Directional spool valve type NSWP 2

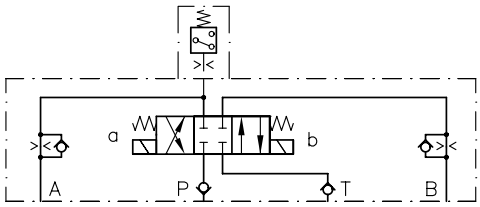
Manifold mounting valve with connection hole pattern conforming DIN 24 340 - A 6 (NG 6)

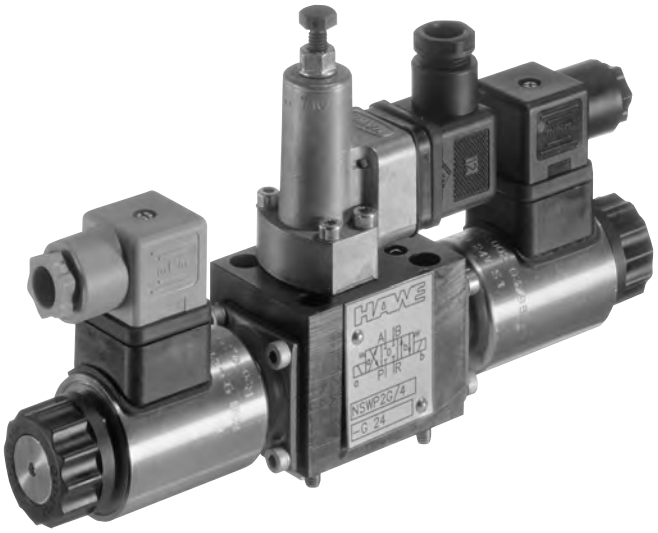
Operation pressure p_{max} = 315 bar
Flow Q_{max} = 25 lpm

See also:

● Directional spool valve	type SW 2	D 7451
● Directional valve bank	type SWR 2	D 7451
● Directional valve bank	type SWS 2	D 7951
● Clamping modules	type NSMD 2	D 7787
● Directional seated valves	type NG etc.	D 7300 N
● Directional seated valves	type NBVP 16	D 7765 N
● Valve banks	type BA 2	D 7788
● Intermediate plates	type NZP	D 7788 Z

Order example:
NSWP 2 G/M/R/ABR1,0 BBR0,8/50/S-G 24



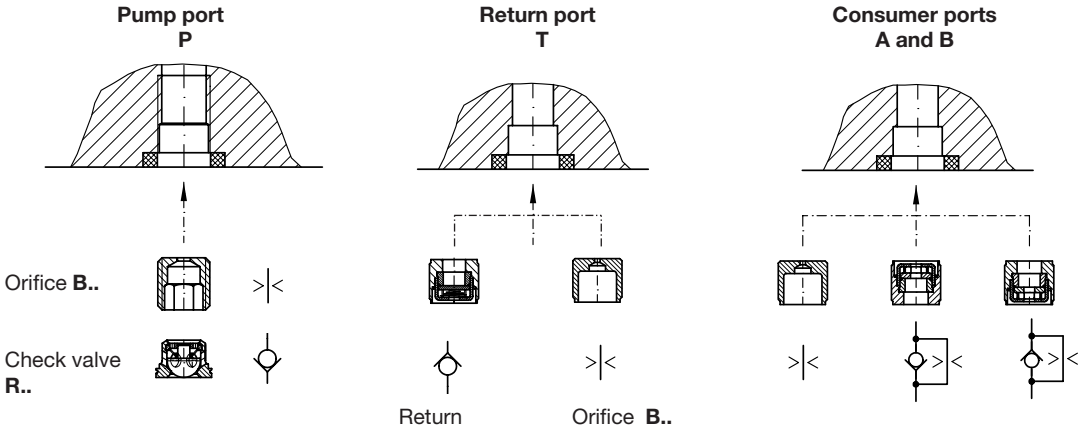


1. General information

Type NSWP 2 was developed as addition to the other already available directional spool valves type SW 2, SWP 2, SWR 2 acc. to D 7451, and SWS 2 acc. to D 7951.

Special features:

- Industrial standard connection hole pattern
- Directly mounted pressure switch monitoring the consumer port
- Various actuation solenoid versions
- Rapid traverse-creeping circuitry
- Differing flow ratings of the spools for the for proportional or throttle spool versions
- Optional elements in the pump, consumer, and return port
- Individual connection block for direct pipe connection

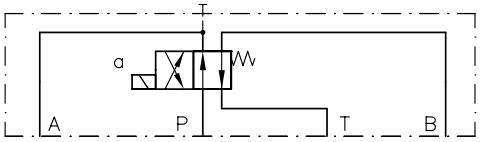


2.1

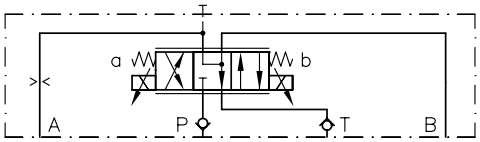
2. Available versions, main data

Order example 1 **NSWP 2 W/M/20 - WG 230** [1])
Order example 2 **NSWP 2 D 06/MP /R/ABR 1,0/20 /S - G 24**
Order example 3 **NSWP 2 G /MM66/R /50 /B 1,0 - G 24 - 3/8**

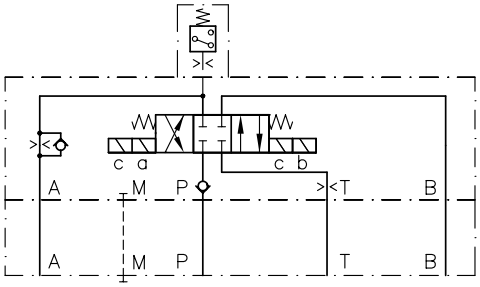
Order example 1



Order example 2



Order example 3



- Individual connection block for direct pipe connection
- Actuation solenoid (see table 8)
- Additional elements at port T (see table 7)
- Pressure switch or pressure gauge (see table 6)
- Additional elements for ports A and/or B (see table 5)
- Additional elements at port P (see table 4)
- Solenoid version (see table 3)

Table 1: Basic type

Coding, description		Flow Q_{max} (lpm)	Pressure p_{max} (bar)
NSWP 2	With industrial standard hole pattern DIN 24 340-A 6	25	315

Table 2: Symbols

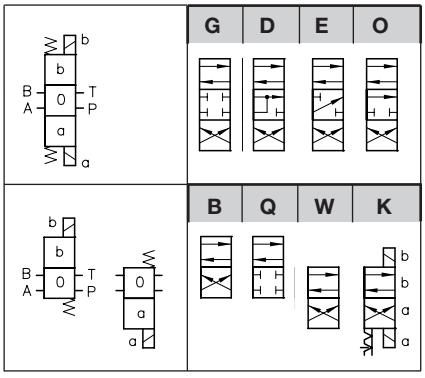


Table 3: Solenoid version

Coding	Description
/M	On/off solenoid
/MK	On/off solenoid with stroke limitation for A and B (Wing screw with lock nut) [2] [3]
/MD	On/off solenoid with stroke limitation (knob) for A and B [2] [3]
/MP	Proportional solenoid [2] [3]
/MPF	Prop. solenoid with stroke limitation [2] [3]
/MM...	Double solenoid for rapid traverse / creeping circuitry at A and B [2] [4] Throttle for 2. speed rate

4	**5**	**6**	**7**	**8**	**9**	**1**	**2**
∅ (mm)							
0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2

Symbols

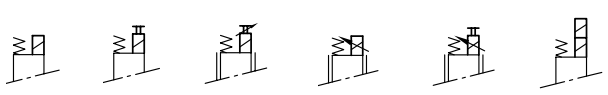


Table 2 a: Flow

Actuation (table 3)	/M /MM..	/MP, /MPF, /MK and /MD [3]			
Coding	no coding	**03**	**06**	**12**	**20**
Q_{max} (lpm)	---	3	6	12	20

[1]) Example for simplified coding, for versions without additional elements
[2]) Version with ex-proof solenoid only with solenoid actuation coding **/M**
[3]) Available only for symbols G, D, E, and O
[4]) Specification is required for both sides, e.g. /MM**67**, for additional info see sect. 5.1

Table 4: Additional elements at port P

Additional element (also in combination)	Coding [1]	∅ (mm)
without	---	---
Orifice	**B 0,4**	0.4
	B 0,5	0.5
	B 0,6	0.6
	B 0,7	0.7
	B 0,8	0.8
	B 0,9	0.9
	B 1,0	1.0
	B 1,1	1.1
	B 1,2	1.2
	B 1,4	1.4
	B 1,5	1.5
	B 1,8	1.8
	B 2,0	2.0
	B 2,4	2,4
	B 2,5	2.5
	B 3,0	3.0
	B 3,5	3.5
	B 4,0	4.0
Check valve	**R**	---

Table 5: Additional elements for ports A and/or B

Additional element	Coding [1] [2] at port A	at port B	∅ (mm)
Orifice in A and/or B	**AB 0,3**	**BB 0,3**	0.3
	AB 0,4	**BB 0,4**	0.4
	AB 0,5	**BB 0,5**	0.5
	AB 0,6	**BB 0,6**	0.6
	AB 0,7	**BB 0,7**	0.7
	AB 0,8	**BB 0,8**	0.8
	AB 0,9	**BB 0,9**	0.9
	AB 1,0	**BB 1,0**	1.0
	AB 1,2	**BB 1,2**	1.2
	AB 1,5	**BB 1,5**	1.5
	AB 2,0	**BB 2,0**	2.0
	AB 2,5	**BB 2,5**	2.5
Restrictor check valve at A and/or B throttling in direction to the consumer	**ABV 0,6**	**BBV 0,6**	0,6
	ABV 0,7	**BBV 0,7**	0,7
	ABV 0,8	**BBV 0,8**	0,8
	ABV 0,9	**BBV 0,9**	0,9
	ABV 1,0	**BBV 1,0**	1,0
	ABV 1,2	**BBV 1,2**	1,2
	ABV 1,5	**BBV 1,5**	1,5
	ABV 2,0	**BBV 2,0**	2,0
Restrictor check valve at A and/or B unthrottled flow to the consumer	**ABR 0,6**	**BBR 0,6**	0,6
	ABR 0,7	**BBR 0,7**	0,7
	ABR 0,8	**BBR 0,8**	0,8
	ABR 0,9	**BBR 0,9**	0,9
	ABR 1,0	**BBR 1,0**	1,0
	ABR 1,2	**BBR 1,2**	1,2
	ABR 1,5	**BBR 1,5**	1,5
	ABR 2,0	**BBR 2,0**	2,0

Table 6: Pressure switch or pressure gauge at port A or B

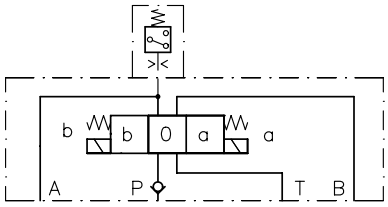
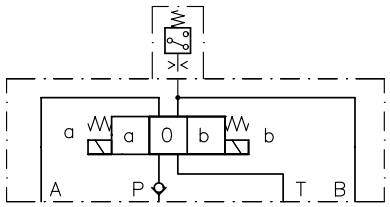
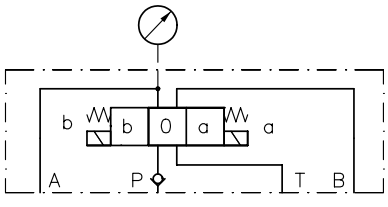
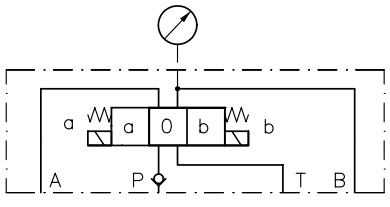
Pressure switch acc. to D 5440 (adjustable range)	at port A		at port B	
without DG (prepared for retrofitting)	**20**		**02**	
DG 33 (200 ... 700 bar)	**30**		**03**	
DG 34 (100 ... 400 bar)	**40**		**04**	
DG 35 (20 ... 250 bar)	**50**		**05**	
DG 36 (4 ... 12 bar)	**60**		**06**	
DG 365 (12 ... 170 bar)	**70**		**07**	
DG 364 (4 ... 50 bar)	**80**		**08**	
Pressure gauge acc. to D 7077 with scale up to	(mounting via adaptor Y9)			
100 bar	**A9/100**		**B9/100**	
160 bar	**A9/160**		**B9/160**	
250 bar	**A9/250**		**B9/250**	
400 bar	**A9/400**		**B9/400**	

Table 7: Additional elements at port T

Additional element	Coding	Open-up pressure
without	---	
Return pressure stop (check valve)	**S**	approx. 0.07 bar
	S 0,2	approx. 0.2 bar
	S 1	approx. 1.5 bar
Orifice	**B 0,7 .. B 2,5**	see coding AB.. resp. BB.. in table 5

Table 8: Actuation solenoid

Standard (with plug)	Without plug	With plug incl. LED's	Nominal voltage
G 12	**X 12**	**L 12**	12 V DC
G 24	**X 24**	**L 24**	24 V DC
G 24 EX	---	---	24 V DC [3]
WG 110	**(X 98)**	---	110 V AC 50 / 60 Hz
WG 230	**(X 205)**	---	230 V AC 50 / 60 Hz

[1] Spare part No. for retrofitting or stock etc., see appendix sect. 5.2

[2] Versions A(B)**BR..** and A(B)**BV..** are identical, but the installed position differs (see illustration in sect. 1)

[3] An explosion proof solenoid is only available for solenoid version **/M** (see table 3). p_{max} = 220 bar, Q_{max} = 12 lpm for symbols B and W duty cycle > 75%

3. Further parameters

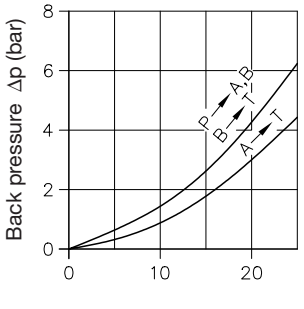
3.1 General and hydraulic data

Design	Directional spool valve
Surface protection	Spool valve housing and solenoid, zinc galvanized
Installed position	Any, for fastening see dimensional drawings in section 4
Hydr. connection	Via manifold
Port coding	According to dimensional drawing or DIN 24 340-A 6
Flow direction	In accordance with arrow direction in the flow pattern symbols; It is not permissible to reverse the flow direction!
Over lapping	Positive
Operation pressure	p_{max} = 315 bar (all ports) p_{max} = 200 bar for version with ex-proof solenoid and with version /MP, /MPF (pure throttling spool valve), Q_{max} = 12 lpm for symbols B and W duty cycle > 75%
Flow	Flow Q_{max} = 25 lpm; Permissible return flow approx. 50 lpm
Hydraulic fluid	Fluids acc. to DIN 51524 table 1 to 3; ISO VG 10 to 68 acc. to DIN 51519 Viscosity range: min. approx. 4; max. approx. 1500 mm²/s Optimal operation range: approx. 10...500 mm²/s Also suitable are biologically degradable pressure fluids of the type HEPG (Polyalkylenglycol) and HEES (synth. Ester) at operation temperatures up to approx. +70°C.
Temperature	Ambient: approx. -40...+80°C; Fluid: -25...+80°C, pay attention to the viscosity range! Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during subsequent running is at least 20K higher. Biological degradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C. **Restrictions for version with ex-proof solenoid!**
Mass (weight)	Directional spool valves coding G, D, E, O, K = approx. 1.6 kg; B, Q, W = approx. 1.1 kg + 0.3 kg for versions with pressure switch DG 3

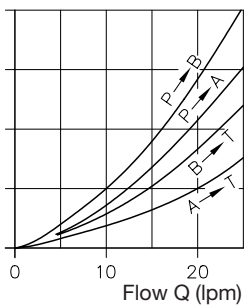
Δp-Q-curve

Viscosity during measuring approx. 60 mm²/s

Type NSWP 2 G (D, E, Q, O)

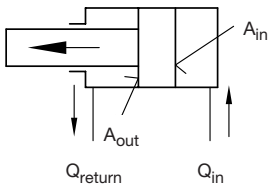


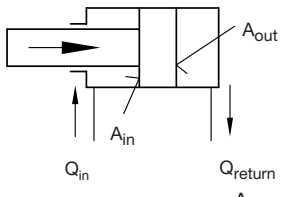
Type NSWP 2 B (W, K)



The curves apply to only one flow direction P→T (idle circulation), P→A(B) or A(B)→T. The total back pressure (Δp_{total}) with 4/3- or 4/2-way directional valves is taken at P. It consists of an inflow share (Δp_{in}) and an outflow share (Δp_{out}). Important: Consumers with unequal area ratio (e.g. differential cylinders) show uneven flow at the consumer ports, i.e. also (Δp_{in}) and (Δp_{out}) won't be equal regardless of the direction of movement!

$$Q_{return} = Q_{in} \frac{A_{out}}{A_{in}}$$

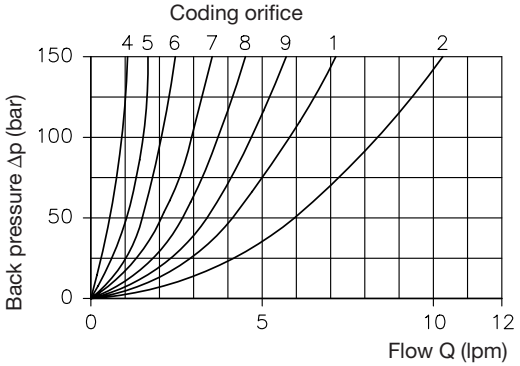




$$\Delta p_{total} = \Delta p_{in} + \Delta p_{out} \frac{A_{out}}{A_{in}}$$

2. speed rate, ports A and B

Coding orifice

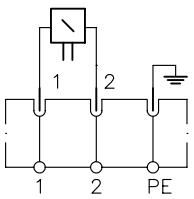


3.2 Solenoid

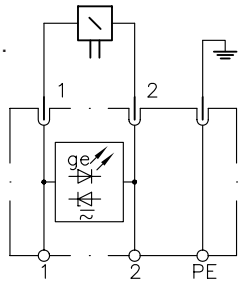
Solenoid	Wet armature solenoid, manufactured and tested conforming VDE 0580 Reference value for nom. power $P_N \approx 24.4$ W ± approx. 6% dep. on nom. voltage U_N and make								
Coding	G 12 X 12 L 12	G 24 X 24 L 24	G 24 EX 2)	G 48 X 48	G 80 X 80	G 98 X 98 1)	G 205 X 205 1)	WG 110	WG 230
Nominal voltage U_N	12 V DC	24 V DC	24 V DC	48 V DC	80 V DC	98 V DC	205 V DC 50/60Hz	110 V AC 50/60Hz	230 V AC
Nom. power P_N (W)	28	28	23	28	28	28	28	28	28
Nom. current I_{20} (A)	2.34	1.17	0.97	0.58	0.35	0.28	0.14	0.28	0.14

Port and circuitry (valid for solenoid a and b)

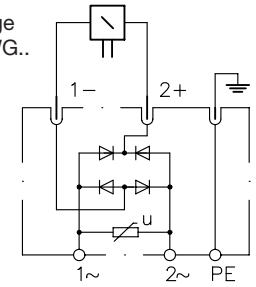
DC-voltage Coding G..



Coding L...



AC-voltage Coding WG..

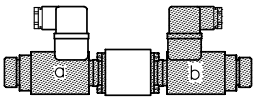


Plug

EN 175 301-803 A, see also D 7163

Coding G (...V DC) is only available with gray or black plugs.
Coding WG (..V AC) is only available with black plugs, featuring an internal bridge rectifier circuit

Gray plug Black plug



Relative duty cycle: 100% Stamping on the solenoid

Operation:

at ambient temperature (°C)	< 40	60	80
Duty cycle (%)	100	approx. 60	approx. 40

Switching times (ref. value)	On: approx. 60 ... 70 ms Off: approx. 30 ... 60 ms
Switching operations	approx. 3600 switchings / h
Protection class	IP 65 (IEC 60529) (plug properly mounte)
Insulation material class	H
Surface temperature	approx. 85°C at 20°C ambient temperature

Mounting

Coding /M:	The solenoid can be simply axially removed and replaced by a new one after undoing the knurled screw.
Coding /MP, /MPF:	The solenoid can be simply axially removed and replaced by a new one after removal of the circlip.
Coding /MK, /MD, /MM..:	The solenoid can be simply removed and replaced by a new one after undoing of the 4 tension rods / screws.

Prop.-solenoid coding /MP.. (differing of above):

Solenoid	conforming VDE 0580	
Nom. voltage U_N	12 V DC	24 V DC
Coil resistance R_{20}	6.0 Ω	24.0 Ω
Current, cold I_{20}	2.5 A	1.25 A
Nom. current $I_N \approx 70\%$ of I_{20}	1.35 A	0.88 A
Power, cold $P_{20} = R_{20} \times I_{20}^2$	30 W	30 W
Nom. power $P_N = R_{20} \times I_{20}^2$	21 W	21 W
Required dither frequency	50 ... 80 Hz	
Dither amplitude	20 ... 40% of I_N	
Relative duty cycle	100% (reference temp. ϑ_{11} = 50°C)	

1) These solenoids are intended to be connected via a customer furnished bridge rectifier to mains 50/60Hz: G 98 (X 98) for mains 110 V AC; G 205 (X 205) for mains 230 V AC

2) **Explosion-proof version**

ATEX-Certificate of conformity	TÜV-A 12ATEX 0006 X
Coding	⟨Ex⟩ II 2 G Ex d IIB + H2 T4 Gb ⟨Ex⟩ II 2 D Ex tb IIIC T135°C Db
Oper. duration	100% ED
Duty cycle	IP 67 (IEC 60529)
Nom. voltage U_N	24 V DC
Power P_N	23 W
Restrictions for use:	
Ambient temperature	-35 ... +40°C
max. fluid temperature	+70°C
el. protection against overload (conf. IEC 60127)	$I_F < 1{,}6$ A-T
Surface coating	Housing galvanically zinc coated Coil and connection cavity are moulded
Electrical connection	3x0,5 mm²
Cable length	3 m, Option 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart)

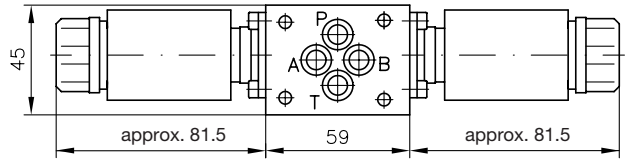
Attention: Protect the complete valve against direct sun light.

Observe the operation manuals B 03/2004 and B ATEX!
Electrical lay-out and testing conforming EN 60079, VDE 0170-1, VDE 0170-5

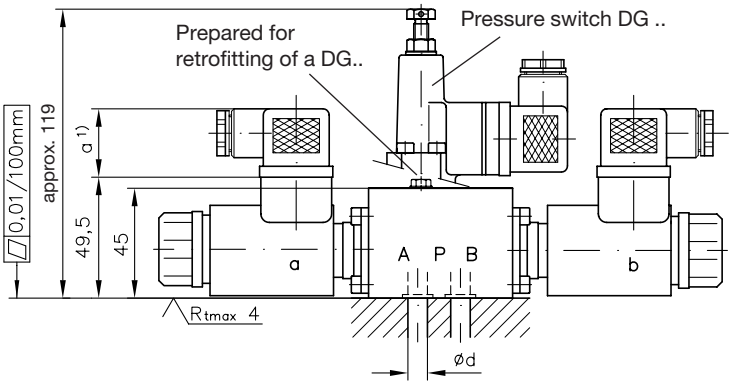
4. Unit dimensions

All dimensions in mm, subject to change without notice !

4/3- and 4/2-way directional spool valves
coding **G, D, E, O, K**
(Illustration with solenoid /M, for other solenoids see below)

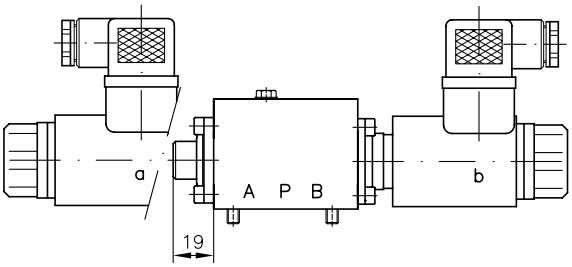


Port	∅ d	Sealing via O-ring NBR 90 Sh
A and B	7	9.25 x 1.78
P	6.5	
T	7	



4/2-way directional spool valve

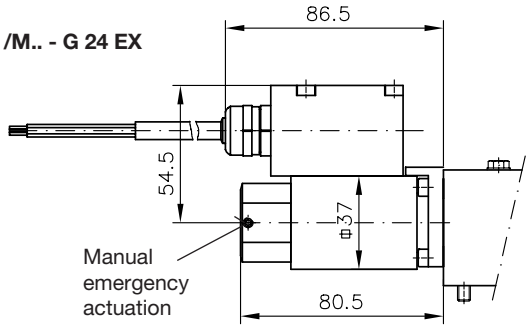
Coding **W**

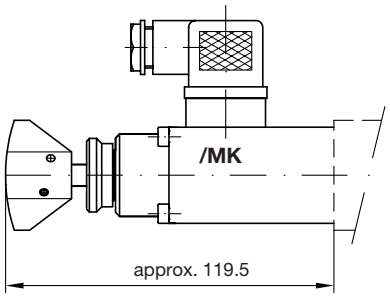


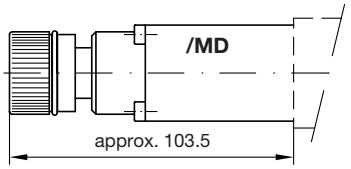
Coding **B** and **Q**

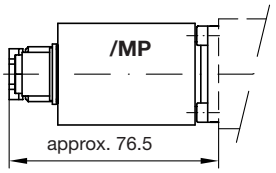
Additional solenoids acc. to table 3, sect. 2

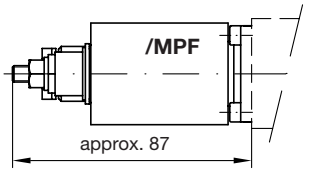
/M.. - G 24 EX



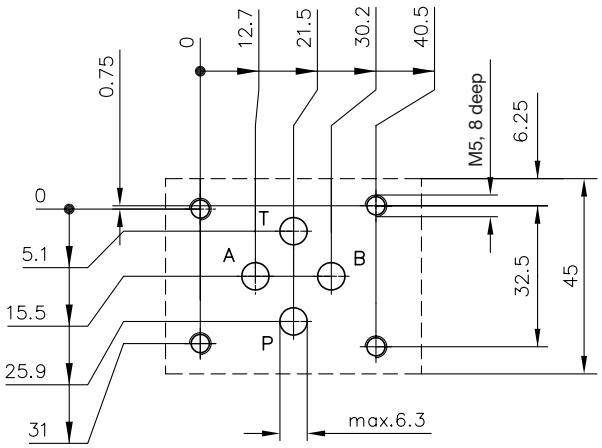




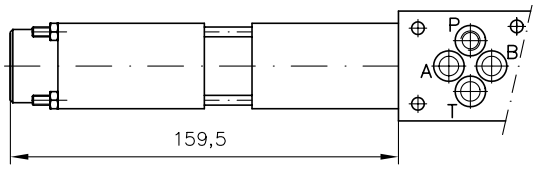


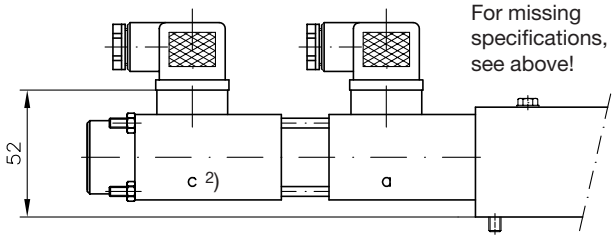


Hole pattern of the manifold (top view)



/MM..

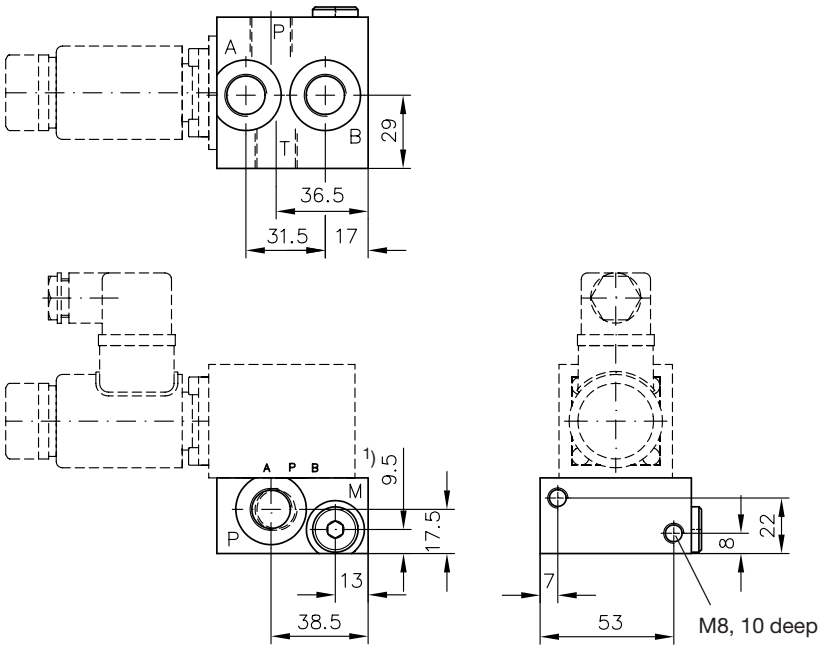




1) a = 29 (G 12 to G 205); 34 (WG 230)
This dimension depends on the manufacturer and may be up to 40 mm acc. to EN 175 301-803 A !

2) Solenoid c for 2. speed rate

Version with individual connection block



Ports conf. ISO 228/1 (BSPP):
A, B, P, T = G 3/8
(M = G 1/4)

1) M, can be used only together with clamping module type NSMD acc. to D 7787

5. Appendix

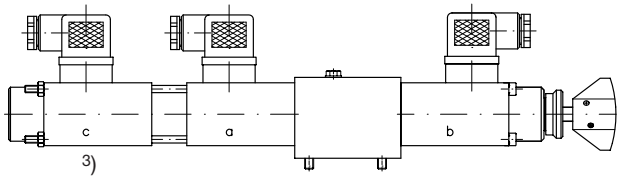
5.1 Notes regarding the uneven solenoid actuation

The notes below have to be observed, when differing solenoid versions are to be combined for a and b:

Order examples: **/MM 6 - MK**
/M - MD

Magnet a — Magnet b

Attention: The stroke limitation (/MK or /MD) at these examples is only active for solenoid a (/MM 6 or /M).



Combination possibilities

Solenoid a	Solenoid b /M, /MD, /MK 2)	/MP, /MPF 2)	/MM..
/M, /MD, /MK	●	---	●
/MP, /MPF	---	●	---
/MM..	●	---	●

2) Combinations of these are also possible

3) Solenoid c for 2. speed rate

5.2 Parts No. of the orifices, when ordering spare parts

Coding	Parts No.
B ... (at port P)	Grub screw ISO 4026 - M8x8 - ... - 10.9 └ Diameter
R	ER 13
S	ER 14
S 0,2	ER 14/0,2
S 1	ER 14/1
ABV ... **BBV ...** **ABR ...** **BBR ...**	EBR 14-B... └ Diameter

Coding	Parts No.	
AB ...	7966 003 m	(without hole)
BB ...	7966 003 h	(∅ 0.3)
	7966 003 i	(∅ 0.4)
	7966 003 k	(∅ 0.5)
	7966 003 l	(∅ 0.6)
	7966 003 a	(∅ 0.7)
	7966 003 n	(∅ 0.8)
	7966 003 f	(∅ 0.9)
	7966 003 b	(∅ 1.0)
	7966 003 g	(∅ 1.2)
	7966 003 c	(∅ 1.5)
	7966 003 d	(∅ 2.0)
	7966 003 e	(∅ 2.5)

5.3 Type coding

Order example:

NSWP 2 D 06/M/B0,8R/ABR1,0/20/ S - G 24 - 3/8

Individual connection block

Nominal voltage (acc. to table 8)
G 12, G 24, WG 110, WG 230
X 12, X 24, X 98, X 205
L 12, L 24
G 24 EX

Additional function, pressure switch (acc. to table 6)
Port B:

02	Without (prepared for retrofitting of a DG 3..)
03, 04, 05, 06, 07	With DG 3.. (acc. to D 5440)
B 9/...	Pressure gauge

Port A:

20	Without (prepared for retrofitting of a DG 3..)
30, 40, 50, 60, 70	With DG 3.. (acc. to D 5440)
A 9/...	Pressure gauge

Additional elements

Port P (acc. to table 4)

B ...	Orifice
R	Check valve
B.. R	Combination orifice - check valve

Port T (acc. to table 7)

S, S 1	Return pressure stop
B 0,7 ... 2,5	Orifice

Port A and/or B (acc. to table 5)

AB ...	Orifice in A
BB ...	Orifice in B
ABR ...	Restrictor check valve in A
BBR ...	Restrictor check valve in B
ABV ...	Restrictor check valve in A
BBV ...	Restrictor check valve in B

Solenoid version (acc. to table 3)

/M	On/off solenoid
/MK	On/off solenoid with stroke limitation (wing screw with lock nut)
/MD	On/off solenoid with stroke limitation (knob)
/MP	Prop. solenoid
/MPF	Prop. solenoid with stroke limitation
/MM..	Double solenoid for rapid traverse /creeping circuitry with orifice diameter spec. for the second speed rate (acc. to table 3)

Flow (acc. to table 2 a)

no coding	for solenoid /M and /MM..
03, 06, 12, 20	for solenoid /MP, /MPF, /MK and /MD

Symbols (acc. to table 2)

G, D, E, O	4/3-way functions
W, Q, B, K	4/2-way functions

Basic type and size (acc. to table 1)
NSWP 2