 valve stations, 1/8 NPTF and 1/4 NPTF, 810 – 2100 Nl/min (0.823 – 2.134 Cv)

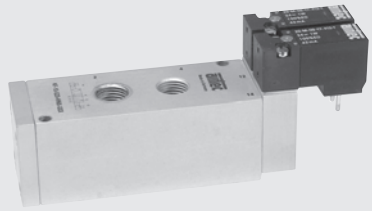
Valves and accessories for series RE-99

Valves

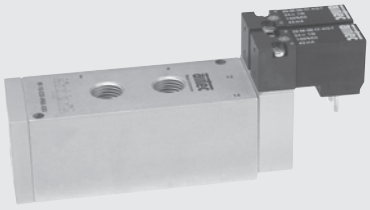


5/2-way
single solenoid 1/8 NPTF
KF-99-510-HNT-442, KF-99-510-HNR-442
KF-99-511-HNT-442, KF-99-511-HNR-442

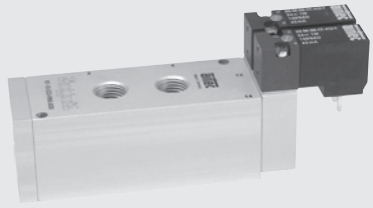
5/2-way
single solenoid 1/4 NPTF
KF-90-510-HNT-442, KF-90-510-HNR-442
KF-90-511-HNT-442, KF-90-511-HNR-442



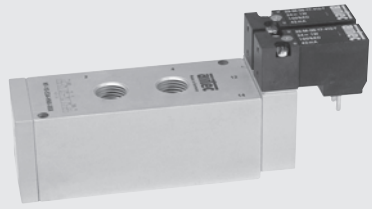
5/2-way
double solenoid 1/4 NPTF
KF-90-520-HNT-442
KF-90-520-HNR-442



5/3-way
center position closed 1/4 NPTF
KF-90-530-HNT-442
KF-90-530-HNR-442



5/3-way
center position exhausted 1/4 NPTF
KF-90-533-HNT-442
KF-90-533-HNR-442



5/3-way
center position pressurized 1/4 NPTF
KF-90-534-HNT-442
KF-90-534-HNR-442

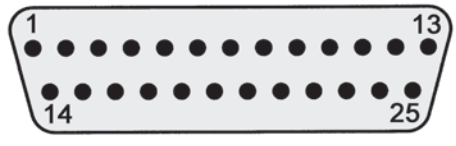
Single elements

RE-19-DT	Dividing plate for 2 different pressures
RE-19-V	Blind plate for valve position
RE-19-V-E	Blind plate for solenoid position
RE-19-V-EP	Blind plate for valve and solenoid position
28-ST-68-M-105	25-pin multi-plug with 5 m cable
28-ST-68-M-110	25-pin multi-plug with 10 m cable
54-RE-19-A	Operating manual RE-19, AS-Interface
54-RE-19-B1	Operating manual RE-19, Profibus-DP
54-RE-19-M	Operating manual RE-19, Multi-pin, German
54-RE-19-M-GB	Operating manual RE-19, Multi-pin, English
54-RE-19-M-F	Operating manual RE-19, Multi-pin, French

RE-99-E-50
Adapter with NPT thread.
(Not for use with AS-Interface.)

Pin assignment for connector cable 28-ST-68-M-...

Pin	Valve	Wire colour	Pin	Valve	Wire colour	Pin	Valve	Wire colour
1	1	white	**12**	12	red/blue	**23**	GND	white/red
2	2	brown	**13**	13	white/green	**24**	GND	brown/red
3	3	green	**14**	14	brown/green	**25**	GND	white/black
4	4	yellow	**15**	15	white/yellow			
5	5	grey	**16**	16	yellow/brown			
6	6	pink	**17**	17	white/grey			
7	7	blue	**18**	18	grey/brown			
8	8	red	**19**	19	white/pink			
9	9	black	**20**	20	pink/brown			
10	10	violet	**21**	21	white/blue			
11	11	grey/pink	**22**	22	brown/blue			

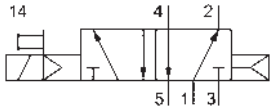


View on valve terminal

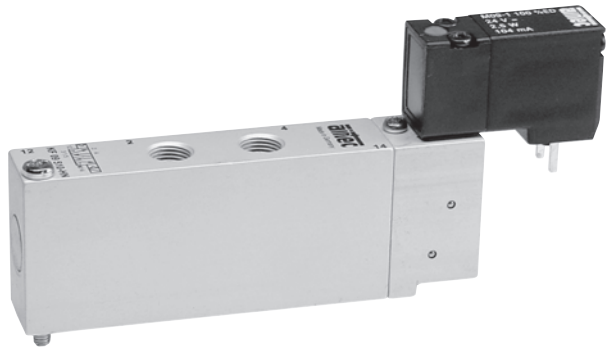
Wiring colour acc. to DIN 47100 (coloured or signed by numbers).

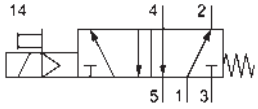
Valves KF-99 and KF-90 for valve terminal RE-99

810 – 2100 Nl/min (0.823 – 2.134 Cv)

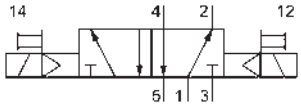


KF-99-510-HNT-442
KF-90-510-HNT-442

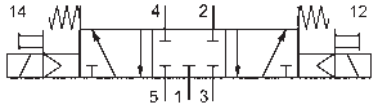




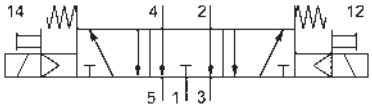
KF-99-511-HNT-442, KF-99-511-HNR-442
KF-90-511-HNT-442, KF-90-511-HNR-442



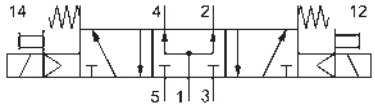
KF-90-520-HNT-442, KF-90-520-HNR-442



KF-90-530-HNT-442, KF-90-530-HNR-442



KF-90-533-HNT-442, KF-90-533-HNR-442



KF-90-534-HNT-442, KF-90-534-HNR-442

Design and function
Spool valve actuated by an electrical signal.
Valves are available either with monostable manual override (order code HNT) or bistable manual override (order code HNR).
Mounting screws are included.

Order number[1]	**KF-99-510-…**	**KF-99-511-…**	**KF-90-510-…**	**KF-90-511-…**	**KF-90-520-…**	**KF-90-530-…**	**KF-90-533-…**	**KF-90-534-…**
Function	5/2-way single solenoid air spring	5/2-way single solenoid mech. spring	5/2-way single solenoid air spring	5/2-way single solenoid mech. spring	5/2-way double solenoid	5/3-way center position closed	5/3-way center position exhausted	5/3-way center position pressurized
Connection	1/8 NPTF at 2 and 4 [2]		1/4 NPTF at 2 and 4 [2]					
Nominal size	6 mm		9 mm					
Nominal flow	950 Nl/min (0.965 Cv)	810 Nl/min (0.823 Cv)	2100 Nl/min (2.134 Cv)	1800 Nl/min (1.829 Cv)	2100 Nl/min (2.134 Cv)	1500 Nl/min (1.524 Cv)		
Working pressure range	3 … 8 bar (44 … 116 psi)		2.5 … 8 bar (36 … 116 psi)			3 … 8 bar (44 … 116 psi)		
Response time at 6 bar	on 11 ms off 20 ms	on 10 ms off 26 ms	on 13 ms off 26 ms	on 18 ms off 29 ms	16 ms	on 16 ms off 26 ms		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives							
Temperatur range	– 10 °C … + 50 °C (+ 14 °F … + 122 °F)							
Materials	Body: Al (anodized), Seals: NBR; Inner parts: Al, stainless steel, brass							
Operating voltage	24 V DC ± 10 %							
Duty cycle	100 %							
Power consumption	1 W							
Degree of protection	IP 65 according to EN 60529, when assembled on RE-19							
Weight	0.20 kg (0.44 lb.)		0.37 kg (0.82 lb.)		0.43 kg (0.95 lb.)			

[1] Please complete according to order code (see circuit symbols)

[2] Flange at ports 1, 3, 5

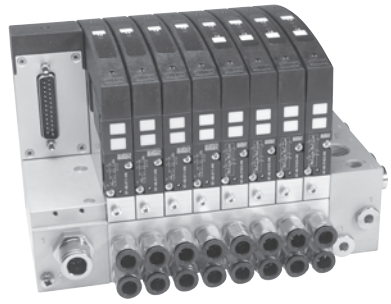
Valve terminal RE-46

with Multi-pin, AS-Interface or Fieldbus,
4 – 24 valve stations, 430 to 950 Nl/min (0.437 to 0.965 Cv)

Type of connection

= AS… = B6 = B8

= B1 = B7



Order code

RE-46/08-M-1-080

Series

Number of stations

Electrical options

M-1	= Multi-pin
AS3	= AS-Interface
AS3-R…	= AS-Interface[1]
B1-1	= Profibus-DP
B6-1	= CANopen
B7-1	= Profinet-RT[2]
B8-1	= EtherCAT[2]

Pilot supply options

0 = internal pilot supply (standard)
E = external pilot supply

Tube connection options

00 = G1/8 at ports 2 and 4, G3/8 at port 1
60 = ∅ 6 mm at ports 2 and 4, ∅ 10 mm at port 1
61 = ∅ 6 mm at ports 2 and 4, ∅ 8 mm at port 1
62 = ∅ 6 mm at ports 2 and 4, ∅ 12 mm at port 1
80 = ∅ 8 mm at ports 2 and 4, ∅ 10 mm at port 1
81 = ∅ 8 mm at ports 2 and 4, ∅ 8 mm at port 1
82 = ∅ 8 mm at ports 2 und 4, ∅ 12 mm at port 1

[1] Valve terminals with AS-Interface are available with integrated sensor connectors, M8-bushing 3-pole.

RE-46/04-AS3-R04-… 4 stations and 4 x M8 - bushing
RE-46/08-AS3-R08-… 8 stations and 8 x M8 - bushing
RE-46/12-AS3-R12-… 12 stations and 12 x M8 - bushing

Design and function

Manifold system with integrated electrical connection including LED indicators. Each station can accomodate two 3/2-way valves or one 5/2- or 5/3-way valve. All connections are accessible from the front.

The valves and the multi-pin plug with cable must be ordered separately.

The valve terminal is delivered pre-assembled and function-tested. If not specified with the order, valve configuration is as follows:

Valves are mounted according to their order number, starting with high numbers at the side of the multi-pin, ending with low numbers on the opposite side, followed by blind plates (if ordered).

Techn. data		AS-Interface	Multi-pin
Number of stations		4, 8, 12	4, 6, 8, 10 … 20
Working pressure range		3 … 8 bar (44 … 116 psi) / 0 … 8 bar (0 … 116 psi) with external pilot supply	
Temperature range		– 10 °C … + 50 °C (+ 14 °F … + 122 °F)	
Degree of protection		IP 65 according to VDE 0470 / EN 60529 (with suitable connectors)	
Voltage		Bus 18.5 V DC … 31.6 V DC Power 24 V DC ± 10 %	24 V DC ± 10 %
Power consumption		1.3 W Valve solenoid* 0.6 W / Slave	1.3 W Valve solenoid*
Status display	LED Yellow	Valve solenoid energized	Valve solenoid energized
	LED Green	Power	–
	LED Green	Bus active (1 / slave)	–
	LED Green	–	–
	LED Red	Bus error (1 / slave)	–
	LED Red	–	–
EMC circuit		Power with Polarized circuit protection and built-in surge protection	Polarized circuit protection, built-in surge protection
Electrical connections		Power – ASi connector Bus – ASi connector	Common GND D-SUB 25-pin, 4 … 12 stations D-SUB 44-pin, 14 … 20 stations
Address selection		Low voltage switch plug ∅ 1.3 mm Slave selection by DIP-switch	–
Baud rate		Standard address range 0 … 31	–

* The status display consumes 0.3 W of the 1.3 W power consumption..

Valve terminal RE-46

with Multi-pin, AS-Interface or Fieldbus,
4 – 24 valve stations, 430 to 950 Nl/min (0.437 to 0.965 Cv)

Type of connection

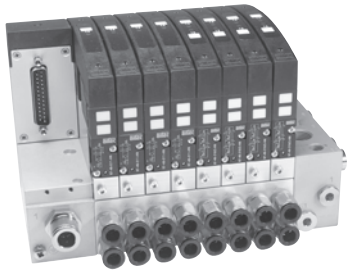
= B1 = B7 = B6 = B8

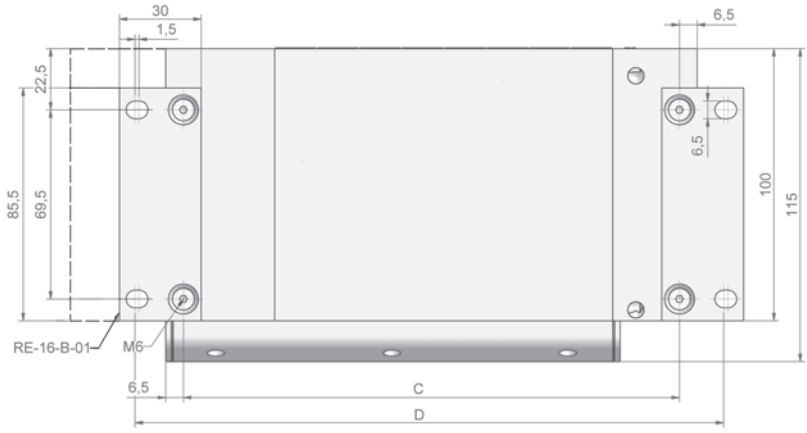
Techn. data		Profibus-DP	CANopen	ProfiNet I/O RT (Real Time)	EtherCAT
Number of stations		6, 8, 10, 12 … 24	6, 8, 10, 12 … 24	6, 8, 10, 12 … 24	6, 8, 10, 12 … 24
Working pressure range		3 … 8 bar (44 … 116 psi) / 0 … 8 bar (0 … 116 psi) with external pilot supply			
Temperature range		– 10 °C … + 50 °C (+ 14 °F … + 122 °F)			
Degree of protection		IP 65 according to VDE 0470 / EN 60529 (with suitable connectors)			
Voltage		24 V DC ± 10 %			
Power consumption each solenoid		1.3 W Valve solenoid* 2.9 W Bus system		1.3 W Valve solenoid* 3.6 W Bus system	1.3 W Valve solenoid* 3.5 W Bus system
Status display	LED Yellow	Valve solenoid energized	Valve solenoid energized	Valve solenoid energized	Valve solenoid energized
	LED Green	Power	Power	Power	Power
	LED Green	Bus active	Init	Bus OK	EtherCAT
	LED Green	–	Run	Link/Activity Port 1	Link/Activity Port 1
	LED Green	–	–	Link/Activity Port 2	Link/Activity Port 2
	LED Red	Bus error	Bus error	Bus error	Error
	LED Red	–	status	–	–
EMC circuit		Power with Polarized circuit protection and built-in surge protection			
Electrical connections		Power – 5-pin M12 socket A-code Bus 2 x – 5-pin M12 out-bushing B-code in-socket B-code	Power – 5-pin M12 socket A-code Bus in – 5-pin M12 socket A-code Bus out – 5-pin M12 bushing A-code	Power – 5-pin M12 socket A-code Bus in – 4-pin M12 socket D-code Bus out – 4-pin M12 bushing D-code	Power – 5-pin M12 socket A-code Bus in – 4-pin M12 socket D-code Bus out – 4-pin M12 bushing D-code
Address selection		By 2 rotary switches	By 2 rotary switches	By controler-remote	–
Baud rate		Automatic adjustment 9.6 kBit/s … 12 Mbit/s	10kBit/s … 1MBit/s	100MBit/s Full duplex	100MBit/s Full duplex

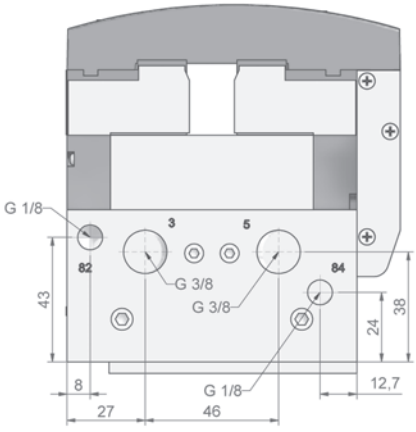
Connector kit is available for Profibus-DP and CANopen as an accessory (see page 1.064).
* The status display consumes 0.3 W of the 1.3 W power consumption.

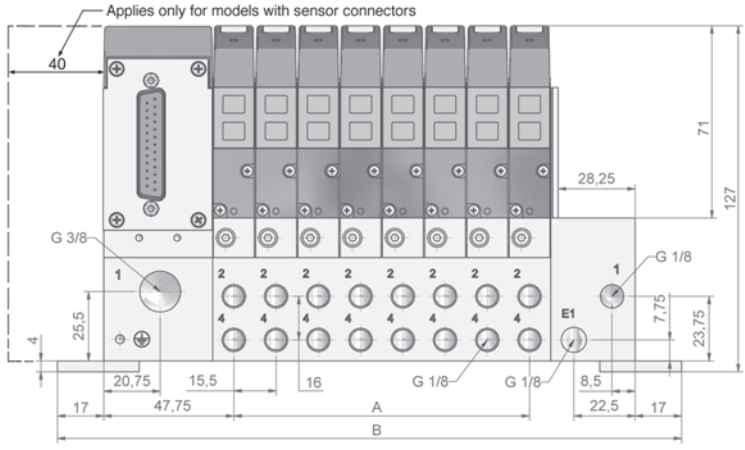
Valve terminal RE-46

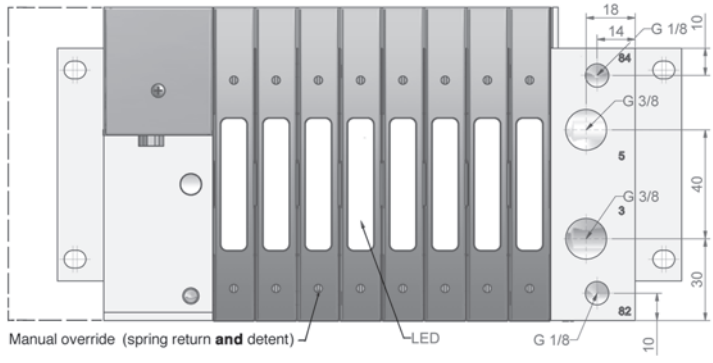
with Multi-pin, AS-Interface or Fieldbus,
4 – 24 valve stations, 430 to 950 Nl/min (0.437 to 0.965 Cv)











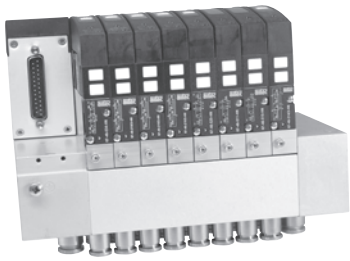
1 = pressure supply G3/8 und G1/8
E1 = external pilot supply G1/8
2, 4 = outlets G1/8
3, 5 = exhausts G3/8
82, 84 = solenoid exhaust G1/8

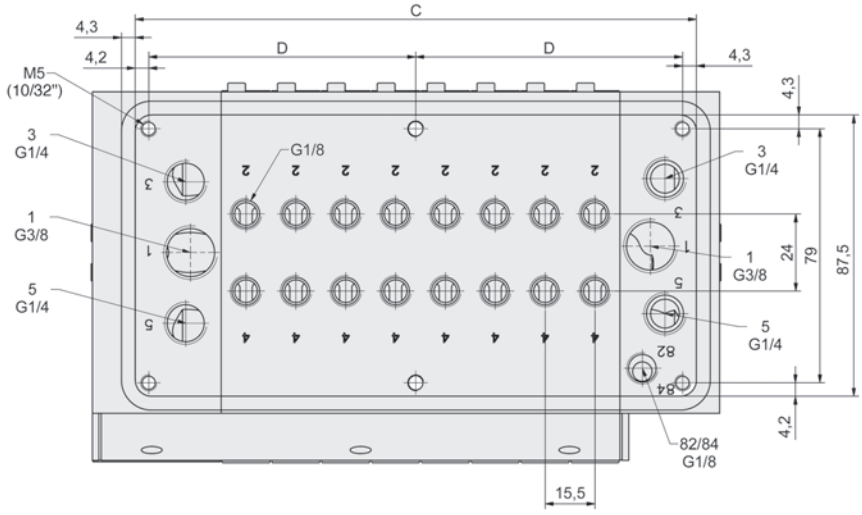
The dimensions of AS-Interface and the different bus types are identical with the multi-pin model.
Six plugs, 4 x G1/8 and 2 x G3/8 are included.

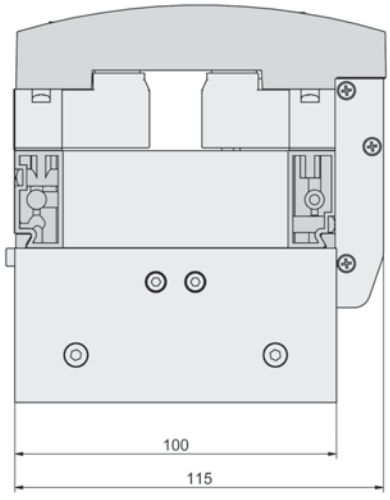
Order number	A	B	C	D
RE-46/04-...	46.5	167	120	154
RE-46/06-...	77.5	198	151	185
RE-46/08-...	108.5	229	182	216
RE-46/10-...	139.5	260	213	247
RE-46/12-...	170.5	291	244	278
RE-46/14-...	201.5	322	275	309
RE-46/16-...	232.5	353	306	340
RE-46/18-...	263.5	384	337	371
RE-46/20-...	294.5	415	368	402
RE-46/22-...	325.5	446	399	433
RE-46/24-...	356.5	477	430	464

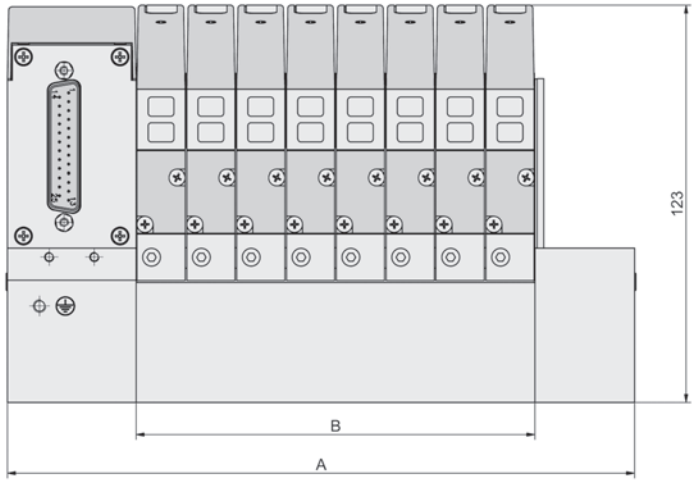
Valve terminal RE-46-G with bottom connection

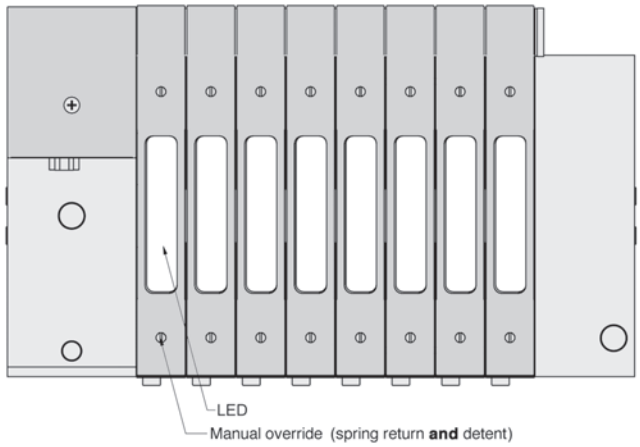
with Multi-pin, AS-Interface or Fieldbus,
8, 12 or 16 valve stations, 430 to 950 Nl/min (0.437 to 0.965 Cv)









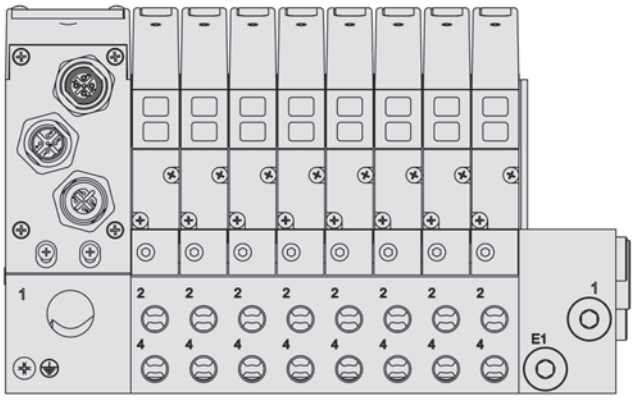


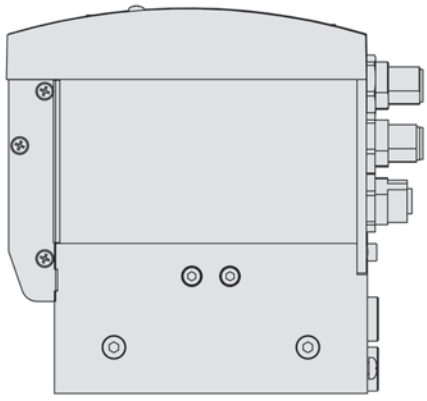
1 = pressure supply G3/8 und G1/8
2, 4 = outlets G1/8
3, 5 = exhausts G1/4
82, 84 = solenoid exhaust G1/8

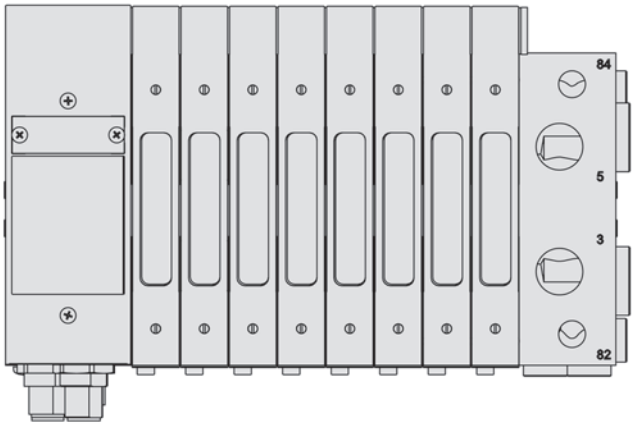
The dimensions of AS-Interface and the different bus types are identical with the multi-pin model.

Order number	A	B	C	D
RE-46/08-G-...	195	124	174.5	83 (2x)
RE-46/12-G-...	257	168	236.5	76 (3x)
RE-46/16-G-...	319	248	298.5	72.5 (4x)

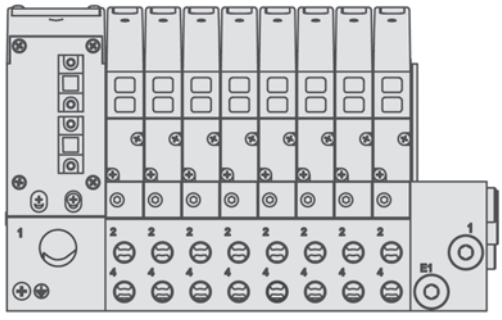
RE-46 Fieldbus

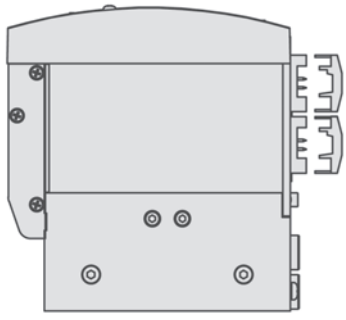


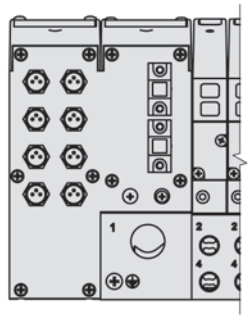


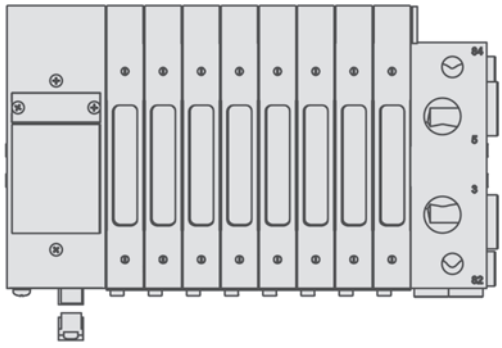


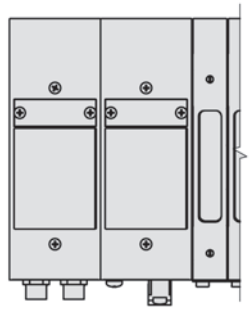
RE-46 AS-Interface and AS-Interface with feed-back signal port*









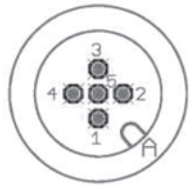


* The feed-back signal box extends the terminal by 40 mm.

PROFI BUS
PROCESS FIELD BUS

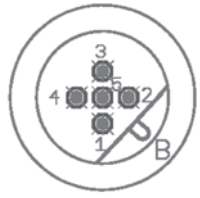
POWER IN Plug M12 5-pin A-code (POWER 24V)[1)]

Pin	Name	Description
1	+24V	Power supply Bus electronic
2	+24V_1	Power supply valve stations 1…12
3	GND	Ground for 24 V DC
4	GND	Ground for 24 V DC
5	+24V_2	Power supply valve stations 13 … 24



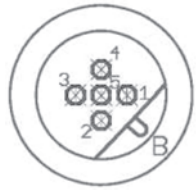
BUS IN Plug M12 5-pin B-code

Pin	Name	Description
1	+5V	Power supply terminal
2	A	RS485A (Tx/Rx-N)
3	GND	Ground
4	B	RS485B (Tx/Rx-P)
5	Shield[1)]	Shield



BUS OUT Socket M12 5-pin B-code[3)]

Pin	Name	Description
1	+5V	Power supply terminal
2	A	RS485A (Tx/Rx-N)
3	GND	Ground
4	B	RS485B (Tx/Rx-P)
5	Shield[1)]	Shield

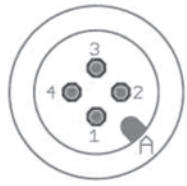


[1)] The shield can be connected to the metal collar of the plug (improves the shield and is recommended) or at pin 5.
[2)] This PIN can be used optional with +24V for the power supply of the CAN-Transceiver. For the standard version this pin cannot be used for this option. Please specify by ordering.
[3)] An unused socket connection must be terminated with the termination resistance.

CANopen

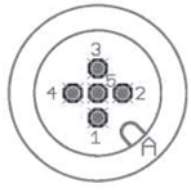
POWER IN Plug M12 5-pin A-code (POWER 24V)[1)]

Pin	Name	Description
1	+24V	Power supply Bus electronic
2	+24V_1	Power supply valve stations 1…12
3	GND	Ground for 24 V DC
4	GND	Ground for 24 V DC
5	+24V_2	Power supply valve stations 13 … 24



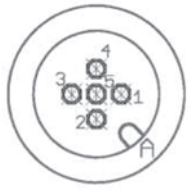
BUS IN Plug M12 5-pin A-code

Pin	Name	Description
1	SHLD	Shield[1)]
2	CAN V+	CAN Supply[2)]
3	GND	CAN Ground
4	CAN H	CAN High
5	CAN L	CAN Low



BUS OUT Socket M12 5-pin A-code[3)]

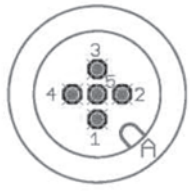
Pin	Name	Description
1	SHLD	Shield[1)]
2	CAN V+	CAN Supply[2)]
3	GND	CAN Ground
4	CAN H	CAN High
5	CAN L	CAN Low



PROFINET / EtherCAT

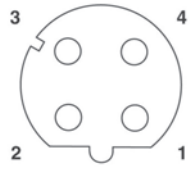
POWER IN Plug M12 5-pin A-code (POWER 24V)

Pin	Name	Description
1	+24V	Power supply Bus electronic
2	+24V_1	Power supply valve stations 1 … 12
3	GND	Ground for 24 V DC
4	GND	Ground for 24 V DC
5	+24V_2	Power supply valve stations 13 … 24



BUS IN **BUS OUT** Socket M12 4-pin D-code

Pin	Name	Description
1	Tx^+	Transmit-data +
2	Rx^+	Receive-data +
3	Tx	Transmit-data -
4	Rx	Receive-data +

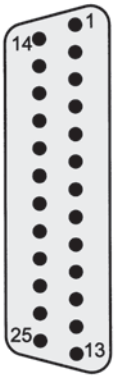


[1)] The shield can be connected to the metal collar of the plug (improves the shield and is recommended) or at pin 5.
[2)] This PIN can be used optional with +24V for the power supply of the CAN-Transceiver. For the standard version this pin cannot be used for this option. Please specify by ordering.
[3)] An unused socket connection must be terminated with the termination resistance.

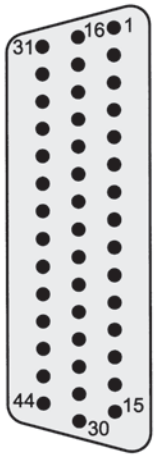
Pin assignment

View on valve terminal

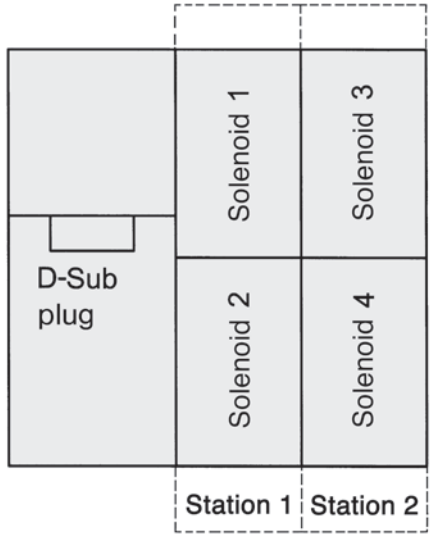
D-Sub
25-pin



D-Sub
44-pin



Solenoid layout



Connector cable 28-ST-16-M1-25-…*
For valve terminals with 4 … 12 stations.

Pin	Solenoid	Wire coding
1	GND	white
2	1	brown
3	3	green
4	5	yellow
5	7	grey
6	9	pink
7	11	blue
8	13	red
9	15	black
10	17	violet
11	19	grey-pink
12	21	red/blue
13	23	white/green
14	2	brown/green
15	4	white/yellow
16	6	yellow-brown
17	8	white/grey
18	10	grey-brown
19	12	white/pink
20	14	pink/brown
21	16	white/blue
22	18	brown/blue
23	20	white/red
24	22	brown/red
25	24	white/black

Connector cable 28-ST-16-M1-44-…*
For valve terminals with 14 … 20 stations.

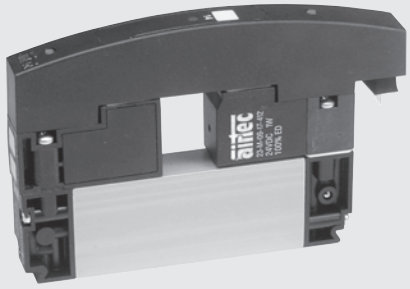
Pin	Solenoid	Wire coding	Pin	Solenoid	Wire coding
1	GND	white	**23**	20	white/red
2	3	brown	**24**	23	brown/red
3	6	green	**25**	26	white/black
4	9	yellow	**26**	29	brown/black
5	12	grey	**27**	32	grey/green
6	15	pink	**28**	35	yellow/grey
7	18	blue	**29**	38	pink/green
8	21	red	**30**	–	yellow/pink
9	24	black	**31**	1	green/blue
10	27	violet	**32**	4	yellow/blue
11	30	grey/pink	**33**	7	green/red
12	33	red/blue	**34**	10	yellow/red
13	36	white/green	**35**	13	green/black
14	39	brown/green	**36**	16	yellow/black
15	–	white/yellow	**37**	19	grey/blue
16	GND	yellow/brown	**38**	22	pink/blue
17	2	white/grey	**39**	25	grey/red
18	5	grey/brown	**40**	28	pink/red
19	8	white/pink	**41**	31	grey/black
20	11	pink/brown	**42**	34	pink/black
21	14	white/blue	**43**	37	blue/black
22	17	brown/blue	**44**	40	red/black

Wiring colour acc. to DIN 47100 (coloured or signed by numbers).

* See page 1.064

Valves and accessories for series RE-46

Valves



KF-46-210/2-HN-S12	2 x 2/2-way NC, air spring return
KF-46-310/2-HN-S12	2 x 3/2 NC, with connector bridge
KF-46-312/2-HN-S12	2 x 3/2 NO, with connector bridge
KF-46-314/2-HN-S12	2 x 3/2 NO/NC, with connector bridge
KF-46-510-HN-S12	5/2-way, with air spring return, with connector bridge
KF-46-511-HN-S12	5/2-way, with spring return, with connector bridge
KF-46-520-HN-S12	5/2-way, double solenoid, with connector bridge
KF-46-530-HN-S12	5/3-way, center position closed, with connector bridge
KF-46-533-HN-S12	5/3-way, center position exhausted, with connector bridge
KF-46-534-HN-S12	5/3-way, center position pressurized, with connector bridge

Other single elements

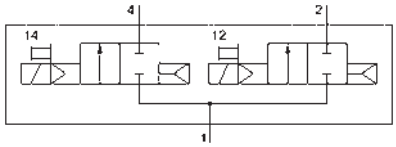
Blind plate
RE-16-V-EP

Blind plate for blank station
RE-46-V-EP

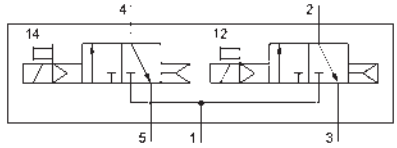
RE-19-DT	Dividing plate for 2 different pressures
RE-26-DS	Seal kit for KF-26 and KF-46
RE-46-B-01	Bracket for flange mounting
RE-46-B-02	Bracket for flange mounting (Terminals with sensor connectors)
RE-46-DS	Seal kit for KF-46
RE-46-RSV	Check valve for dynamic exhaust pressure
RE-16-V-EP	Blind plate set
RE-46-V-EP	Blind plate set
21-KF-46-01	Mounting Kit (Seal, mounting clamp and screw for valve fixing)
28-ST-16-M1-25-105	Connector Multi-pin D-Sub, 25-pin with 5 m cable
28-ST-16-M1-25-110	Connector Multi-pin D-Sub, 25-pin with 10 m cable
28-ST-16-M1-44-105	Connector Multi-pin D-Sub, 44-pin with 5 m cable
28-ST-16-M1-44-110	Connector Multi-pin D-Sub, 44-pin with 10 m cable
28-ST-RE-16-01-B1	Connector kit RE-46, Profibus-DP, in and out
28-ST-RE-16-01-B6	Connector kit RE-46, CANopen, in and out
28-ST-RE-16-02-B1	Connector kit RE-46, Profibus-DP termination resistance
28-ST-RE-16-02-B6	Connector kit RE-46, CANopen termination resistance
54-RE-46-D	Operating manual for RE-46 – Multi-pin, AS-Interface, Profibus, German
54-RE-46-E	Operating manual for RE-46 – Multi-pin, AS-Interface, Profibus, English
54-RE-46-FR	Operating manual for RE-46 – Multi-pin, AS-Interface, Profibus, French
54-RE-46-D-CAN	CANopen supplementary instructions on operating manual, German

Valve KF-46 for valve terminal RE-46

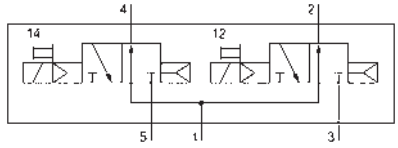
430 to 950 Nl/min (0.437 to 0.965 Cv)



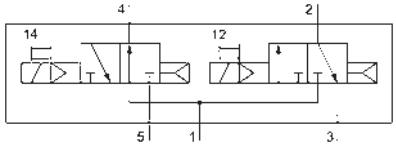
KF-46-210/2-HN-S12



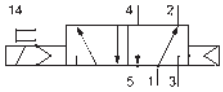
KF-46-310/2-HN-S12



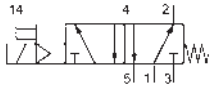
KF-46-312/2-HN-S12



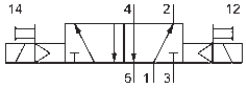
KF-46-314/2-HN-S12



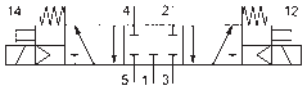
KF-46-510-HN-S12



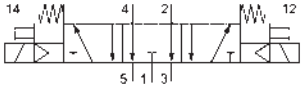
KF-46-511-HN-S12



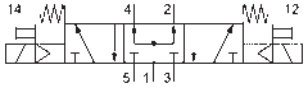
KF-46-520-HN-S12



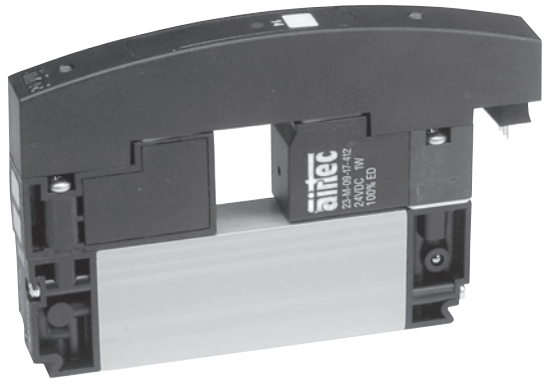
KF-46-530-HN-S12



KF-46-533-HN-S12



KF-46-534-HN-S12



7

Design and function

Spool valve actuated by an electrical signal.

Order number*	KF-46-210/2-...	KF-46-310/2-...	KF-46-312/2-...	KF-46-314/2-...	KF-46-510-...	KF-46-511-...	KF-46-520-...	KF-46-530-...	KF-46-533-...	KF-46-534-...
Function	2x2/2-way NC air spring return	2x3/2-way NC	2x3/2-way NO	2x3/2-way 1 x NO 1 x 1 x NC	5/2-way single solenoid air spring return	5/2-way single solenoid mechanical spring return	5/2-way double solenoid	5/3-way center pos. closed	5/3-way center pos. exhausted	5/3-way center pos. pressurized
Connection	Flange									
Nominal size	4.5 mm				6 mm					
Nominal flow	430 Nl/min geschl. / 630 Nl/min offen (0.437 Cv) NC / (0.640 Cv) NO				950 Nl/min (0.965 Cv)	810 Nl/min (0.823 Cv)	950 Nl/min (0.965 Cv)	680 Nl/min (0.691 Cv)		
Pressure range										
Internal pilot supply	Working pressure 2.5 … 8 bar (36 … 116 psi)							Working pressure 3 … 8 bar (44 … 116 psi)		
External pilot supply	Valves are not suitable for external pilot supply				Pilot pressure 3 … 8 bar / Working pressure 0 … 10 bar[1]					
Response time at 6 bar	on 15 ms off 28 ms				on 15 ms off 31 ms	on 14 ms off 33 ms	20 ms	on 20 ms off 30 ms		
Medium	Compressed air in accordance with ISO 8573-1: 2001, Class 7 4 – and free of aggressive additives									
Temperature range	– 10 °C … + 50 °C (+ 14 °F … + 122 °F)									
Materials	Body: Al (anodized), plastic, Seals: NBR; Inner parts: Al, stainless steel, brass									
Operating voltage	24 V DC ± 10 %									
Power consumption	1 W per solenoid, 0.3 W per LED									
Degree of protection	IP 65 according to EN 60529, when assembled on RE-46									
Weight	0.19 kg (0.42 lb.)				0.16 kg (0.35 lb.)		0.19 kg (0.42 lb.)			

* Please complete according to order code (see circuit symbols)

[1] For KF-46-511-… the pilot pressure must be higher than the working pressure

Pneumatic and explosion protection

The directive 94/9/EC (ATEX)

ATEX derives it's name from ATmosphère EXposible and stands for the Directive 94/9/EC of the European Parliament. The Directive concerns electrical and non-electrical equipment and protection systems for use in potential explosive atmospheres.

Since 1st of July 2003, devices and protection systems for use in potentially explosive areas must satisfy the new Directive 94/9/EC.

Compared with the previons directives, it must be noted that the specification refers not only to electrical but also to mechanical equipment.

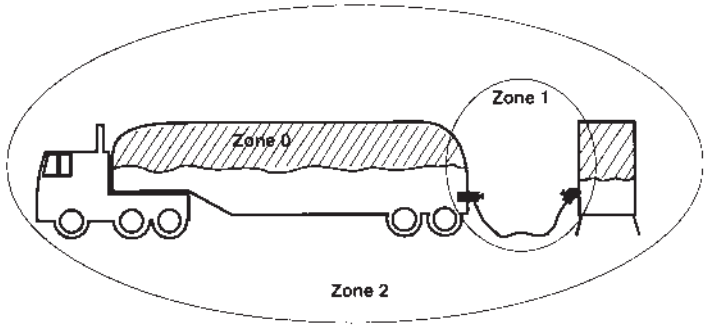
ATEX classifies explosive atmospheres and associates equipment

explosion protection document from plant manufacture	AIRTEC
Plant evaluation acc. to ATEX directive 99/92/EC	Equipment evaluation according (acc.) to ATEX directive 94/9/EC
– Zone classification – Temperature class – Explosion group – Ambient temperature	**– Equipment group** – Temperature class – Explosion group – Ambient temperature

General information

Category

The categories define which zones the devices may be used in. The classification states how frequently and in what concentration the ignitable mixture occurs. Furthermore, differentiation is made as to whether the hazard is due to gases, vapors and mists or due to dust.



Example of zone classification in gas Ex area.

Category 1

For devices, which guarantee a **very high level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected frequently or continuously.
Devices in this category can also be used in Category 2 and 3.

Inflammable gases, vapors or mists

Zone 0 equivalent to Category 1G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists is continuously or frequently present or present for long periods.

Inflammable dusts

Zone 20 equivalent to Category 1D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air is continuously or frequently present or present for long periods.

Category 2

For devices, which guarantee a **high level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected.
Devices in this category can also be used in Category 3.

Inflammable gases, vapors or mists

Zone 1 equivalent to Category 2G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists can form occasionally during normal operation.

Inflammable dusts

Zone 21 equivalent to Category 2D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air can form occasionally during normal operation.

Category 3

For devices, which guarantee a **normal level** of safety.
Intended for the case where an atmosphere at risk of explosion is to be expected rather infrequently and, if so, for only short periods.

Inflammable gases, vapors or mists

Zone 2 equivalent to Category 3G
Area in which an atmosphere at risk of explosion as a mixture of air and inflammable gases, vapors or mists does not normally occur at all or only for short periods during normal operation.

Inflammable dusts

Zone 22 equivalent to Category 3D
Area in which an atmosphere at risk of explosion in the form of a cloud of inflammable dust contained in the air does not normally occur at all or only for short periods during normal operation.

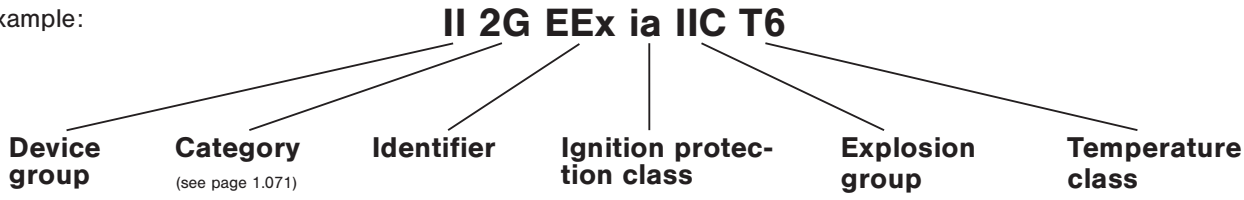
General information

According to 94/9/EC, a device that is to be used in an environment at risk of explosion may only be brought into the market if it satisfies the standards specified in the norm.

Compared with the previous directives, it must be noted that the specification refers not only to electrical but also to mechanical equipment (e.g. cylinders).

Devices are divided into categories and groups to accurately define the conditions of use. This definition is marked on the device and may appear as follows:

Example:



Device group

There are 2 groups of devices.
Devices of Group I, Category M are for use in underground mines and their above ground equipment, which are at risk from firedamp and/or inflammable dusts. (This is not given further coverage in this document).
All other areas at risk of explosion are combined in Device Group II.

Identifier

EEx defines that this is an electrical device.

Ignition protection class

This defines which measures are used to ensure explosion protection.
The following ignition protection classes are used by AIRTEC:
m = Encapsulation, **ia** = Intrinsic safety, **c** = Safe by design
Other ignition protection classes are defined in EN 50014: 1997. The abbreviations are currently under review discussion.
It should be noted that devices in ignition protection class ia may only be supplied from circuits that are certified to be intrinsically safe.

Explosion group

Device group II is sub-divided into Explosion Groups A, B or C.
This classification is dependent on the typical material properties of the gases and vapors that occur.
The hazard level of materials increases from Explosion Group IIA to IIC. The requirements for the devices increase accordingly. If a device is approved for IIC, it can be used for all other explosion groups. Alternatively, the chemical formula or the name of the material can be stated here.

Temperature class

It must be ensured that the ignition temperature of an inflammable material is not reached during operation. For this purpose, the maximum surface temperature of a device must be less than the minimum ignition temperature. For this reason, the maximum surface temperature of equipment for use with inflammable gases, vapors or mists is specified in temperature classes. For dusty environments, the maximum surface temperature is specified in °C.

Temperature class	Maximum permissible surface temperature of the equipment (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

The following AIRTEC products are available in explosion-proof design for Device Group II in accordance with 94/9/EC.

The following list is intended to provide an overview. Attention must be paid to the Operating Instructions and Declaration of Conformity before commissioning. These can be provided on request.

Electrically operated valves

Series	Functions	Classification	Special features	Catalogue/ NPTF folder page
MS-18/MS-98	310	II 2GD c T5 T 100° C	Valves are equipped with special actuators. Dimensional changes and technical data can be seen in the following pages. Compressed air in accordance with ISO 8573-1: 2001 Class 74- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	4.040/1.039
M-04	310, 311, 320, 510, 511, 520, 530, 533, 534			4.080
ME-04	311, 511			
M-05/M-95	310, 311, 320, 510, 511, 520, 530, 533, 534			4.110/1.040
ME-05	311, 320, 511, 520			4.110
MO-05	311			4.110
M-07/M-97	310, 311, 320, 510, 511, 520, 530, 533, 534			4.151/1.043
MO-07	311			4.151
ME-07	311, 320, 511, 520, 530			4.151
MG-07	510, 520, 530, 533, 534			–
MN-06	310, 311, 320, 510, 511, 520, 530, 533			5.020
M-22	310, 311, 320, 510, 511, 520, 530, 533, 534			4.181
ME-22	311, 520			
MO-22	310, 311			
KN-05	310, 311, 510, 511, 520, 530, 533, 534			5.040
KNE-05	511			
KM-09/KM-99	510, 511, 520, 530, 533, 534			4.120/1.027
KM-10/KM-90	510, 511, 520, 530, 533, 534			4.161/1.033
KME-10	520, 530, 533			–
MI-01	510, 511, 520, 530, 533			5.061
MI-02	510, 520, 530, 533			5.081
MI-03	510, 511, 520, 530, 533			5.101

Pneumatically operated valves

Series	Functions	Classification	Special features	Example order number	Catalogue page
P-04	311, 511, 530, 533, 534	II 2GD c T5 T 100° C	Compressed air in accordance with ISO 8573-1: 2001 Class 74- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	P-04-311-ATEX	–
P-05	310, 311/2, 320, 510, 511, 520, 530, 533, 534			P-05-310-ATEX	3.060
P-07	310, 311/2, 320, 510, 511, 520, 530, 533, 534			P-07-310-ATEX	3.080
PG-07	510, 520, 530, 533, 534			–	–
P-12	310, 311, 320, 510, 511, 520, 534			P-12-310-ATEX	3.100
L-25	310, 311, 320, 510, 520			L-25-310-ATEX	3.020
L-28	310, 311, 320, 510, 511, 520			L-28-310-ATEX	3.040
PI-01	510, 511, 520			PI-01-510-ATEX	–
PI-02	510, 520, 530, 533, 534			PI-02-510-ATEX	–
PI-03	510, 520, 530, 533, 534			PI-03-510-ATEX	–

Other series can be provided on request.

Manually operated valves

Series	Functions	Classification of the pneumatic valves	Special features	Example order number	Catalogue/ NPTF folder page
HF-12	310	II 2GD c T6 T 85° C	Compressed air in accordance with ISO 8573-1:2001 Class 7 4- free of any aggres- sive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 60° C	HF-12-310-ATEX	2.101
HF-14/HF-94	310, 510			HF-14-310-ATEX	2.101/1.002
HF-18/HF-98	310, 533			HF-18-310-ATEX	2.101/1.002
HR-12	on request			HR-12-…-ATEX	2.102
HR-14/HR-94	320, 530			HR-14-320-ATEX	2.102/1.003
HR-18/HR-98	520			HR-18-520-ATEX	2.102/1.003
T-28	311			T-28-311-ATEX	2.123
T-30	310			T-30-310-ATEX	2.125

Quick exhaust valves

Series	Functions	Classification of the pneumatic valves	Special features	Example order number	Catalogue page
SE-12	–	II 2GD c T6 T 85° C	Compressed air in accordance with ISO 8573-1:2001 Class 7 4- free of any aggres- sive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	SE-12-ATEX	8.160
SE-14	–			SE-14-ATEX	8.160
SE-18	–			SE-18-ATEX	8.160
SE-98	–			SE-98-ATEX	8.160

Speed regulation plates for valves acc. to NAMUR

Series	Classification	Special features	Example order number	Catalogue page
KN-063-DRH **KN-063-DRS** **KN-065-DRH** **KN-065-DRS**	II 2GD c T5 T 100° C – 10° C ≤ T_{amb} ≤ 50° C	Compressed air in accordance with ISO 8573-1:2001 Class 7 4- free of any aggressive particles T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 50° C	KN-063-DRH-ATEX	5.042

The following accessories are approved for the valves:

Manifolds: R-281/n, R-283/n, R-181/n,R-183/n, R-141/n, R-143/n, RF-05, RF-07

Hollow bolt: H-281, H-283, H-183, H-143, HI-143, HI-183

Blind plates: R-281-V, R-283-V, R-181-V, R-183-V, RF-09-V, RF-10-V, R-141-V, RF-04-V, RF-C-07-V, R-143-V, MG-07-V

Brackets: R-281-W, R-181-W, R-141-W

Modular manifolds: RF-09/n, RF-10/n, RF-19-E, RF-09-E1, RF-10-E1, RF-09-E2, RF-10-E2, RF-09-Z1, RF-10-Z1, RF-09-Z4, RF-10-Z4, RF-24, RF-C/n

Seal plate: RF-19-01

Cylinders

Series	Classification	Special features	Example order number	Catalogue page
XL	II 2GD c T5 T 100° C – 20° C ≤ T_{amb} ≤ 80° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- At V > 1 m/s Class 744 free of any aggressive particles T_{Medium} – 20° C … + 50° C T_{amb} – 20° C … + 80° C Max permissible energy in the end positions: ø 32 – 0,1 J, ø 40 and 50 – 0,2 J, ø 63 – 0,5 J, ø 80 – 0,9 J, ø 100 – 1,2 J, ø 125 – 5 J	XL-040-0320-000-ATEX	9.009
XG	II 2GD c T5 T 100° C – 20° C ≤ T_{amb} + 80° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- At V > 1 m/s Class 744 free of any aggressive particles	XG-160-0250-000-ATEX	9.030
CX			CX-032-0250-000-ATEX	9.180
HM			HM-016-025-ATEX	9.081
CM			CM-16-025-ATEX	9.170

The following accessories are approved for the cylinders:

Flexible coupling	FK	Cylinder fixings	XLB-ø-01, XLB-ø-02, XLB-ø-03,
Rod eye	FO and RO up to Vmax 1 m/s		XLB-ø-04, XLB-ø-05, XLB-ø-06,
Rod clevis	FD and RD		XLB-ø-07, XLB-ø-08, XLB-ø-09,
Piston rod nut	FE and RL		XLB-ø-10, XLB-ø-12

Rodless cylinders

Series	Classification	Special features	Example order number	Catalogue page
ZX	II 2G T6 T 85° C, – 20° C ≤ T_{amb} ≤ 60° C	Compressed air in accordance with ISO 8573-1:2001 Class 74- free of any aggressive particles V_{max} 1 m/s T_{Medium} – 10° C … + 50° C T_{amb} – 10° C … + 60° C	ZX-25-S-0500-01ATEX	10.140

The following accessories are approved for the cylinders:

Head mount	ZXB-Ø-01	Trunnion mount	ZXB-Ø-10
Head mount tall	ZXB-Ø-02		

Proximity Sensors

Series	Classification	Order number	Catalogue page
ZS	II 3G Ex nA T4 II 3D Ex tD A22 IP67 T 125 °C	ZS-7300	9.221
	EX II 3D Ex tc IIIC T125°C Dc X	ZS-7302	

Electrically operated valves

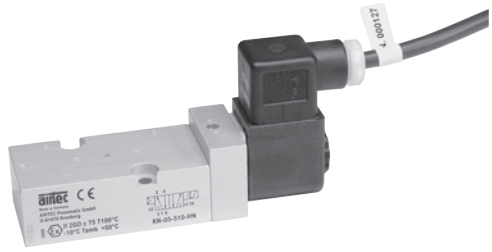
in Ⓔx-proof design

Valves from the (e.g. **MS-98, M-95, others see table page 1.073)** ranges can be provided in explosion proof design in accordance with 94/9/EC (ATEX) for device group II.

For this purpose, special valves are equipped with alternative electrical equipment. The dimensional changes of these components, which are mounted on the valve housing, can be seen on the following pages.

The valves are supplied in an assembled state, complete with valve, as the approval relates both to the electrical and the mechanical components. Individual parts may only be supplied for replacement purposes.

When ordering, the number of the required design must be added to the valve order number, or the required version must be noted in the item text.



Example 1: M-95-510-HN-**Ex037**-24V=

Example 2: M-95-510-HN
Solenoid valve 5/2-way 1/8 NPTF,
explosion proof design **Ex037**
Control voltage 24V=.

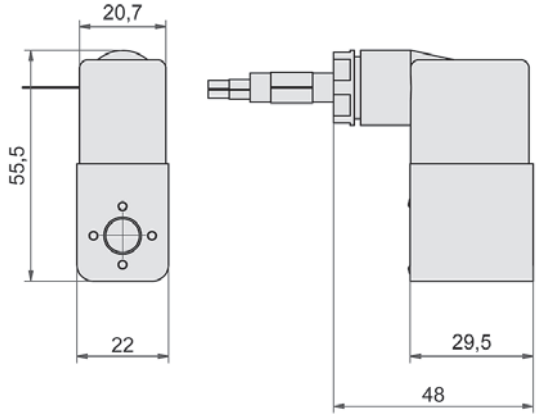
The specified technical boundary conditions are to enable the user to make a selection. The operating instructions for the valve and the electrical equipment must be taken into account before putting into operation. These are included with each valve and we would be pleased to send them to you on request by quoting Order No. 54-ATEX-01.

Version	23-SP-037-012-xx	23-SP-037-025-xx	23-SP-037-027-xx	23-SP-038-01-912	23-SP-040-B12	23-SP-040-B27	23-SP-041-A12
Width	30 mm						22 mm
Ignition protection class	Encapsulated with casting compound mb (gases) mb tb (dust)			Intrinsically safe ia (gases) t (dust)	Non-sparking device nA (gases) tc (dust)		
Classification	II 2G Ex mb IIC T5 II 2D Ex mb tb IIIC T95 °C IP65			II 2G Ex ia IIC T6 Ga (≤ 28VDC) II 2G Ex ia IIB T6 Ga (≤ 32VDC) II 2D Ex t IIIC T80°C Db IP65	II 3G Ex nA IIC T5 Gc II 3D Ex tc IIIC T95°C Dc IP65		II 3G Ex nA IIC T5 Gc X II 3D Ex tc IIIC T5 Dc X
Rated voltage	24 VDC	110…120 VAC	230 VAC	U ≦ 28VDC / U ≦ 32VDC	24 VDC	230 VAC	24 VDC
Rated current	136 mA	27 mA	14 mA	I ≦ 115 mA / I ≦ 195 mA	112 mA	15 mA…18 mA	120 mA
Rated power	3,3 W	3 VA	3,1 VA	–	2,7 W	4 VA	3 W
Cable length	xx: 03 = 3 m (standard) xx: 05 = 5 m xx: 10 = 10 m			– incl. connector			– without connector*1
Medium	Compressed air in accordance with ISO-8573-1 : 2001, Class 7 4 - Free of any aggressive particles						
Temperature range	– 20 °C…+ 50 °C			– 40 °C…+ 50 °C	– 20 °C…+ 50 °C		– 15 °C…+ 50 °C
Ambient Battery fitted	– 20 °C…+ 40 °C			–	–		–
Temperature range Medium	– 10 °C … + 50 °C **(Mounting on manifold -10°C…+40°C)**						
Pressure range	depending on armature						

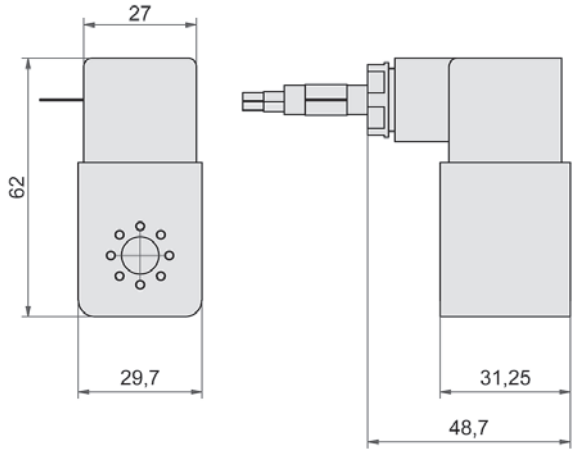
Version	23-SP-036-012-03	23-SP-036-011-03	23-SP-045-B12	23-SP-045-B27
Width	22 mm		36 mm	
Ignition protection class	Encapsulated with casting compound mb (gases) mb tb (dust)		Flame proof enclosures / Encapsulated with casting compound d mb (gases) tb (dust)	
Classification	II 2G Ex mb IIC T4 II 2D Ex mb tb IIIC T130°C IP65		II 2G Ex d mb IIC T5 Gb II 2D Ex tb IIIC T95°C Db IP66	
Rated voltage	24 VDC	12 VDC	24 VDC	230 VAC
Rated current	207 mA	375 mA	125 mA	14 mA
Rated power	5 W	4,5 W	3 W	3,8 VA
Cable length	3 m		Terminal box	
Medium	Compressed air in accordance with ISO-8573-1 : 2001, Class 7 4 - Free of any aggressive particles			
Temperature range	– 20 °C…+ 50 °C		– 50 °C…+ 50 °C	
Ambient Battery fitted	–		–	
Temperature range Medium	– 10 °C … + 50 °C **(Mounting on manifold -10°C…+40°C)**		–	
Pressure range	depending on armature			

*1: suitable connector 28-ST-05-B

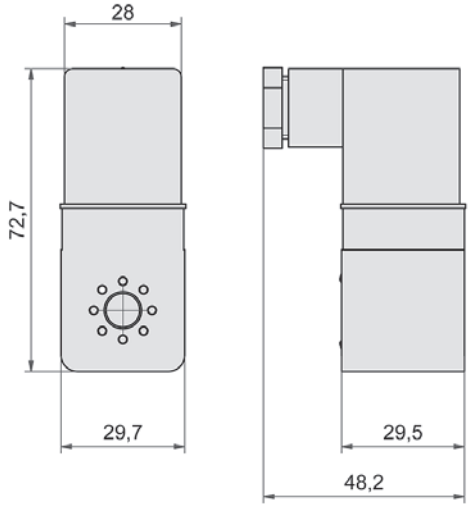
23-SP-036, Dimensions



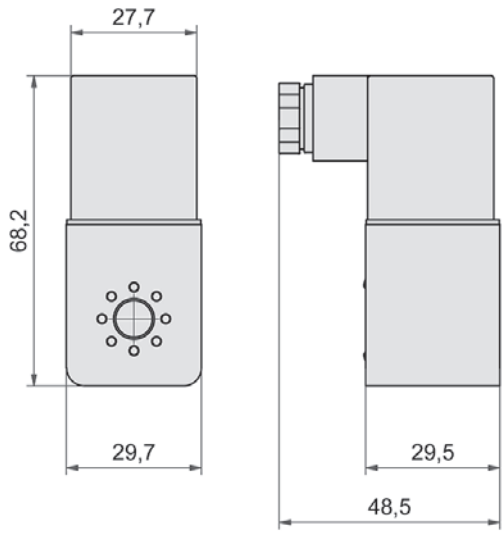
23-SP-037, Dimensions



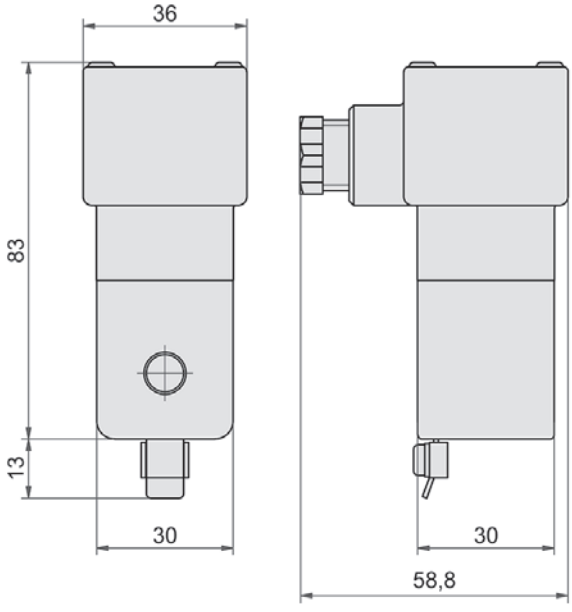
23-SP-038, Dimensions



23-SP-040, Dimensions



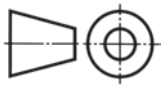
23-SP-045, Dimensions



A Drawings

The method of projection within this catalouge is the first angle projection according to DIN ISO 5456-2.

First angle projection (Used in this catalogue)
Is based on the idea that the body is turned to the side. This means that a view from left is on the right hand side of the main view.



Third angle projection
Normally used in USA and english speaking countries. Specify that a view from right has to be on the right hand side of the main view.

All dimensions in the drawings are generally in millimeters (mm) if not stated otherwise. The abbreviations SW, WS, or CH are the short form of wrench size.

B Length

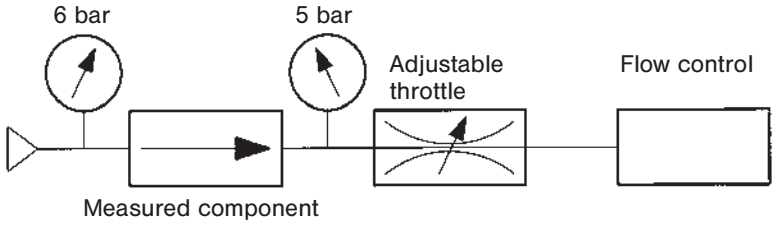
The following table assists in the conversion of the used mm dimension to inches.
For precise calculation please use the following formula:

mm to inch 1 mm = 0.03937 inch
inch to mm 1 inch = 25.4 mm

mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
0.1	0.0039	3.8	0.1496	7.5	0.2953	11.2	0.4409	14.9	0.5866	290	11.417
0.2	0.0079	3.9	0.1535	7.6	0.2992	11.3	0.4449	15.0	0.5906	300	11.811
0.3	0.0118	4.0	0.1575	7.7	0.3031	11.4	0.4488	20.0	0.7874	310	12.205
0.4	0.0157	4.1	0.1614	7.8	0.3071	11.5	0.4528	25.0	0.9843	320	12.598
0.5	0.0197	4.2	0.1654	7.9	0.3110	11.6	0.4567	30.0	1.1811	330	12.992
0.6	0.0236	4.3	0.1693	8.0	0.3150	11.7	0.4606	35.0	1.3780	340	13.386
0.7	0.0276	4.4	0.1732	8.1	0.3189	11.8	0.4646	40.0	1.5748	350	13.780
0.8	0.0315	4.5	0.1772	8.2	0.3228	11.9	0.4685	45.0	1.7717	360	14.173
0.9	0.0354	4.6	0.1811	8.3	0.3268	12.0	0.4724	50.0	1.9685	370	14.567
1.0	0.0394	4.7	0.1850	8.4	0.3307	12.1	0.4764	55.0	2.1654	380	14.961
1.1	0.0433	4.8	0.1890	8.5	0.3346	12.2	0.4803	60.0	2.3622	390	15.354
1.2	0.0472	4.9	0.1929	8.6	0.3386	12.3	0.4843	65.0	2.5591	400	15.748
1.3	0.0512	5.0	0.1969	8.7	0.3425	12.4	0.4882	70.0	2.7559	410	16.142
1.4	0.0551	5.1	0.2008	8.8	0.3465	12.5	0.4921	75.0	2.9528	420	16.535
1.5	0.0591	5.2	0.2047	8.9	0.3504	12.6	0.4961	80.0	3.1496	430	16.930
1.6	0.0630	5.3	0.2087	9.0	0.3543	12.7	0.5000	85.0	3.3465	440	17.323
1.7	0.0669	5.4	0.2126	9.1	0.3583	12.8	0.5039	90.0	3.5433	450	17.717
1.8	0.0709	5.5	0.2165	9.2	0.3622	12.9	0.5079	95.0	3.7402	460	18.110
1.9	0.0748	5.6	0.2205	9.3	0.3661	13.0	0.5118	100	3.937	470	18.504
2.0	0.0787	5.7	0.2244	9.4	0.3701	13.1	0.5157	110	4.331	480	18.898
2.1	0.0827	5.8	0.2283	9.5	0.3740	13.2	0.5197	120	4.724	490	19.291
2.2	0.0866	5.9	0.2323	9.6	0.3780	13.3	0.5236	130	5.119	500	19.685
2.3	0.0906	6.0	0.2362	9.7	0.3819	13.4	0.5276	140	5.512	510	20.079
2.4	0.0945	6.1	0.2402	9.8	0.3858	13.5	0.5315	150	5.906	520	20.472
2.5	0.0984	6.2	0.2441	9.9	0.3898	13.6	0.5354	160	6.230	530	20.866
2.6	0.1024	6.3	0.2480	10.0	0.3937	13.7	0.5394	170	6.693	540	21.260
2.7	0.1063	6.4	0.2520	10.1	0.3976	13.8	0.5433	180	7.087	550	21.654
2.8	0.1102	6.5	0.2559	10.2	0.4016	13.9	0.5472	190	7.480	560	22.047
2.9	0.1142	6.6	0.2598	10.3	0.4055	14.0	0.5512	200	7.874	570	22.441
3.0	0.1181	6.7	0.2638	10.4	0.4094	14.1	0.5551	210	8.268	580	22.835
3.1	0.1220	6.8	0.2677	10.5	0.4134	14.2	0.5591	220	8.661	590	23.228
3.2	0.1260	6.9	0.2717	10.6	0.4173	14.3	0.5630	230	9.056	600	23.622
3.3	0.1299	7.0	0.2756	10.7	0.4213	14.4	0.5669	240	9.449	700	27.559
3.4	0.1339	7.1	0.2795	10.8	0.4252	14.5	0.5709	250	9.843	750	29.528
3.5	0.1378	7.2	0.2835	10.9	0.4291	14.6	0.5748	260	10.236	800	31.496
3.6	0.1417	7.3	0.2874	11.0	0.4331	14.7	0.5787		10.630	900	35.433
3.7	0.1457	7.4	0.2913	11.1	0.4370	14.8	0.5827	280	11.024	1000	39.370

C Flow rate

The flow rate values given in the AIRTEC catalouge are in Nl/min. and based on a pressure drop from a pressure inlet 6 bar (87 psi) to a pressure outlet of 5 bar (72.5 psi). The flow rates are measured with the following experimental circuit.



The table below simplifies the calculation of Cv and Kv values.
For precise calculation please use the following formula:

Nl/min to K_V K_V = Nl/min / 1100
Nl/min to C_V C_V = Nl/min / 984

Nl/min.	K_V	C_V
10	0.0091	0.0102
20	0.0182	0.0203
30	0.0273	0.0305
40	0.0364	0.0407
50	0.0455	0.0508
60	0.0545	0.0610
70	0.0636	0.0711
80	0.0727	0.0813
90	0.0818	0.0915
100	0.0900	0.1016
110	0.1000	0.1118
120	0.1091	0.1220
130	0.1182	0.1321
140	0.1273	0.1423
150	0.1364	0.1524
160	0.1455	0.1626
170	0.1545	0.1728
180	0.1636	0.1829
190	0.1727	0.1931
200	0.1818	0.2033
250	0.2273	0.2541
300	0.2727	0.3049
350	0.3182	0.3557
400	0.3636	0.4065
450	0.4091	0.4573
500	0.4545	0.5081
550	0.5000	0.5589
600	0.5455	0.6098
650	0.5909	0.6606
700	0.6364	0.7114
750	0.6818	0.7622
800	0.7273	0.8130
850	0.7727	0.8638
900	0.8182	0.9146
950	0.8636	0.9654
1000	0.9090	1.0163
1050	0.9545	1.0671
1100	1.0000	1.1179
1150	1.0450	1.1687
1200	1.0900	1.2195
1250	1.1364	1.2703
1300	1.1818	1.3211
1350	1.2273	1.3720
1400	1.2727	1.4228
1450	1.3182	1.4736

Nl/min.	K_V	C_V
1500	1.3636	1.5244
1550	1.4091	1.5752
1600	1.4545	1.6260
1700	1.5455	1.7276
1800	1.6364	1.8293
1900	1.7273	1.9309
2000	1.8182	2.0325
2100	1.9091	2.1341
2200	2.0000	2.2358
2300	2.0909	2.3374
2400	2.1818	2.4390
2500	2.2727	2.5407
2600	2.3636	2.6423
2700	2.4545	2.7439
2800	2.5455	2.8455
2900	2.6364	2.9472
3000	2.7273	3.0488
3100	2.8182	3.1504
3200	2.9091	3.2520
3300	3.0000	3.3537
3400	3.0909	3.4553
3500	3.1818	3.5569
3750	3.4091	3.8110
4000	3.6364	4.0650
4250	3.8636	4.3191
4500	4.0909	4.5732
4750	4.3182	4.8272
5000	4.5455	5.0813
5250	4.7727	5.3354
5500	5.0000	5.5894
5750	5.2273	5.8435
6000	5.4545	6.0976
6250	5.6818	6.3516
6500	5.9091	6.6057
6750	6.1364	6.8598
7000	6.3636	7.1138
7250	6.5909	7.3679
7500	6.8182	7.6220
7750	7.0455	7.8760
8000	7.2727	8.1301
8250	7.5000	8.3841
8500	7.7273	8.6382
8750	7.9545	8.8923
9000	8.1818	9.1463

D Pressure

The data contained in the AIRTEC catalogue for pressures are given in bar.
The table below shows conversion to psi.

1 bar = 100 kPa = 14.5 psi = 10 N/cm²
1 psi = 0.069 bar = 6896.5 Pa = 1 lb./sq. in.
1 Pa = 0.00001 bar = 0.000145 psi = 1 N/m²

bar	psi	kPa	bar	psi	kPa	bar	psi	kPa
0.05	0.725	5	0.90	13.050	90	7.00	101.500	700
0.10	1.450	10	1.00	14.500	100	7.50	108.750	750
0.15	2.175	15	1.50	21.750	150	8.00	116.000	800
0.20	2.900	20	2.00	29.000	200	8.50	123.250	850
0.25	3.625	25	2.50	36.250	250	9.00	130.500	900
0.30	4.350	30	3.00	43.500	300	9.50	137.750	950
0.35	5.075	35	3.50	50.750	350	10.00	145.000	1000
0.40	5.800	40	4.00	58.000	400	10.50	152.250	1050
0.45	6.525	45	4.50	65.250	450	11.00	159.500	1100
0.50	7.250	50	5.00	72.500	500	11.50	166.750	1150
0.60	8.700	60	5.50	79.750	550	12.00	174.000	1200
0.70	10.150	70	6.00	87.000	600	14.00	203.000	1400
0.80	11.600	80	6.50	94.250	650	16.00	232.000	1600

E Temperature

The temperature values given in the AIRTEC-catalogue are in °C.
The following table assists in the conversion to °F or Kelvin (°K).

Formula °C to °F

$$\frac{C \times 9}{5} + 32 = °F$$

Formula °F to °C

$$(F - 32) \times \frac{5}{9} = °C$$

°C → °F		°C → °F	
−100	−148	75	167
−95	−139	80	176
−90	−130	85	185
−85	−121	90	194
−80	−112	100	212
−75	−103	110	230
−70	−94	120	248
−65	−85	130	266
−60	−76	140	284
−55	−67	150	302
−50	−58	160	320
−45	−49	170	338
−40	−40	180	356
−35	−31	190	374
−30	−22	200	392
−25	−13	210	410
−20	−4	220	428
−15	5	230	446
−10	14	240	464
−5	23	250	482
0	32	260	500
5	41	270	518
10	50	280	536
15	59	290	554
20	68	300	572
25	77	310	590
30	86	320	608
35	95	330	626
40	104	340	644
45	113	350	662
50	122	360	680
55	131	370	698
60	140	380	716
65	149	390	734
70	158	400	752

°F → °C		°F → °C	
−100	−73.3	70	21.1
−95	−70.6	75	23.9
−90	−67.8	80	26.7
−85	−65.0	90	32.2
−80	−62.2	100	37.8
−75	−59.4	110	43.3
−70	−56.7	120	48.9
−65	−53.9	130	54.4
−60	−51.1	140	60.0
−55	−48.3	150	65.6
−50	−45.6	160	71.1
−45	−42.8	170	76.7
−40	−40.0	180	82.2
−35	−37.2	190	87.8
−30	−34.4	200	93.3
−25	−31.7	210	98.9
−20	−28.9	220	104.4
−15	−26.1	230	110.0
−10	−23.3	240	115.6
−5	−20.6	250	121.1
0	−17.8	260	126.7
5	−15.0	270	132.2
10	−12.2	280	137.8
15	−9.4	290	143.3
20	−6.7	300	148.9
25	−3.9	310	154.4
30	−1.1	320	160.0
32	0.0	330	165.6
35	1.7	340	171.1
40	4.4	350	176.7
45	7.2	360	182.2
50	10.0	370	187.8
55	12.8	380	193.3
60	15.6	390	198.9
65	18.3	400	204.4

°C	°F	°K
−20	−4	253.15
−15	5	258.15
−10	14	263.15
−5	23	268.15
0	32	273.15
5	41	278.15
10	50	283.15
15	59	288.15
20	68	293.15
25	77	298.15
30	86	303.15
35	95	308.15
40	104	313.15
45	113	318.15
50	122	323.15
55	131	328.15
60	140	333.15
65	149	338.15
70	158	343.15
75	167	348.15
80	176	353.15
85	185	358.15
90	194	363.15
95	203	368.15
100	212	373.15
105	221	378.15
110	230	383.15
115	239	388.15
120	248	393.15
125	257	398.15
130	266	403.15
135	275	408.15
140	284	413.15
145	293	418.15
150	302	423.15

F SI – Basic units

Description	Symbol	SI-unit	SI-name
Area	A	m^2	square meter
Current intensity	I	A	Ampere
Energy (work)	W	J, Nm	Joule, Newton meter
Force	F	N	Newton
Length	l	m	meter
Mass	m	kg	kilogramme
Power	P	W	Watt
Pressure	p	Pa, bar	Pascal, bar
Speed	v	m/s	meter per second
Temperature	T	K	Kelvin
Time	t	s	second
Torque	M_t, T	Nm	Newton meter
Volume	V	m^3	cubic meter
Volume flow	$\dot{V}$	m^3/s	cubic meter per second

G Conversion chart (European/USA standards)

Area
1 sq. in. = 6.452 cm^2
1 cm^2 = 0.155 sq. in.
1 sq. ft. = 0.0929 m^2
1 m^2 = 10.764 sq. ft.

Force
1 lbf. = 4.44822 N

Length
1 mm = 0.03937 in
1 in = 25.4 mm
1 ft = 12 in = 0.3048 m
1 m = 3.281 ft
1 yd = 3 ft = 0.914398 m
1 m = 1.09362 yd

Mass
1lb = 0.4536 kg
1 kg = 2.2046 lb
1 oz = 28.35 g
1 g = 0.0353 oz

Pressure
1 bar = 14.5 psi = 100 kPa
1 psi = 0.069 bar
= 6.8965 kPa
1 lb/sq. ft. = 47.88 Pa
= 0.0004788 bar
1 bar = 2089 lb/sq. ft.
1 Pa = 0.0209 lb/sq. ft.

Speed
1 ft./s. = 0,3048 m/s
1 m/s = 3,281 ft./s

Temperature
Δ 1 °C = 1,7999 °F = 1 K
Δ 1 °F = 0,5556 °C = 0,5556 K
0 °C = 32 °F = 273,15 K

Volume
1 cu. in. = 16.387 cm^3
1 cm^3 = 0.0610 cu. in.
1 cu. ft. = 28.317 dm^3
1 dm^3 = 0.0353 cu. ft.
1 US-gallon = 3.785 l
1 l = 0.2642 US-gallon

TERMS AND CONDITIONS OF SALE

1. **Offer and Contract**

Acceptance by Seller of Buyer's order is expressly made conditional on assent to these Terms and Conditions, either by written acknowledgement or by conduct of Buyer that recognizes the existence of the contract with respect to Goods described on this acknowledgement form.

These Terms and Conditions also serve as notice of Seller's objection to and rejection of any Terms and Conditions of purchase or sale included in Buyer's purchase order or other writing that are different from or additional to these Terms and Conditions.

Sales representatives are not authorized to bind Seller.

All written quotations automatically expire thirty (30) days from the date quoted unless otherwise specified.

2. **Prices and Taxes**

Prices are subject to change without notice at any time prior to acceptance of order on Seller's acknowledgement form. All prices are F.O.B. Chicago, Illinois unless otherwise agreed by Buyer and Seller in writing. Buyer agrees to pay all present and future U.S. federal, state and local tax obligations, including but not limited to sales, use and excise taxes. If Buyer claims that the Goods are exempt from any particular tax, Buyer must provide Seller with a tax exemption certificate acceptable to the tax authorities.

3. **Cancellation Charges**

No cancellations or changes of any kind in the purchase order shall be effective unless agreed to in writing by Seller. All changes are accepted subject to adjustment in prices and delivery dates. All cancellations are accepted subject to cancellation charges which will be determined by the Seller and will reflect, among other factors, the expenses already incurred and commitments made by the Seller, sales and administrative overhead and profits.

Seller shall have the absolute right to cancel the order upon (i) material breach of any of these Terms and Conditions by Buyer, or (ii) failure by Buyer to make any payment or (iii) insolvency of Buyer, the filing of voluntary petition in bankruptcy by Buyer, the filing of an involuntary petition to have the Buyer declared bankrupt, the appointment of a receiver or trustee for Buyer, the execution by Buyer of an assignment for the benefit of creditors, or (iv) the discontinuance of business by Buyer or the sale by Buyer of the bulk of its assets other than in the usual course of business. Upon cancellation, Seller shall be entitled to a cancellation charge as described above.

4. **Shipment and Delivery**

All delivery dates are estimates only. Seller's only obligation with respect to delivery dates shall be to use reasonable effort to meet same. All shipments shall be F.O.B. Chicago, Illinois unless otherwise agreed in writing between Buyer and Seller. Title and risk of loss shall pass to Buyer at the F.O.B. point. Unless otherwise agreed in writing, Seller will ship via surface transportation. Sell will not be liable for any delays, breakage, loss or damage after having made delivery in good order to the carrier. Seller reserves the right to insure all shipments at Buyer's expense.

5. **Force Majeure, Waiver**

Seller shall not be liable for any delay to make delivery or failure to deliver due to any clause or contingency beyond the control of Seller (including but not limited to accidents, breakdowns, strikes, riots, sabotage, insurrections, war, delay or interruptions in or failure of sources of materials, supplies, labor, energy or transportation, acts of God or orders of any court, governmental body, authority or agency). Seller may, at its option, allocate available supplies among its customers, including Buyer, in any manner that Seller decides is fair and reasonable, extend the delivery time or cancel the contract for such Goods, in whole or in part. Such allocation, extension of delivery time or cancellation shall not affect the right of Seller to cover for any unpaid Goods previously delivered. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR FOR ANY OTHER LOSS, DAMAGE OR EXPENSE OF ANY KIND INCLUDING LOSS OF PROFITS ARISING IN CONNECTION WITH SUCH FAILURE OR DELAY IN DELIVERY.

6. **Terms of Payment**

Unless otherwise expressly agreed between Buyer and Seller in writing, terms of payment are net thirty (30) days after date of shipment. Seller reserves the right to alter or suspend credit terms and require C.O.D. or advance payment, whenever Seller has reasonable doubt as to Buyer's creditworthiness. If Buyer becomes delinquent in payment or refuses to accept C.O.D. shipments, Seller shall have the right, in addition to any other rights it may have, to cancel any order of Buyer's, without further deliveries and declare all unpaid amounts for Goods previously delivered immediately due and payable. Each shipment shall be considered a separate and independent transaction and payment therefore shall be made accordingly. Amounts past due shall be subject to a late charge of 1.5% per month. All costs and expenses incurred by Seller as result of non-payment or delinquent payment by Buyer, including collections costs, interest, and reasonable attorneys fees shall be paid by the Buyer.

7. **Claims and Remedies**

All claims for loss or damage in transit are to be made by Buyer directly to the carrier. No deduction of any kind from the invoice amount shall be made. Buyer shall inspect all Goods immediately upon their arrival and shall immediately give written notice to Seller of any claim that the Goods do not conform to the terms of the contract. Seller shall have reasonable access to inspect any allegedly non-conforming Goods. Buyer waives any right to assert any claim against Seller arising from any non-conformity of Goods which would have been observable on reasonable inspection or testing within thirty (30) days after delivery.

Written notice of any alleged defect within the warranty period must be presented t o Seller immediately upon Buyer's discovery of the defect and Seller must be allowed in inspect the Goods while they are in the alleged defective condition. Operation of the Goods must be suspended until written clearance is issued by Seller for continued operation provided that Seller, upon receipt of written notice of an alleged defect, proceeds without unreasonable delay to remedy any defects coming within the warranty.

8. **Warranty, Disclaimer, Limitation of Liability**

General Warranty Terms Applicable To All Goods:

The above warranties by Seller do not extend to any Goods subject to (i) improper installation or storage, (ii) accident, damage, abuse or misuse, (iii) abnormal or unusual operating conditions or applications, (iv) operating conditions or applications above the rated capacity of the Goods, (v) operating conditions or applications not made known to Seller prior to the date of the agreement, or (vi) a purpose or application in any way different from that for which the Goods were designed. Seller's warranty does not extend to any Good or parts thereof that are not manufactured by Seller or that Buyer alters or modifies or that Buyer adds to or incorporates into Seller's Goods (including but not limited to controls, electronics, valves and other parts or equipment and only the warranty, if any, given by the manufacturer thereof, will apply. Seller's obligation under this warranty will not apply to any product which (i) is normally consumed in operations or (ii) has a normal life inherently shorter that the warranty period stated herein.

THE WARRANTY EXPRESSED HEREIN IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IS IN LIEU OF ANY AND ALL OTHER OBLIGATIONS OR LIABILITY ON THE SELLER'S PART. UNDER NO CIRCUMSTANCES WILL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR FOR ANY OTHER LOSS, DAMAGE OR EXPENSE OF ANY KIND, INCLUDING LOSS OF PROFITS, ARISING IN CONNECTION WITH THE CONTRACT OR WITH THE USE OR LIABILITY TO USE SELLER'S GOODS FURNISHED UNDER THE CONTRACT. SELLER'S SOLE LIABILITY AND BUYER'S SOLE REMEDY ARE LIMITED TO EITHER (i) REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR GOODS, OR (ii) AT THE SELLER'S OPTION, RETURN OF THE GOODS TO SELLER AND REFUND OF PURCHASE PRICE. SUCH REMEDY SHALL BE BUYER'S ENTIRE AND EXCLUSIVE REMEDY, IN THE EVENT OF BREACH OF WARRANTY OR NEGLIGENCE OF SELLER.

9. **Confidentiality**

All drawings, diagrams, specifications, and other materials furnished by Seller relating to the sale, installation, service or repair of Goods furnished hereunder and the information therein are proprietary to Seller. Buyer may not reproduce or distribute such materials without the written consent of Seller except to Buyer's employees who may use the material as part of their duties. All such materials relating to the Goods supplied by Seller (except information as may be established to be in the public domain or disclosed through judicial or government action) shall be received in confidence, and Buyer shall exercise reasonable care to hold all such information in confidence.

In the event Buyer's personnel visit Seller's plant or assembly facility or otherwise receive any proprietary to confidential information from Seller, said information shall be retained as confidential by Buyer and not disclosed to any third party without the written consent of Seller.

10. **Limitation of Actions**

Any cause of action arising from this agreement or the breach thereof must be commenced within one (1) year after the cause of action accrues.

11. **Applicable Law**

The law governing the agreement and any further agreement or contractual relation between Seller and Buyer shall be the law of the State of Illinois. The invalidity of any provision of this agreement shall not affect the validity of the remaining provisions.

12. **Non-Assignment**

Buyer's rights and obligations hereunder may not be assigned without prior written consent of Seller.

AIRTEC Pneumatics, Inc.