Directional spool valve type WEH16 electro-hydraulically operated

ES 000 004

01.2022

NS16	up to 35 MPa	up to 240 dm³/min

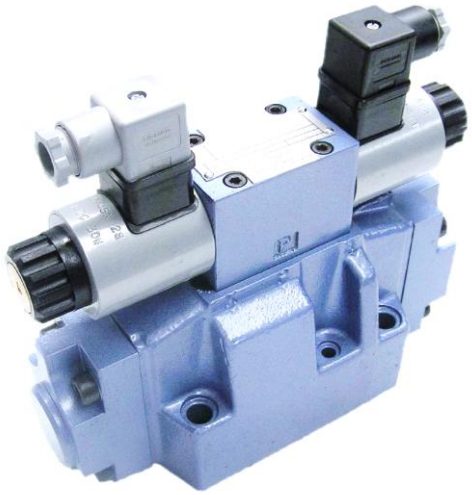
DATA SHEET - OPERATION MANUAL

APPLICATION

Directional spool valves type **WEH16…** electro-hydraulically operated are intended for change in direction of fluid flow in a system and thus it allows to change direction of movement of a receiver - mostly piston rod of a cylinder or hydraulic motor as well to use functions: *on* and *off*. These directional spool valves are used for subplate mounting in any position in a hydraulic system.

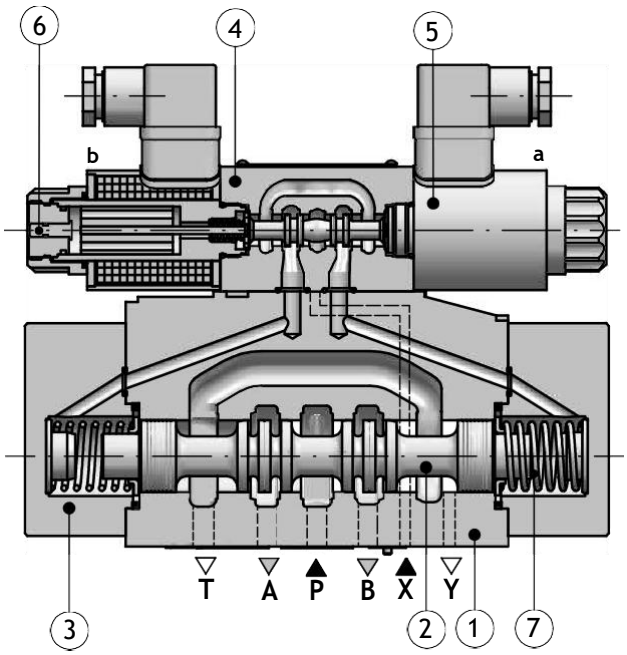
The directional spool valve type **WEH16…** is complied with the regulations of directive **2006/95/WE** for the following voltages:

- **50 - 250 V** for **AC**
- **75 - 250 V** for **DC**

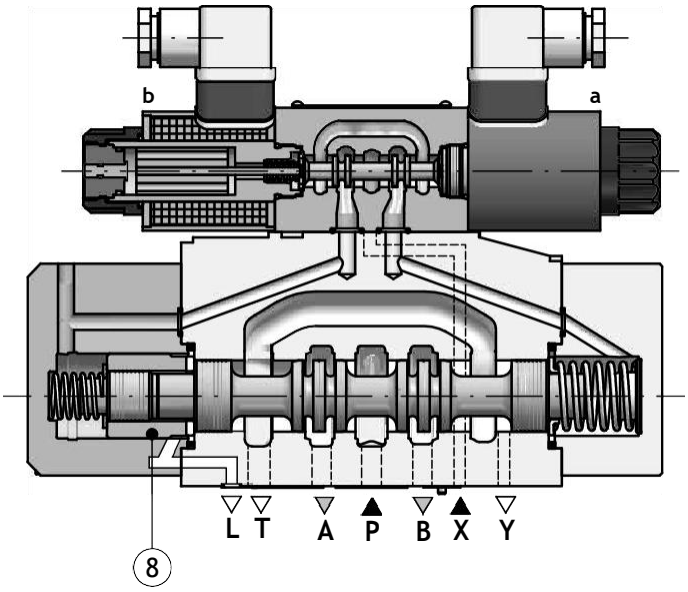


DESCRIPTION OF OPERATION

H-4WEH16E73/G24NZ4



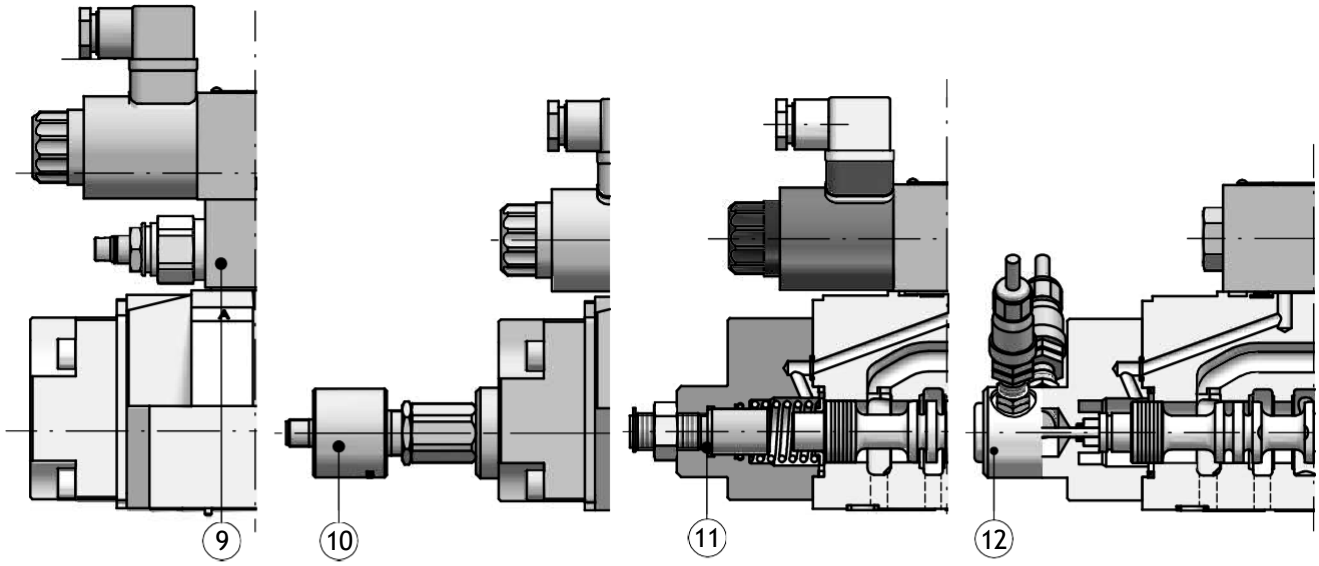
H-4WEH16HE73/G24NZ4



Main bore and annular ports **P**, **T**, **A**, **B** are made in the housing (1) and connected to its subplate connection. Directional valve is switched by shifting the spool (2) into one end position. Various control functions are dependent on the spool (2) which affects the change in configuration of connections among ports **P**, **T**, **A**, **B** in the housing (1). The spool (2) is shifted from its neutral position by affecting pressure of hydraulic fluid supplied via pilot valve (4) into one chamber of caps (3). The pilot valve (4) - type **WE6…** is operated by means of solenoids (5). In case of failure, the pilot valve (4) may be shifted manually by means of manual overrides (6) - version …4WEH16…/…**N**. The spool (2) is centered in neutral position by means of springs (7) - version …4WEH16…/**…** or may be hydraulically operated by the fluid pressure from the pilot valve (4) - version …4WEH16**H**…/… - for 3-position directional valves the centering is possible by means of the sleeve (8).

DESCRIPTION OF OPERATION

...WEH16.../...S... ...WEH16.../...M... ...WEH16.../...11... ...WEH16.../...18...



Directional spool valves may be provided with the pilot choke adjustment (9) as well as with accessories such as: spool position sensor (10), spool stroke limiter (11), spool end position monitor (12). Accessories may be mounted depending on version of directional valve like given on pages 14 - 25.

TECHNICAL DATA

Hydraulic fluid	
Hydraulic fluid	mineral oil
Required fluid cleanliness class	**ISO 4406 class 20/18/15**
Nominal fluid viscosity	37 mm ^{2}/s at temperature 55 ^{o}C
Viscosity range	2,8 up to 380 mm ^{2}/s
Fluid temperature range (in a tank)	recommended 40 ^{o}C up to 55 ^{o}C max -20^{o}C up to +70 ^{o}C
Ambient temperature range	- 20 ^{o}C up to +50 ^{o}C
Max operating pressure	
Ports **A, B, P** • version **H-4 WEH 16.../...** • version **4 WEH 16.../...** Port **T** • pilot fluid return **Y- external** • pilot fluid return **Y- internal** (2-position and 3-position directional valve spring centered only, no 3-position version hydraulically centered with Y- internal	 **35 MPa** **28 MPa** **25 MPa** **21 MPa**
Max control pressure	**25 MPa**
Min control pressure	
Pilot fluid supply **X- external** • 3-position directional valve • 2-position directional valve spring positioned • 2-position directional valve hydraulically positioned Pilot fluid supply **X- internal** (When pre-load valve applied or when flow rate is suitably high) • versions **4 WEH 16...** with spools **G,H,F,S,T** • versions **H-4 WEH 16.../...D1...** with spools **G,H,F,S,T**	 0,8 MPa 1,0 MPa 0,5 MPa 0,45 MPa 0,7 MPa

TECHNICAL DATA

Fluid volume required to operate the valve	
3-position spring centered directional valve	5,75 cm^3
3-position hydraulically centered directional valve	
• from ***0*** (neutral) to operated position ***a***	2,85 cm^3
• from ***0*** (neutral) to operated position ***b***	5,75 cm^3
• from operated position ***a*** to ***0*** (neutral) position	2,9 cm^3
• from operated position ***b*** to ***0*** (neutral) position	2,3 cm^3
2-position directional spool valve	11,5 cm^3
Total time of spool shifting from neutral to end position	
3-position spring centered directional valve	
at pilot pressure p st = 5 MPa	50 ms
p st =15 MPa	45 ms
p st =25 MPa	40 ms
3-position hydraulically centered directional valve	
• solenoid **a** operation	
at pilot pressure p st = 5 MPa	40 ms
p st = 15 MPa	40 ms
p st = 25 MPa	40 ms
• solenoid **b** operation	
at pilot pressure p st = 5 MPa	50 ms
p st = 15 MPa	45 ms
p st = 25 MPa	40 ms
2-position directional valve	
at pilot pressure p st = 5 MPa	55 ms
p st = 15 MPa	50 ms
p st = 25 MPa	45 ms
Total time of spool shifting from end to neutral position	
3-position spring centered directional valve	
at pilot pressure p st = 5; 15; 25 MPa	40 ms
3-position hydraulically centered directional valve	
• solenoid **a** operation	
at pilot pressure p st = 5 MPa	30 ms
p st = 15 MPa	25 ms
p st = 25 MPa	20 ms
• solenoid **b** operation	
at pilot pressure p st = 5 MPa	40 ms
p st = 15 MPa	35 ms
p st = 25 MPa	30 ms
2-position directional valve	
at pilot pressure p st = 5 MPa	35 ms
p st = 15 MPa	30 ms
p st = 25 MPa	25 ms

TECHNICAL DATA

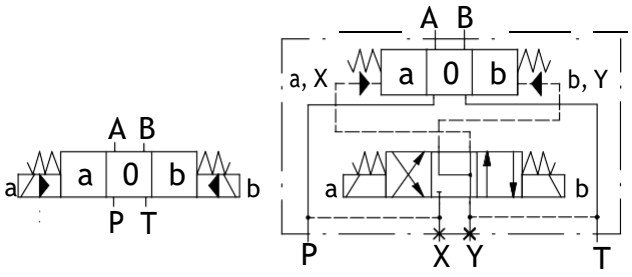
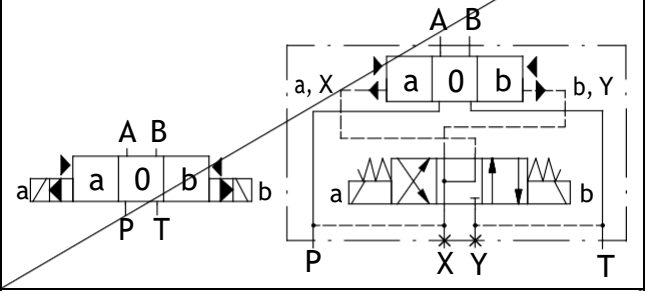
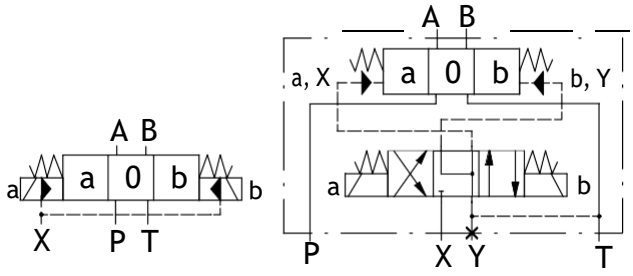
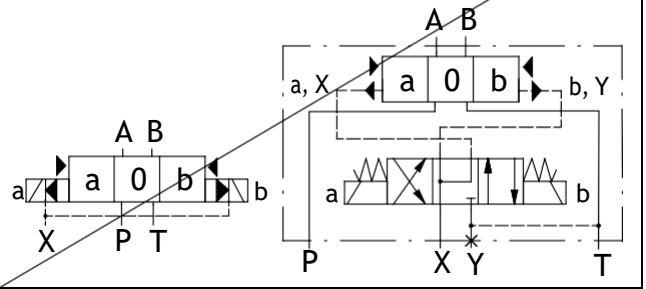
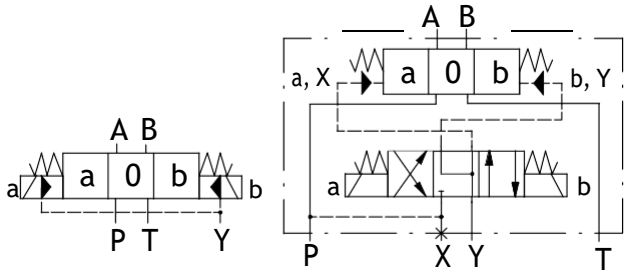
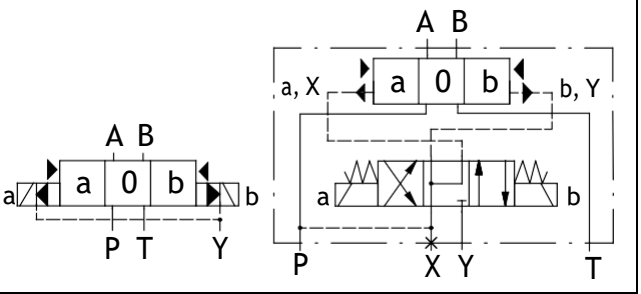
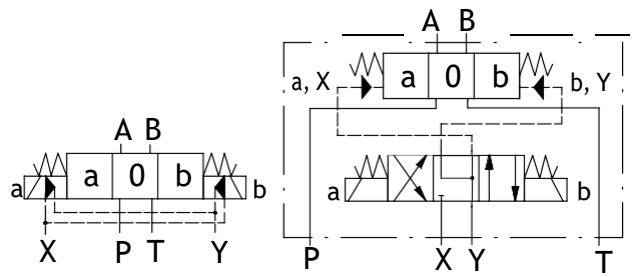
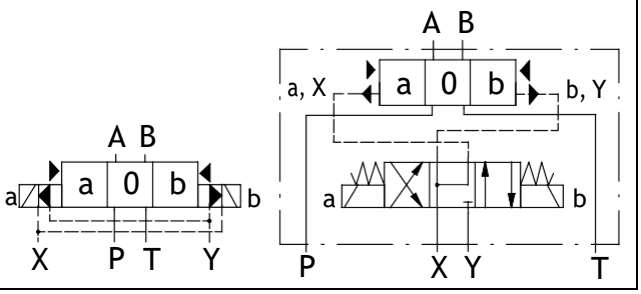
Pilot valve							
Type of pilot valve • for 3-position spring centered main directional valve • for 2-position spring centered main directional valve (**a**, **0**) • for 2-position spring centered main directional valve (**0**, **b**) • for 3-position hydraulically centered main directional valve • for 2-position hydraulically centered main directional valve (**a**, **0**) • for 2-position hydraulically centered main directional valve (**0**, **b**) • for 2-position main directional valve	4WE6 **J**... 4WE6 **JA**... 4WE6 **JB**... 4WE6 **M**... 4WE6 **MA**... 4WE6 **MB**... 4WE6 **D**... or 4WE6 **D**... /**O**... or 4WE6 **D**... /**OF**...						
Supply voltage of solenoids	**DC**			**AC** (plug-in connector with rectifier)			**AC** direct supply
	12V	**24V**	**110V**	**230V-50Hz**	**220V- 50Hz**	**110V- 50Hz**	**230V- 50Hz**
Supply voltage tolerance Power requirement (DC) **Degree of protection** Temperature of solenoid coil	±10% **30** W **IP 65** max 150 °C						
Inductive spool position sensors							
Type of sensors **Supply voltage** **Max load current** **Connection type of sensor** **Connection type of conductor** **External diameter of conductor** **Degree of protection**	**two PNP inductive proximity sensors:** **normally closed - NC** (contact breaker) + **normally opened - NO** (contact maker) **10 - 30V DC** **200 mA** sensor with **M12x1 external thread, male connection** plug with **M12 x 1 internal thread, female plug** configuration of connection according to **PN-EN-61076 -2-101** φ **2,5 - 6,5 mm** (**PG7**) **IP 67**						
Weight	max 10,5 kg						

INSTALLATION AND APPLICATION REQUIREMENTS

1. Only fully functional and operational valve, properly connected to electrical installation must be used. Connecting or disconnecting the valve to an electrical installation must only be carried out by qualified personnel.
2. Ground connection (⏚) must be connected with protective earth wire (PE⏚) in supply system according to appropriate instructions.
3. Solenoid plug shall precisely adhere to socket and shall be secured with thread bolt screwed in securely in a place. It is forbidden to operate the valve if the tightness and suitable clamp of cable in the plug gland are not ensured.
4. For the ...W230 - 50... pilot valve version, simultaneous joining of two solenoids of the same valve should not be permitted (partial overriding of the valve can overheat and damage the winding coils).
5. During the period of operation must be kept fluid viscosity acc. to requirements defined in this Data Sheet - Operation Manual
6. In order to ensure failure free and safe operation the following must be checked:
   - condition of the electrical connection
   - proper working of the valve
   - cleanliness of the hydraulic fluid
7. Due to heating of electromagnet solenoid coils to high temp., the valve shall be placed in such way to eliminate the risk of accidental contact with solenoid during operation or to apply suitable covers acc. to PN - EN ISO 13732 -1 and PN - EN 982
8. In order to ensure tightness of the directional valve block, one should take care of dimension of sealing rings and valve operation parameters given in this Data Sheet - Operation Manual
9. A person that operates the valve must be thoroughly familiar with this Data Sheet - Operation Manual.

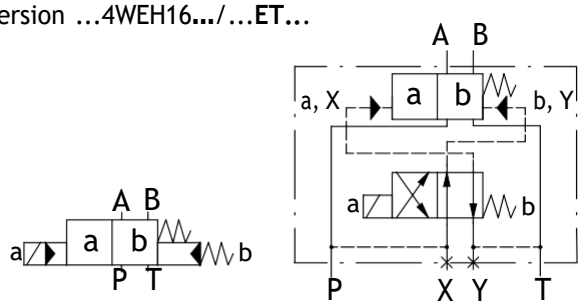
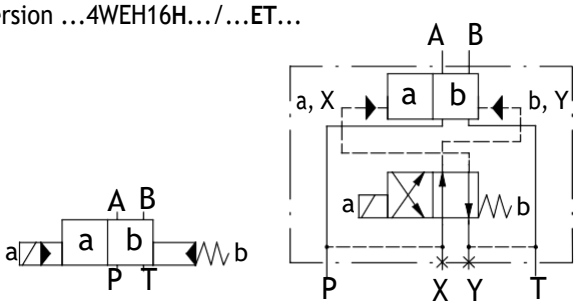
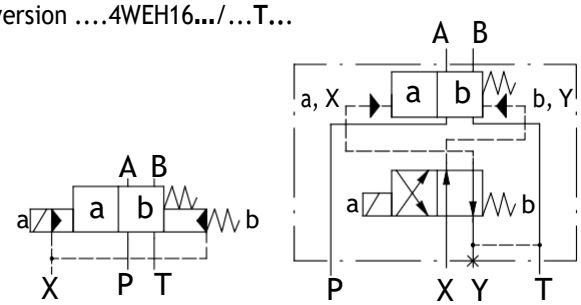
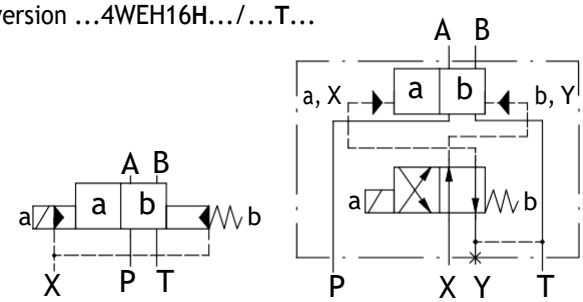
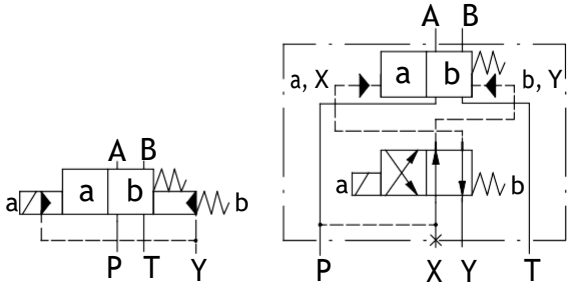
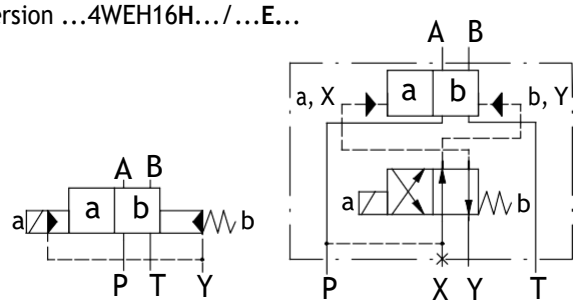
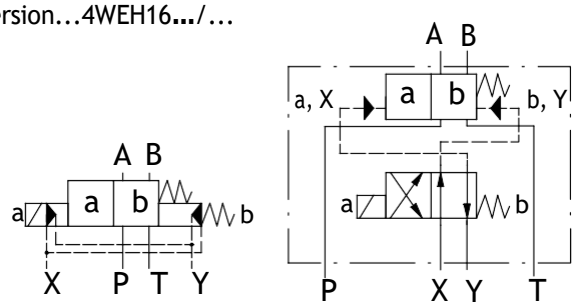
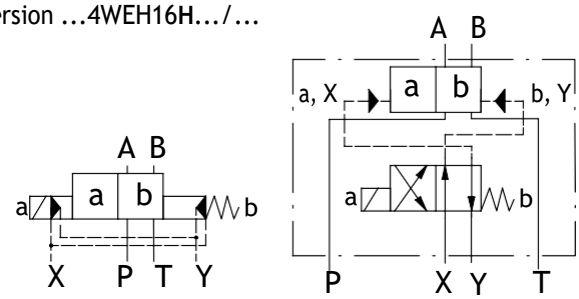
DIAGRAMS

Simplified and detailed hydraulic diagrams for 3-position directional valves with various pilot supply (X) and pilot drain (Y)

3-position directional valves with spring centered spool at ***0*** position in main valve and pilot valve version ...4WEH16**...**/...	3-position directional valves with hydraulically centered spool at ***0*** position in main valve and spring centered spool in pilot valve version ...4WEH16**H**.../...
internal supply (X); **internal** drain (Y) version ...4WEH16**...**/...**ET...** 	**internal** supply (X); **internal** drain (Y) version ...4WEH16H.../...ET...- impossible 
external supply (X); **internal** drain (Y) version ....4WEH16**...**/...**T...** 	**external** supply (X); **internal** drain (Y) version ...4WEH16H.../...T...- impossible 
internal supply (X); **external** drain (Y) version ...4WEH16**...**/...**E...** 	**internal** supply (X); **external** drain (Y) version ...4WEH16**H**.../...**E...** 
external supply (X); **external** drain (Y) version...4WEH16**...**/... 	**external** supply (X); **external** drain (Y) version ...4WEH16**H**.../... 

DIAGRAMS

Simplified and detailed hydraulic diagrams for 2-position directional valves with various pilot supply (X) and pilot drain (Y)

2-position directional valves with spring positioned spool in main valve and pilot valve version ...4WEH16**...**/...	2-position directional valves with hydraulically positioned spool in main valve and spring positioned spool in pilot valve version ...4WEH16**H**.../...
internal supply (X); **internal** drain (Y) version ...4WEH16**...**/...**ET...** 	**internal** supply (X); **internal** drain (Y) version ...4WEH16**H**.../...**ET...** 
external supply (X); **internal** drain (Y) version ....4WEH16**...**/...**T...** 	**external** supply (X); **internal** drain (Y) version ...4WEH16**H**.../...**T...** 
internal supply (X); **external** drain (Y) version ...4WEH16**...**/...**E...** 	**internal** supply (X); **external** drain (Y) version ...4WEH16**H**.../...**E...** 
external supply (X); **external** drain (Y) version...4WEH16**...**/... 	**external** supply (X); **external** drain (Y) version ...4WEH16**H**.../... 

DIAGRAMS

Simplified and detailed hydraulic schemes for 2-position directional valves with various pilot supply (X) and pilot drain (Y)

2-position directional valves with hydraulically positioned spool in main valve, pilot valve without return spring version ...4WEH16**H**.../**O**...	2-position directional valves with hydraulically positioned spool in main valve, pilot valve without return spring, with detent version ...4WEH16**H**.../**OF**...
internal supply (X); **internal** drain (Y) version ...4WEH16**H**.../**O**...**ET**...	**internal** supply (X); **internal** drain (Y) version ...4WEH16**H**.../**OF**...**ET**...
external supply (X); **internal** drain (Y) version ....4WEH16**H**.../**O**...**T**...	**external** supply (X); **internal** drain (Y) version ...4WEH16**H**.../**OF**...**T**...
internal supply (X); **external** drain (Y) version ...4WEH16**H**.../**O**...**E**...	**internal** supply (X); **external** drain (Y) version ...4WEH16**H**.../**OF**...**E**...
external supply (X); **external** drain (Y) version...4WEH16**H**.../**O**...	**external** supply (X); **external** drain (Y) version ...4WEH16**H**.../**OF**...

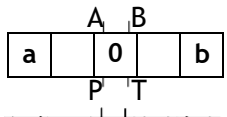
DIAGRAMS

Diagrams of spools

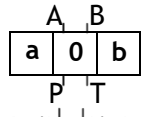
3-position

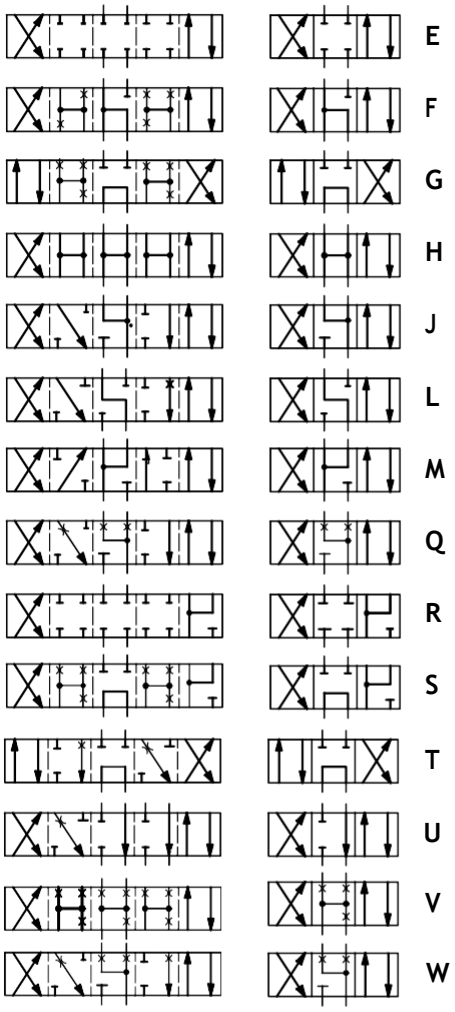
versions ...4WEH16**...**

working and indirect positions



working positions

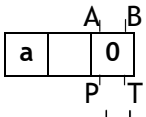




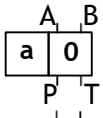
2-position (a, 0)

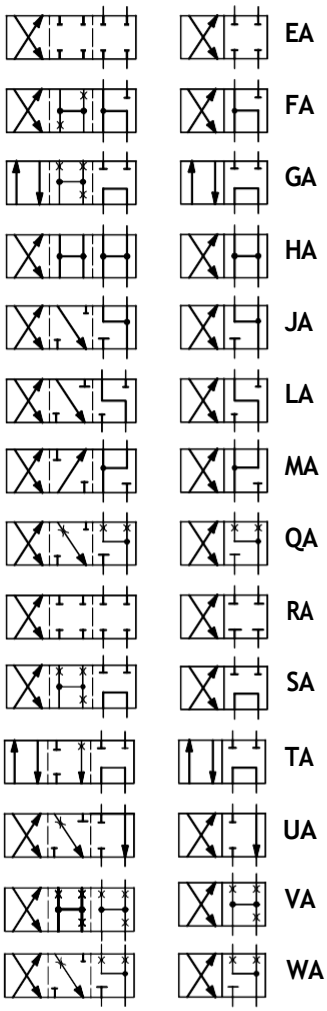
versions **...**4WEH16...**A**...

working and indirect positions



working positions

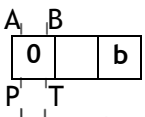




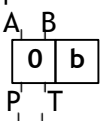
2-position (0, b)

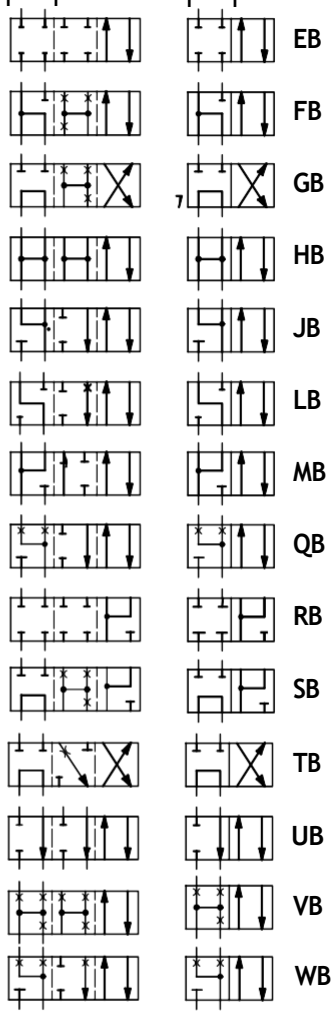
versions ...4WEH16...**B**...

working and indirect positions



working positions

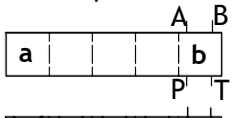




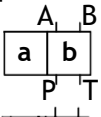
2-position (a, b)

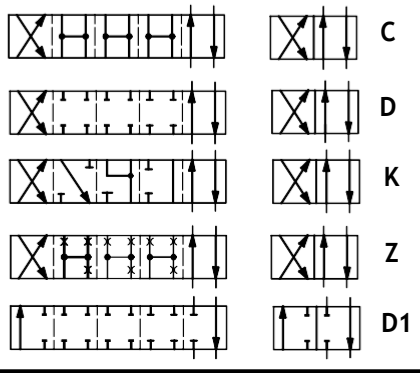
versions ...4WEH16**...**

working and indirect positions



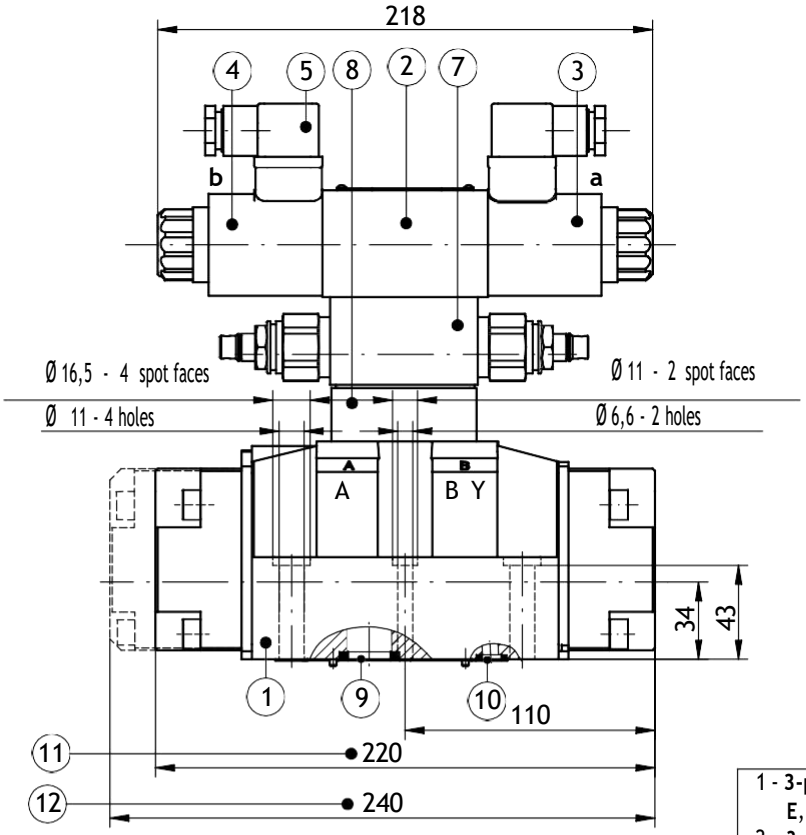
working positions

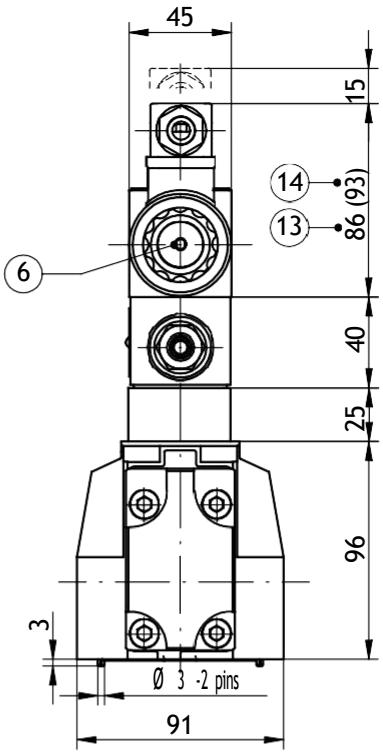


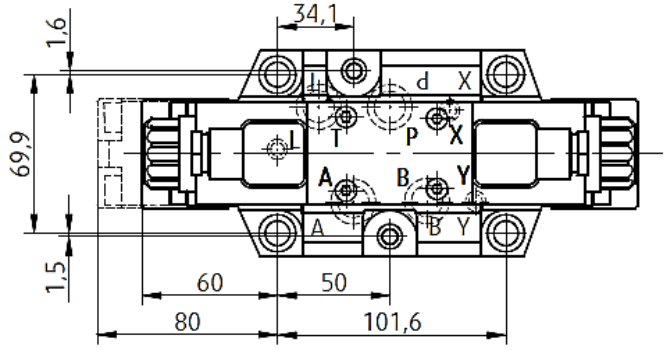


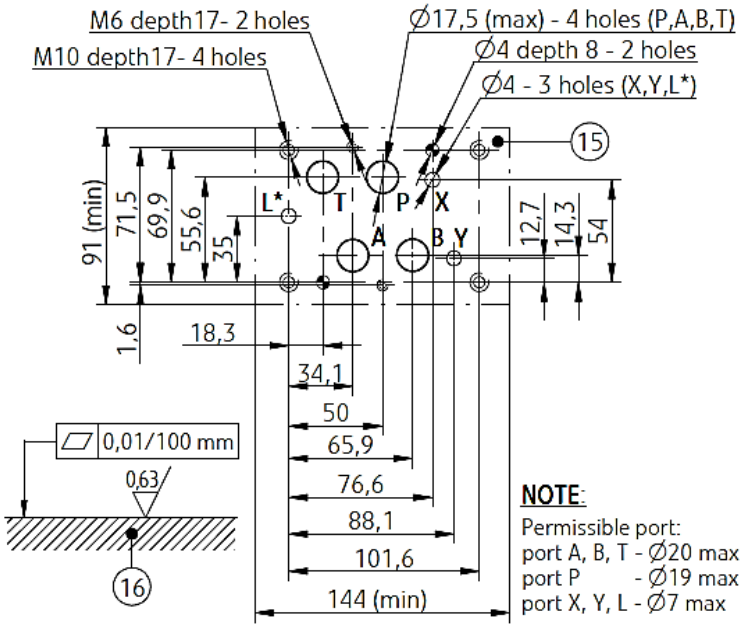
OVERALL AND CONNECTION DIMENSIONS

3-position standard versions ...4WEH16...S... D1...







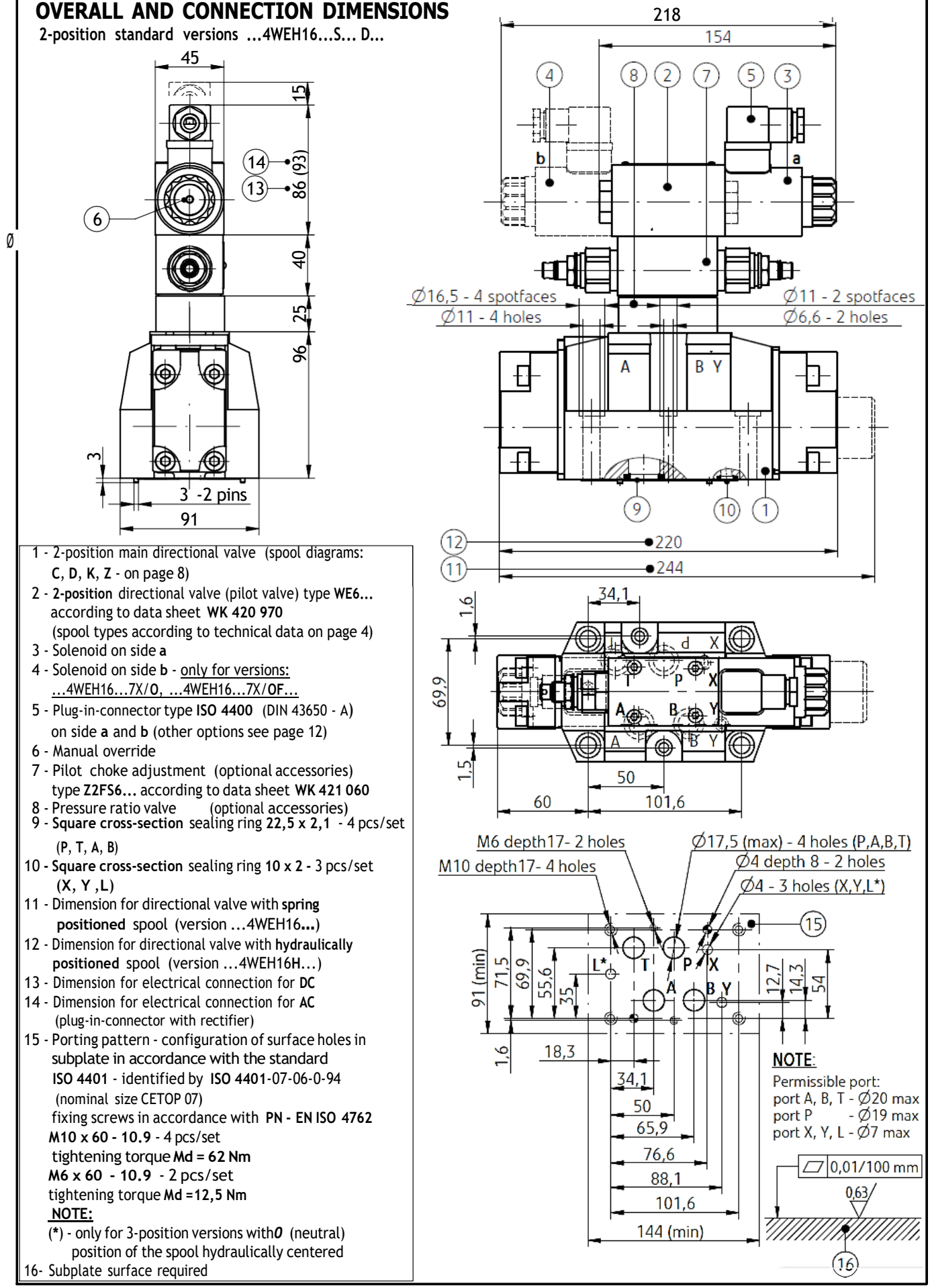


NOTE:
Permissible port:
port A, B, T - Ø20 max
port P - Ø19 max
port X, Y, L - Ø7 max

1 - **3-position** main directional valve (spool diagrams: **E, F, G, H, J, L, M, P, Q, R, U, V, W** - on page 8)
2 - **3-position** directional valve (pilot valve) type **WE6...** according to data sheet **WK 420 970** (spool types according to technical data on page 4)
3 - Solenoid on side **a**
4 - Solenoid on side **b**
5 - Plug-in-connector type **ISO 4400** (DIN 43650 - A) on side **a** and **b** (other options see page 12)
6 - Manual override
7 - Pilot choke adjustment (optional accessories) type **Z2FS6...** according to data sheet **WK 421 060**
8 - Pressure ratio valve (optional accessories)
9 - **Square cross-sectio** n sealing ring **22,5 x 2,1** - 4 pcs/set **(P, T, A, B)**
10 - **Square cross-section** sealing ring **10 x 2** -3 pcs/set **(X,Y,L)**
11 - Dimension for directional valve with the spool position ***0*** (neutral) **spring centered** (version ...4WEH16**...**)
12 - Dimension for directional valve with the spool position ***0*** (neutral) **hydraulically centered** (version ...4WEH16H...)
13 - Dimension for electrical connection for **DC**
14 - Dimension for electrical connection for **AC** (plug-in-connector with rectifier)
15 - Porting pattern - configuration of surface holes in subplate in accordance with the standard **ISO 4401** - identified by **ISO 4401**-07-06-0-94 (nominal size CETOP 07)
fixing screws in accordance with **PN - EN ISO 4762**
M10 x 60 - 10.9 - 4 pcs/set;
tightening torque **Md = 62 Nm**
M6 x 60 - 10.9 - 2 pcs/set
tightening torque **Md = 12,5 Nm**
NOTE:
(*) - only for 3-position versions with ***0*** (neutral) position of the spool hydraulically centered
16 - Subplate surface required

OVERALL AND CONNECTION DIMENSIONS

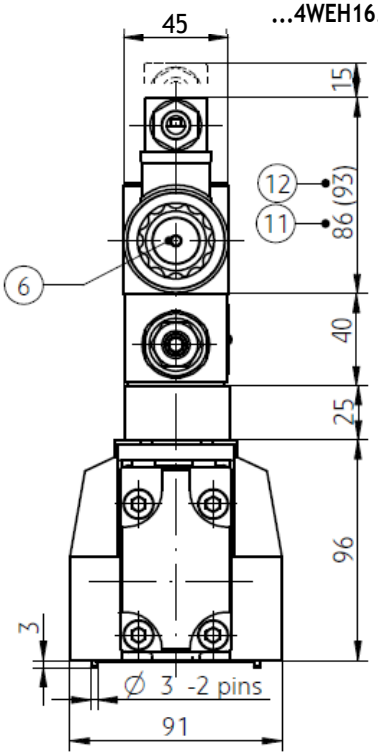
2-position standard versions ...4WEH16...S... D...

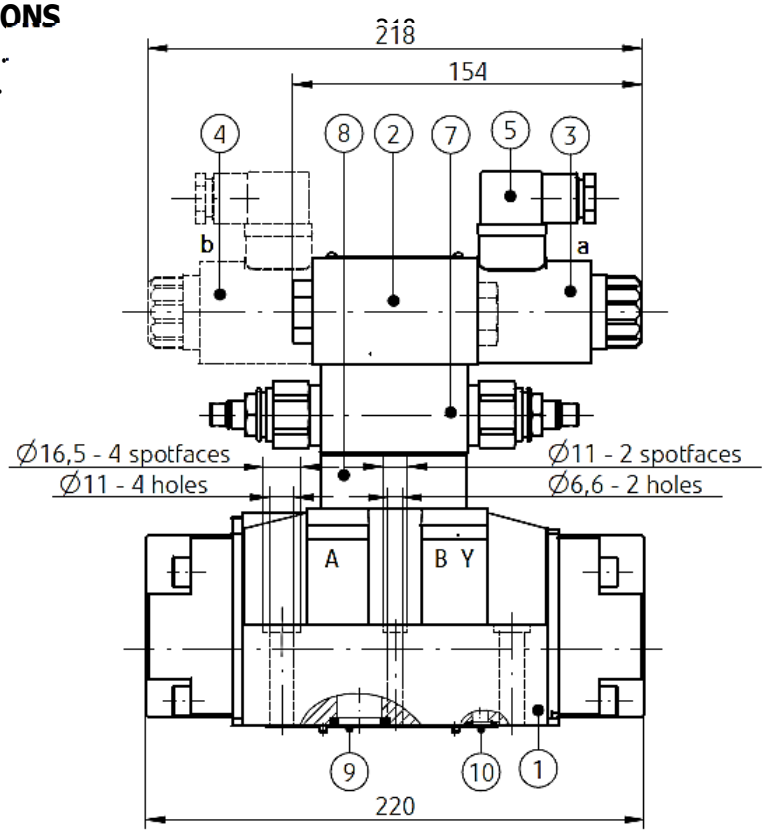


1 - 2-position main directional valve (spool diagrams: **C, D, K, Z** - on page 8)
2 - **2-position** directional valve (pilot valve) type **WE6...** according to data sheet **WK 420 970** (spool types according to technical data on page 4)
3 - Solenoid on side **a**
4 - Solenoid on side **b** - only for versions: ...4WEH16...7X/**O**, ...4WEH16...7X/**OF**...
5 - Plug-in-connector type **ISO 4400** (DIN 43650 - A) on side **a** and **b** (other options see page 12)
6 - Manual override
7 - Pilot choke adjustment (optional accessories) type **Z2FS6...** according to data sheet **WK 421 060**
8 - Pressure ratio valve (optional accessories)
9 - **Square cross-section** sealing ring **22,5 x 2,1** - 4 pcs/set (**P, T, A, B**)
10 - **Square cross-section** sealing ring **10 x 2** - 3 pcs/set (**X, Y ,L**)
11 - Dimension for directional valve with **spring positioned** spool (version ...4WEH16**...**)
12 - Dimension for directional valve with **hydraulically positioned** spool (version ...4WEH16H...)
13 - Dimension for electrical connection for **DC**
14 - Dimension for electrical connection for **AC** (plug-in-connector with rectifier)
15 - Porting pattern - configuration of surface holes in subplate in accordance with the standard **ISO 4401** - identified by **ISO 4401**-07-06-0-94 (nominal size CETOP 07)
fixing screws in accordance with **PN - EN ISO 4762**
M10 x 60 - 10.9 - 4 pcs/set
tightening torque **Md = 62 Nm**
M6 x 60 - 10.9 - 2 pcs/set
tightening torque **Md =12,5 Nm**
NOTE:
(*) - only for 3-position versions with ***O*** (neutral) position of the spool hydraulically centered
16- Subplate surface required

OVERALL AND CONNECTION DIMENSIONS

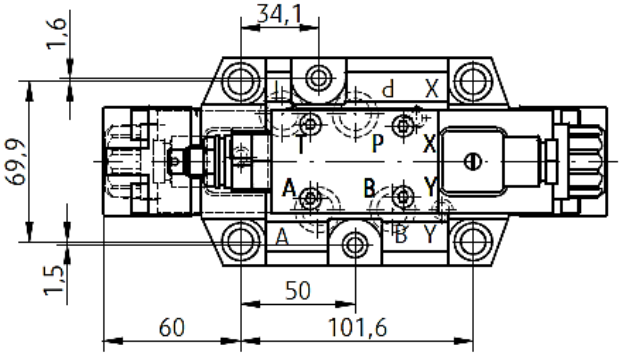
2-position standard versions: ...4WEH16...A... S...D...
...4WEH16...B...S...D...

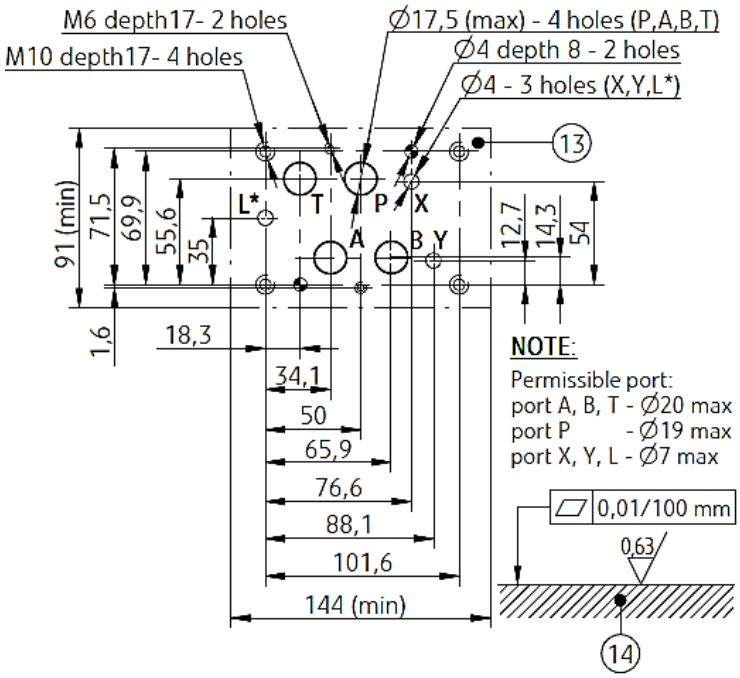




1 - 3-position main directional valve - versions:
- ...4WEH16...A... (spool diagrams: **EA, FA, GA, HA, JA, LA, MA, PA, QA, RA, UA, VA, WA** - on page 8)
- ...4WEH16...B... (spool diagrams: **EB, FB, GB, HB, JB, LB, MB, PB, QB, RB, UB, VB, WB** - on page 8)

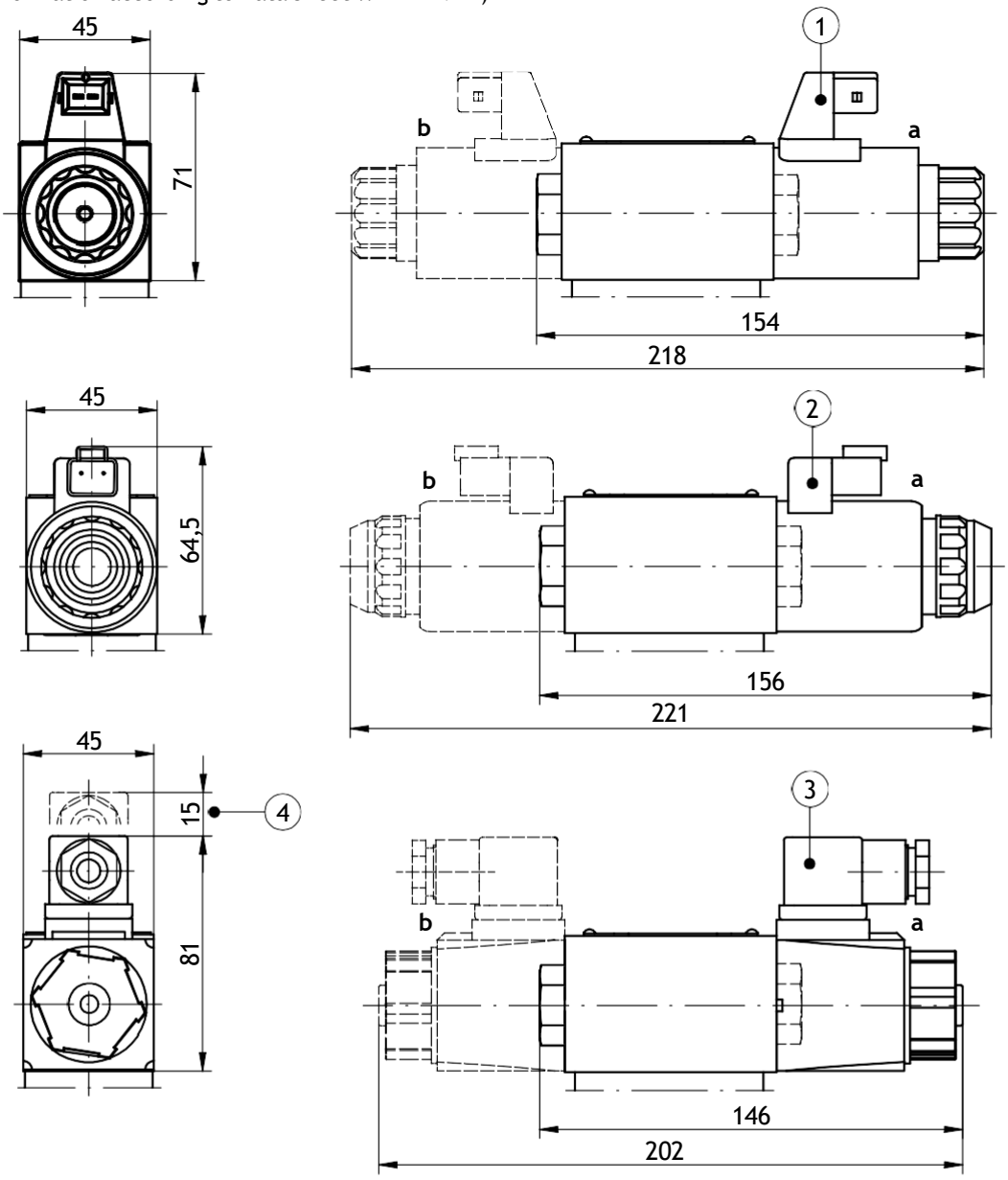
2 - **2-position** directional valve (pilot valve) type **WE6...** according to data sheet **WK 420 970** (spool types according to technical data on page 4)
3 - Solenoid on side **a** - for version ...4WEH16...A...
4 - Solenoid on side **b** - for version ...4WEH16...B...
5 - Plug-in-connector type **ISO 4400** (DIN 43650 - A) on side **a** and **b** (other options see page 12)
6 - Manual override
7 - Pilot choke adjustment (optional accessories) type **Z2FS6...** according to data sheet **WK 421 060**
8 - Pressure ratio valve (optional accessories)
9 - **Square cross-section** sealing ring **22,5 x 2,1** - 4 pcs/set **(P, T, A, B)**
10 - **Square cross-section** sealing ring **10 x 2** - 3 pcs/set **(X, Y ,L)**
11 - Dimension for electrical connection for **DC**
12 - Dimension for electrical connection for **AC** (plug-in-connector with rectifier)
13 - Porting pattern - configuration of surface holes in subplate in accordance with the standard **ISO 4401** - identified by **ISO 4401-07-06-0-94** (nominal size **CETOP 07**)
fixing screws in accordance with **PN - EN ISO 4762**
M10 x 60 - 10.9 - 4 pcs/set
tightening torque **Md = 62 Nm**
M6 x 60 - 10.9 - 2 pcs/set
tightening torque **Md = 12,5 Nm**
NOTE:
(*) - only for 3-position versions with ***0*** (neutral) position of the spool hydraulically centered
14- Subplate surface required





OVERALL AND CONNECTION DIMENSIONS

options of electrical connection of pilot valve solenoids
(further information according to Data Sheet **WK 420 970**)



1 - Versions WEH16...**G12**...**J**...; ...**G24**...**J**... - **DC solenoids**; connector type **AMP Junior Timer male 2-pole** (plug-in-connectors not shown in the drawing must be ordered separately - see Data Sheet **WK 499 963**)

2 - Version WEH16...**G24**...**D**... - **DC solenoids**; connector type **Deutsch DT04 - 2P** (plug-in-connectors type **Deutsch DT06 - 2S** not shown in the drawing must be ordered separately - see Data Sheet **WK 499 963**)

3 - Versions WEH16...**W230 - 50**...**Z4**... - **AC solenoids** (with direct supply); plug-in-connectors type **ISO 4400**

NOTE:

simultaneous joining of two solenoids of the same pilot valve should not be permitted (partial overriding of the valve can overheat and damage the winding coils)

4 - Distance for dismantling of plug from solenoid connector

ACCESSORIES FOR STANDARD VERSION OF THE DIRECTIONAL VALVE

Pilot choke adjustment

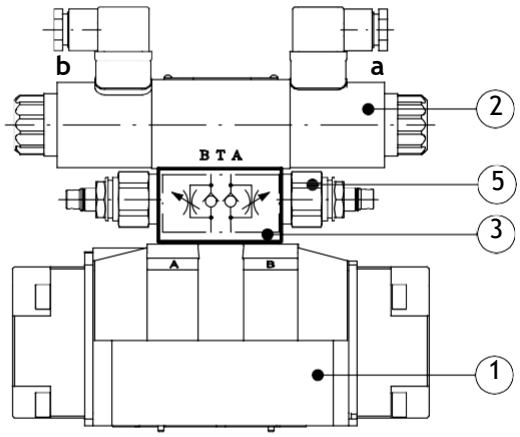
versions: ...4WEH16.../...**S**...
...4WEH16.../...**S2**...

Directional spool valve type ...**4WEH16**... may be optionally provided with pilot choke adjustment (throttle check valve type **Z2FS6**...), which allows to adjust switching time directional spool valve.
The change of adjustment method of switching time (flow throttling):

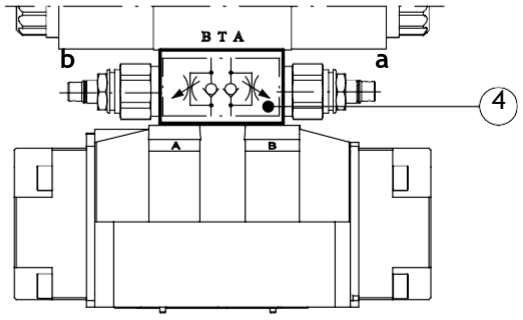
- on inlet (version ...4WEH16.../**S**...)
- on outlet (version ...4WEH16.../**S2**...)

is made while mounting by rotating the pilot choke adjustment (3) o 180 degrees around its longitudinal axis.
Rotation of the adjusting screw (5) clockwise increases and counterclockwise decreases the switching of the valve.
Screws M5 x 90 - 10.9 acc. to PN - EN ISO 4762 - 4 pcs fixing the adjustment (3) and the initial valve (2) must be tightened with torque **Md = 9 Nm**.

...4WEH16. .../...**S2** ...



...4WEH16. .../...S...

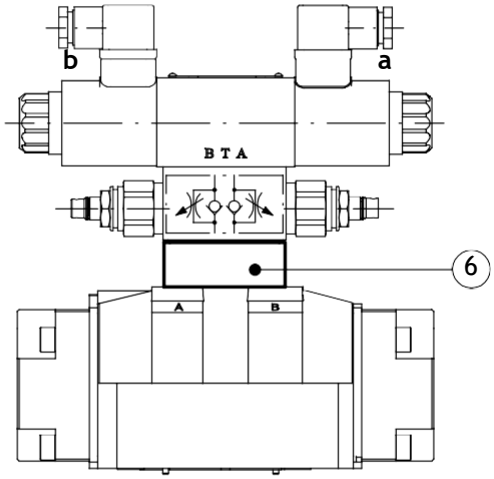


Pressure ratio valve

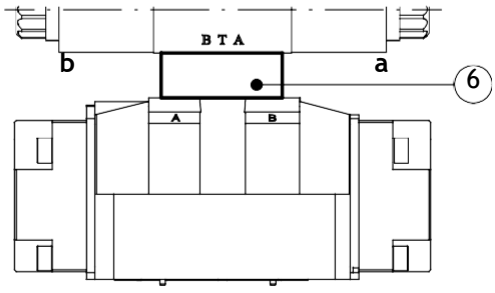
versions: ...4WEH16.../...ET...**D1**...
...4WEH16.../...E...**D1**...

The directional control valve type ...4WEH16... with internal pilot oil supply - versions: ...**E**...;...**ET**... **at the pilot oil supply pressure exceeding 25 MPa must be equipped with a pressure ratio valve (6).**
It causes the pilot pressure to be reduced at the ratio 1:0,66 = 1,515. The minimum control pressure when applying the pressure ratio valve must be increased by the ratio 1:0,66 = 1,515.
The screws **M5 x 115 - 10.9** acc. to **PN - EN ISO 4762** 4 pcs fixing the pressure ratio valve (6) and the pilot choke adjustment (3) must be tightened with torque **Md = 9Nm.**

H - 4WEH16.../...ET S...**D1**...
H - 4WEH16.../...E S...**D1**...



H - 4WEH16.../...ET...D1...
H - 4WEH16.../...E...D1...



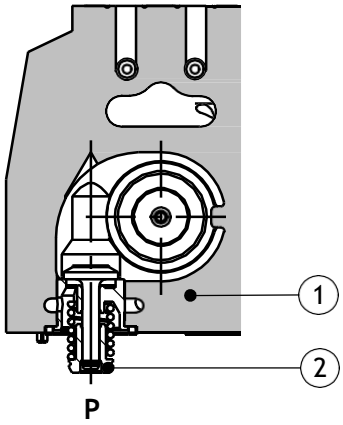
1 - Main valve
2 - Pilot valve
3 - Pilot choke adjustment with adjustment of switching time on outlet
4 - Assembly method of pilot choke adjustment with adjustment of switching time at the inlet
5 - Adjusting screw
6 - Pressure ratio valve

ACCESSORIES FOR STANDARD VERSION OF THE DIRECTIONAL VALVE

Pre-load valve

versions: ...4WEH16.../...**P4,5**...
...4WEH16.../...**P7**...

Directional valve type**...4WEH16...** with internal pilot oil supply (**X**) - versions: ...**E...**; ...**ET**... with spools **C**, **Z**, **F**, **G**, **H**, **S**, **T**, **V** (diagrams according to page 8) with pressure less circulation of hydraulic fluid (supply and drain connected at working or indirect positions) **must be equipped with the pre-load valve (2) fixed in port P** of the main valve (1).
Cracking pressure for pre-load valves:
version **P 4.5** - **0,45 MPa**
version **P 7** - **0,7 MPa**
For directional valves with fixed pressure ratio valve - versions H4 - 4WEH16.../...**D1**... the pre-load valve **P7** must be applied.

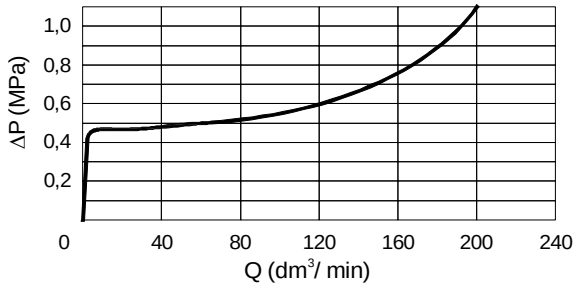


1 - Main valve body
2 - Pre-load valve

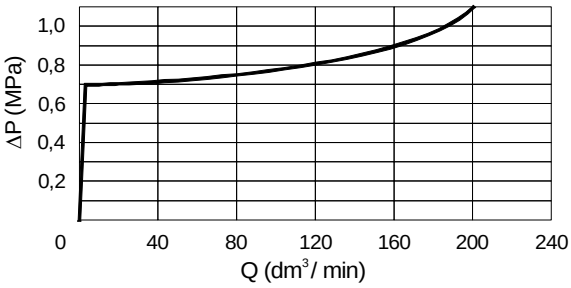
Performance curves for pre-load valves

(measured at viscosity ν = 41 mm^2/s and temperature t =50 ^{o}C)

version 4WEH16... /...**P4,5**...



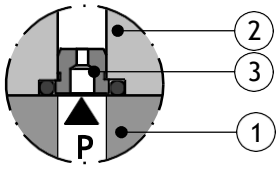
version H - 4WEH16.../...**P7**...



Throttle inserts

version ...4WEH16.../...**B**...

Directional valves type **...4WEH16...** may be equipped with throttle insert (3) in port **P** in pilot valve (2) which allows to delay switching time of the main valve.



1 - Main valve
2 - Pilot valve
3 - Throttle insert

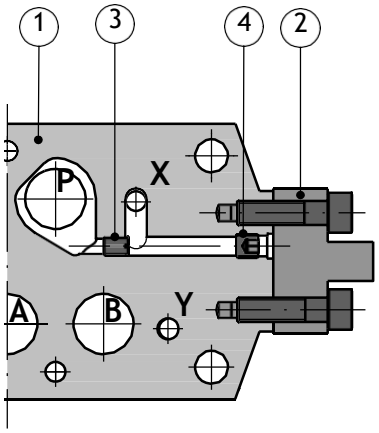
ACCESSORIES FOR STANDARD DIRECTIONAL VALVE

Pilot oil supply and pilot oil drain

Pilot oil supply (X) - **external**
pilot oil drain (Y) - **external**
version ...4WEH16.../**...**

In version...4WEH16.../**...** the hole screw plugs (3) and (5) and plugs (4) and (6) must be mounted in the position like given on the drawing.

...4WEH16.../**...**



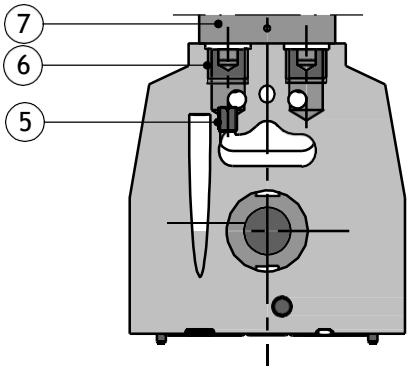
Pilot oil supply (X) - **internal**
pilot oil drain (Y) - **external**
version ...4WEH16.../...**E**...

In version ...4WEH16.../...**E**... the hole screw plug (3) must be dismounted whereas the hole screw plug (5), plugs (4) and (6) must be mounted and port **X** in a subplate should be plugged.

Pilot oil supply (X) - **internal**
pilot oil drain (Y) - **internal**
version ...4WEH16.../...**ET**...

In version ...4WEH16.../...**ET**... the hole screw plugs (3) and (5) must be dismounted whereas the plugs (4) and (6) must be mounted and ports **X** and **Y** in a subplate must be plugged.

...4WEH16.../**...**



Pilot oil supply (X) - **external**
pilot oil drain (Y) - **internal**
version ...4WEH16.../...**T**...

In version ...4WEH16.../...**T**... the hole screw plug (3) must be mounted whereas the hole screw plug (5) must be dismounted. The plugs (4) and (6) must be mounted and the port **Y** in a subplate must be plugged.

NOTES:

Versions with internal oil drain:...**ET**...; ...**T**... are non-applicable for directional valves with main spool hydraulically centered (versions...4WEH16**H**...).

The hole screw plug (3) in port **X** is accessible after screwing out a side cover (2) in the main valve (1).
The hole screw plug (5) in port **Y** is accessible after dismounting the pilot valve (7).

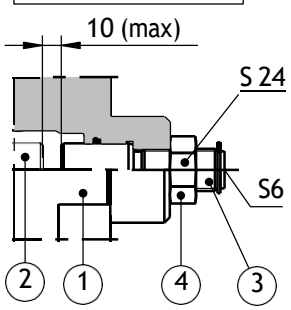
1 - Main valve body
2 - Side cover
3 - Hole screw plug **M6 - 8,8** (S3)
4 - Plug
5 - Hole screw plug **M6 - 8,8** (S3)
6 - Plug
7 - Pilot valve body

OPTIONAL ACCESSORIES FOR DIRECTIONAL VALVE

Stroke limiter of the spool may be mounted:

- stroke limiter on valve ends **A** and **B** version ...4WEH16.../...**10**...
- stroke limiter on valve end **A** version ...4WEH16.../...**11**...
- stroke limiter on valve end **B** version ...4WEH16.../...**12**...

...4WEH16.../...**12**...



Adjustment of the stroke of the main spool is by rotating the pin (3) and securing with locknut (4). Rotating the pin (3) clockwise reduces the stroke of the main spool (2). While adjusting the stroke the control chamber must be at zero pressure.

1 - Stroke limiter body (on valve end **B**)
2 - Spool of the main valve
3 - Pin
4 - Locknut

End position monitor

End position monitor may be mounted:
• on valve end **A**
versions: ...4WEH16.../...**18**... (contact breaker)
...4WEH16.../...**22**... (contact maker)
• on valve end **B**
versions: ...4WEH16.../...**19**... (contact breaker)
...4WEH16.../...**23**... (contact maker)

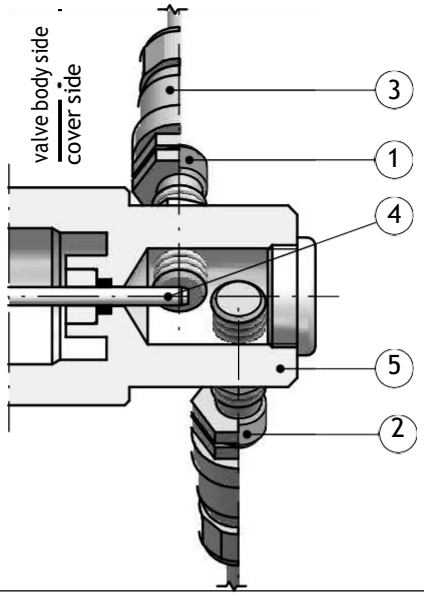
Directional valves type ...4WEH16... may be equipped with spool end position monitor, optionally contact maker or contact breaker, mounted depending on the version, in main valve cover on valve end **A** or **B** - overall dimensions on pages 24 - 27.
Detailed information concerning proximity sensors and plug-in connectors given on page 4.

sensor position	signal level					
	end position monitor with contact breakers (Versions 4WEH16.../...**18**...; ...**19**...)			end position monitor with contact makers (Versions 4WEH16.../...**22**...; ...**23**...)		
	spool position			spool position		
	valve body side	central	cover side	valve body side	central	cover side
sensor (1) valve body side	0	1	1	1	0	0
sensor (2) cover side	1	1	0	0	0	1

OPTIONAL ACCESSORIES FOR DIRECTIONAL VALVE

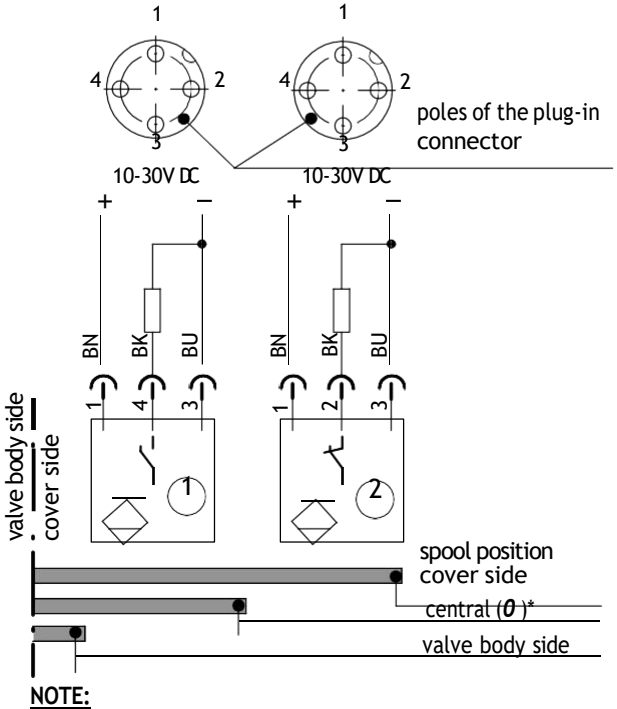
End position monitor

...4WEH16.../...**19**...



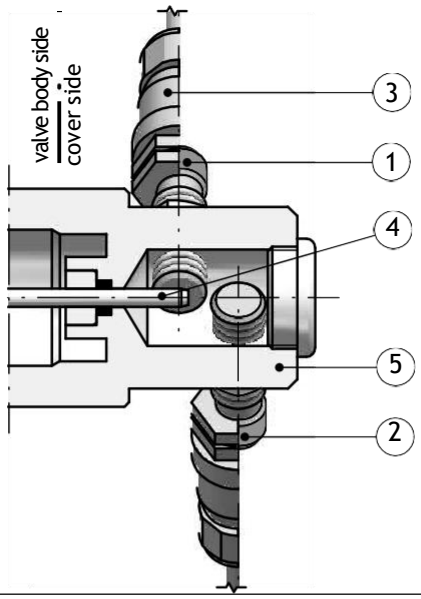
1 - Inductive sensor contact maker **PNP NO** according to page 4
2 - Inductive sensor contact breaker **PNP NC** according to page 4
3 - Plug-in cable connector (straight, female plug-in connectors - according to page 4, 2 pcs delivered with the valve
4 - Mandrel of the main spool
5 - Sensors cover

diagram of electrical connection of sensors set contact breaker



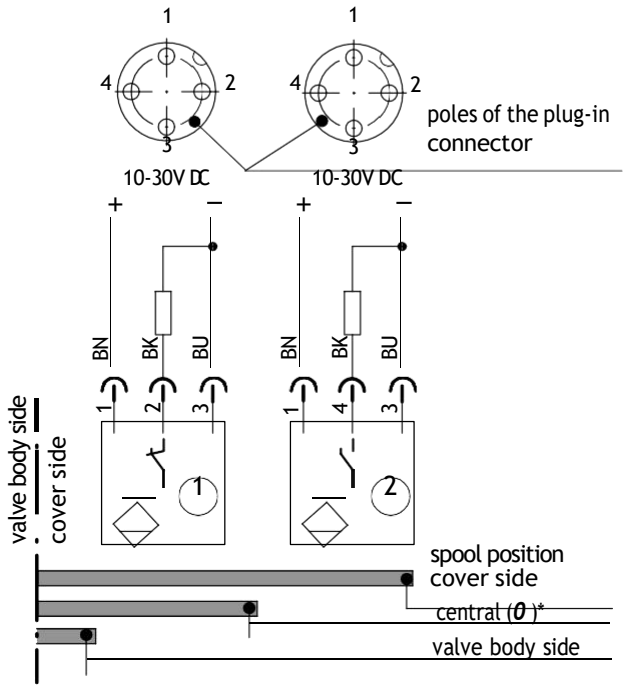
NOTE:
(*) - Only for 3-position directional valves

...4WEH16.../...**23**...



1 - Inductive sensor contact breaker **PNP NC** according to page 4
2 - Inductive sensor contact maker **PNP NO** according to page 4
3 - Plug-in cable connector (straight, female plug-in connectors - according to page 4, 2 pcs delivered with the valve
4 - Mandrel of the main spool
5 - Sensors cover

diagram of electrical connection of sensors set contact maker



NOTE:
(*) - Only for 3-position directional valves

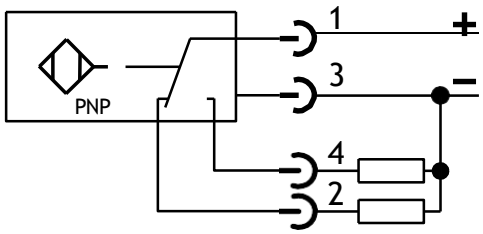
OPTIONAL ACCESSORIES FOR THE DIRECTIONAL CONTROL VALVE

Spool position sensor type M

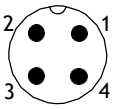
Additional technical data

Sensor type M	
Type of spool position sensor	sensor with 2 alternative PNP type outputs
Supply voltage range of the sensor	24 VDC $^{+20\%}_{-10\%}$
Max sensor load current	400 mA
Sensor connection type	external thread M12 x1; 4 poles (pins)
Degree of protection	IP 65
WARNING: M type inductive sensors must not be connected serially.	

Diagram of electrical connection of inductive sensor

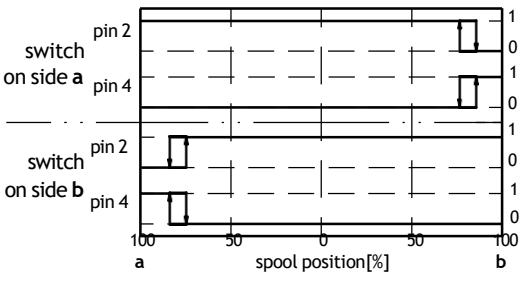


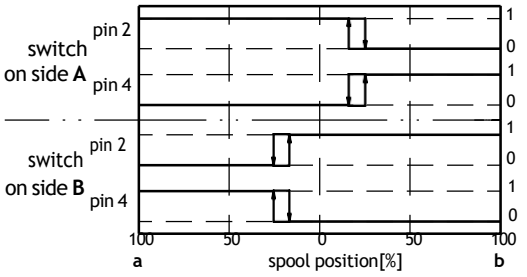
contact allocation (pins of sensor connector)

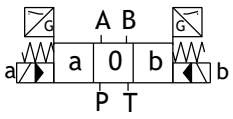


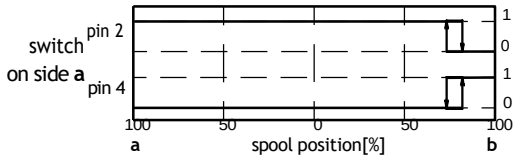
Diagrams for directional control valves and status of sensors

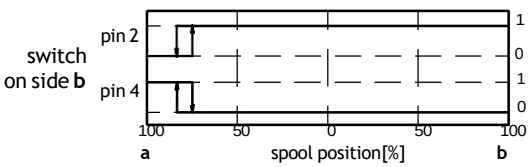
status of sensor type M depending on position of the spool **0** - **off**, **neutral**, **potential-free state** at the output contact **1** - **on**, **voltage state** at the output contact		diagram for directional control valve
3-position, spring centered versions ...MAB... **a** and **b** position monitoring (sensor at the side **a** and **b**)	**3-position, spring centered versions ...M0...** **0** position monitoring (sensor at the side **a** and **b**)	
3-position, spring centered version ...MB... **b** position monitoring (sensor at the **a** side).	**3-position, spring centered versions...MA...** **a** position monitoring (sensor at the **b** side).	

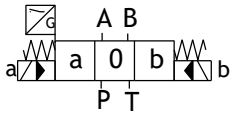


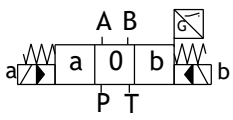




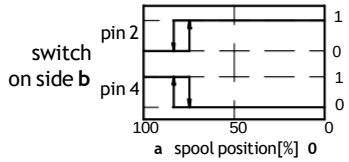
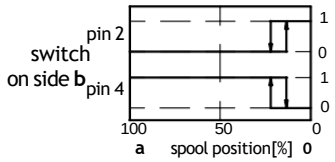
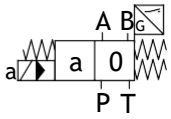
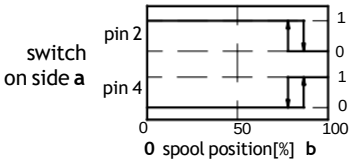
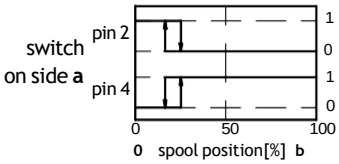
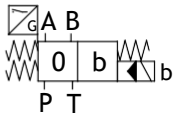
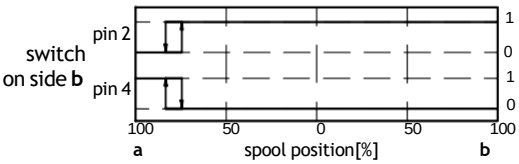
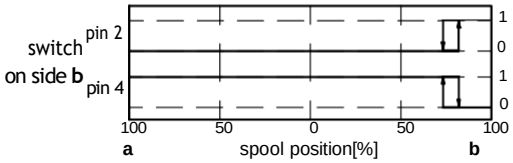
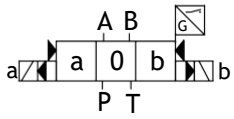
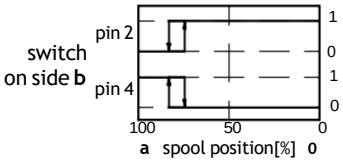
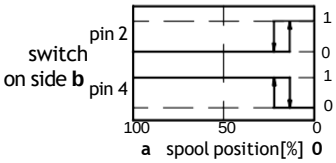
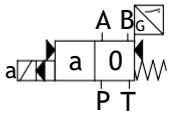
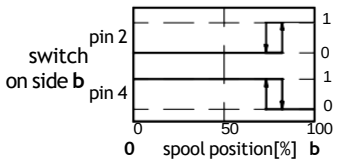
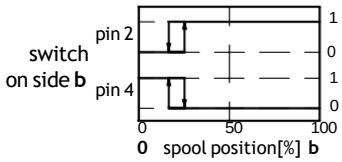
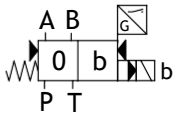
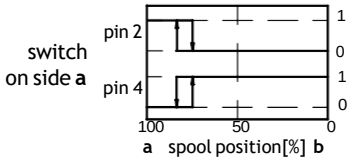
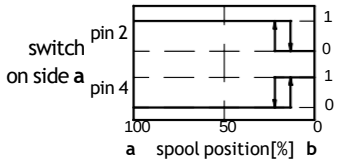
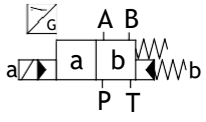








Diagrams for directional control valves and status of sensors

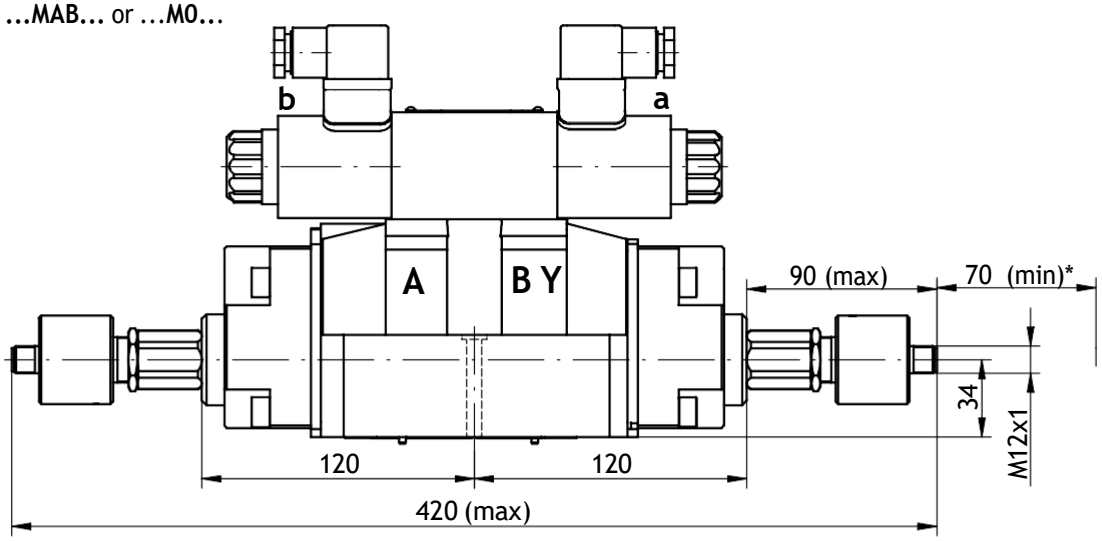
status of sensor type M depending on position of the spool **0 - off, neutral, potential-free state** at the output contact **1 - on, voltage state** at the output contact		**diagram for directional control valve**
2-position (a, 0), spring centered **versions ...MA...** **a** position monitoring (sensor at the **b** side) 	**2-position (a, 0), spring centered** **versions ...M0...** **0** position monitoring (sensor at the **b** side) 	
2-position (0, b), spring centered **versions ...MB...** **b** position monitoring (sensor at the **a** side) 	**2-position (0, b), spring centered** **versions ...M0...** **0** position monitoring (sensor at the **a** side) 	
3-position, hydraulically centered **versions ...MA...** **a** position monitoring (sensor at the **b** side) 	**3-position, hydraulically centered** **versions ...MB...** **b** position monitoring (sensor at the **b** side) 	
2-position (a, 0), hydraulically centered **versions ...MA...** **a** position monitoring (sensor at the **b** side) 	**2-position (a, 0), hydraulically centered** **versions ...M0...** **0** position monitoring (sensor at the **b** side) 	
2-position (0, b), hydraulically centered **versions ...MB...** **b** position monitoring (sensor at the **b** side) 	**2-position (0, b), hydraulically centered** **versions ...M0...** **0** position monitoring (sensor at the **b** side) 	
2-position (a, b), spring positioned **versions ...MA...** **a** position monitoring (sensor at the **a** side) 	**2-position (a, b) spring positioned** **versions...MB...** **b** position monitoring (sensor at the **a** side) 	

OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

Connection plan and required state of the connection surface - see page 9

versions with a spool position sensor type M

3-positions, spring centered
a, **b** or **0** position monitoring, sensor at the **A** and **B** side
versions **...MAB...** or **...M0...**



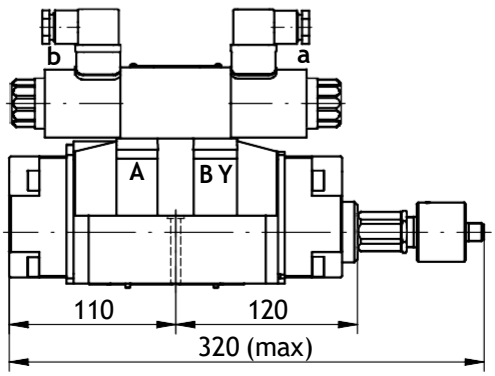
...4WEH16.../...- MAB...
...4WEH16.../...- M0...

NOTES:
- the valve with the spool position sensor has been factory calibrated, any further adjustments with in the valve can be made only by the producer
- in case of any defect of the sensor or the valve, the whole valve should be replaced

NOTE:
(*) - Distance for mounting the plug-in connector and the sensor cable (the plugs not shown on the drawing, supplied on a separate order, Data Sheet **WK 499 963**)

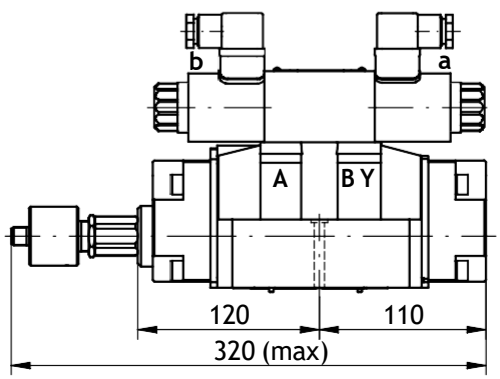
NOTE: In compliance with PN-EN 693, the valve should not be equipped with a manual override button.

3-position, spring centered versions
a position monitoring, sensor at the **B** side
version **...MA...**



...4WEH16.../...- MA...

3-position, spring centered versions
b position monitoring, sensor at the **A** side
version **...MB...**

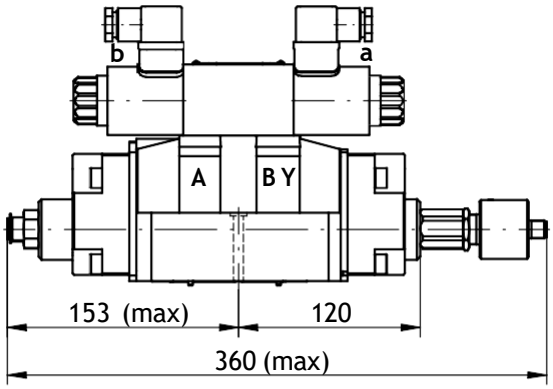


...4WEH16.../...- MB...

OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

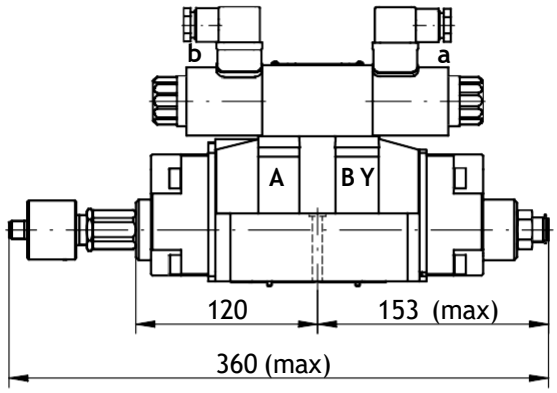
versions with a spool position sensor type M

3-position, spring centered versions
a position monitoring, sensor at the **B** side
with a spool stroke limiter at the **A** side
version **...MA11...**



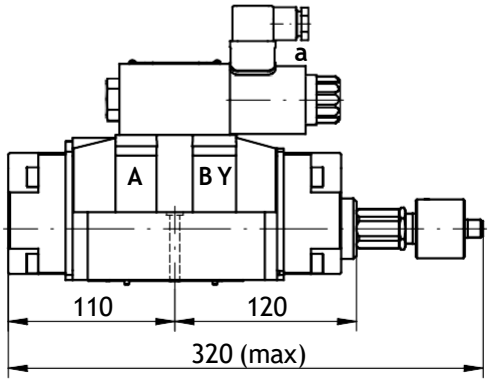
...4WEH16.../...- MA11...

3-position, spring centered versions
b position monitoring, sensor at the **A** side
with a spool stroke limiter at the **B** side
version **...MA12...**



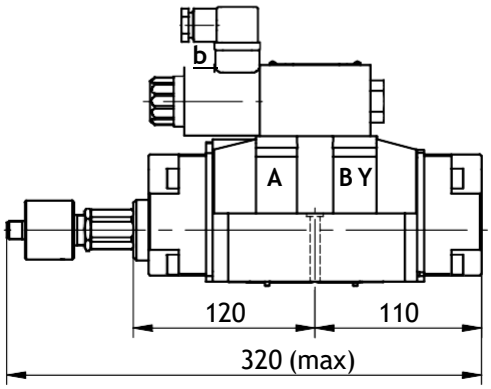
...4WEH16.../...- MB12...

2-position (a, 0), spring centered versions
a or **0** position monitoring, sensor at the **B** side
version **...MA...** or **...M0...**



...4WEH16...A.../...- MA...
...4WEH16...A.../...- M0...

2-position (0, b), spring centered versions
b or **0** position monitoring, sensor at the **A** side
version **...MB...** or **...M0...**

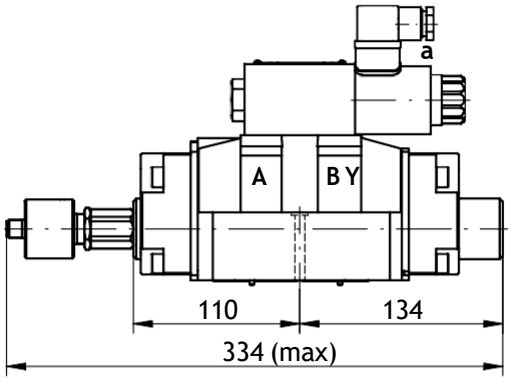


...4WEH16...B.../...- MB...
...4WEH16...B.../...- M0...

OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

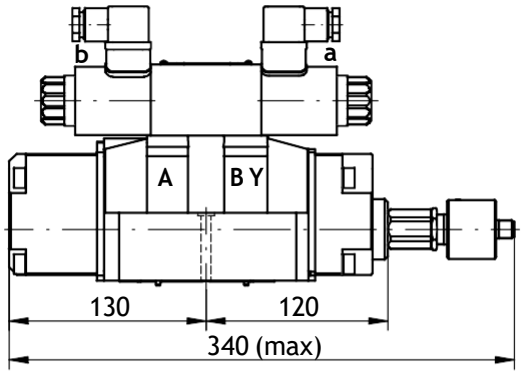
versions with a spool position sensor type M

2-position (a, b) spring positioned versions
a or **b** position monitoring, sensor at the **A** side
version ...**MA**... or ...**MB**...



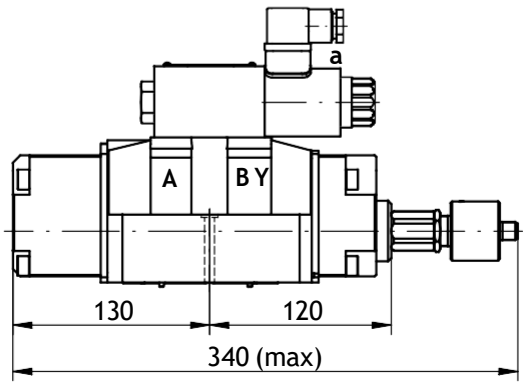
...4WEH16C; ...D...; ...K...; ...Z.../...- MA...
...4WEH16C; ...D...; ...K...; ...Z.../...- MB...

3-position, hydraulically centered versions
a or **b** position monitoring, sensor at the **B** side
version ...**MA...** or ...**MB...**



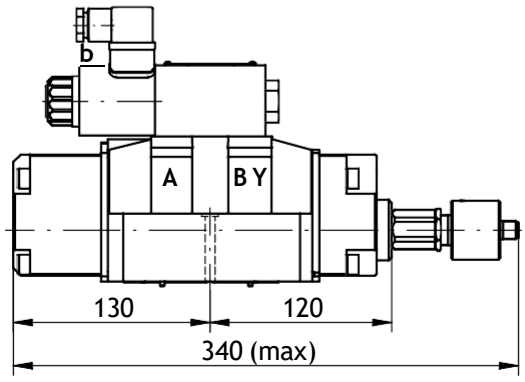
...4WEH16H.../...- MA...
...4WEH16H.../...- MB...

2-position (a, 0), hydraulically centered versions
a or **0** position monitoring, sensor at the **B** side
version ...**MA...** or ...**M0...**



...4WEH16H...A.../...- MA...
...4WEH16H...A.../...- M0...

2-position (0, b), hydraulically centered versions
b or **0** position monitoring, sensor at the **B** side
version ...**MB...** or ...**M0...**



...4WEH16H...B.../...- MB...
...4WEH16H...B.../...- M0...

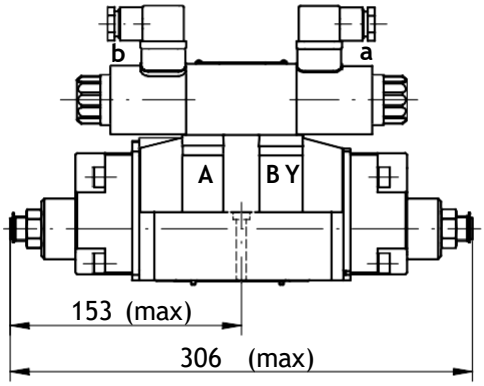
OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

versions with stroke limiter

3-position directional valves with the main spool spring centered

stroke limiter may be mounted:

- on side **A** - version ...4WEH16.../...**11**...
- on side **B** - version ...4WEH16.../...**12**...
- on sides **A** and **B** - version ...4WEH16.../...**10**...



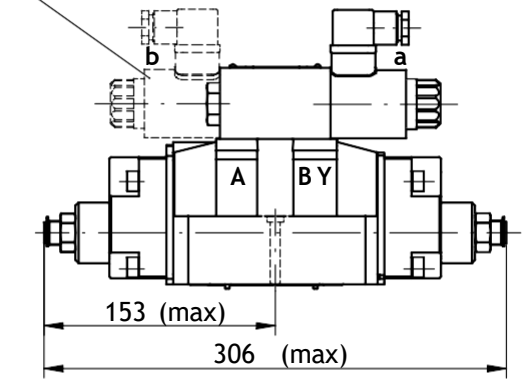
...4WEH16.../...**10**...

2-position directional valves with the main spool hydraulically positioned

stroke limiter may be mounted:

- on side **A** - version ...4WEH22**H**.../...**11**...
- on side **B** - version ...4WEH22**H**.../...**12**...
- on sides **A** and **B** - version ...4WEH22**H**.../...**10**...

2 solenoids (on side **a**, **b**) only for versions 4 WEH16**H**.../**O**...; **OF**...

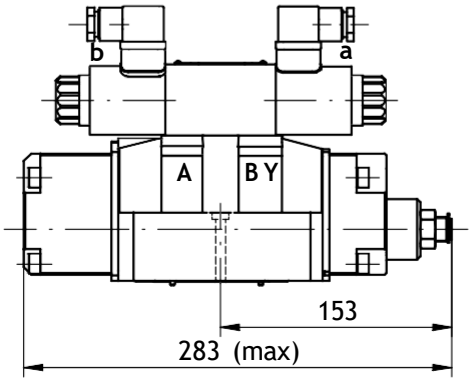


...4WEH16**H**.../...**10**...

3-position directional valves with the main spool hydraulically centered

stroke limiter may be mounted:

- on side **B** - version ...4WEH16**H**.../...**12**...

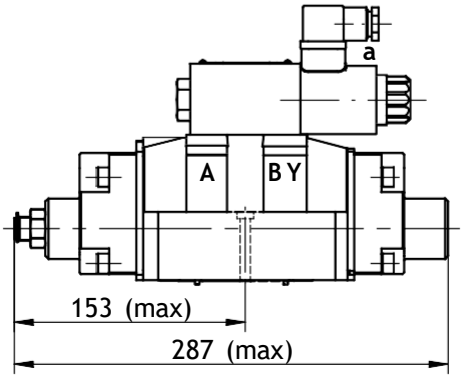


...4WEH16**H**.../...**12**...

2-position directional valves with the main spool spring positioned

stroke limiter may be mounted:

- on side **A** - version ...4WEH16.../...**11**...



...4WEH16.../...**11**...

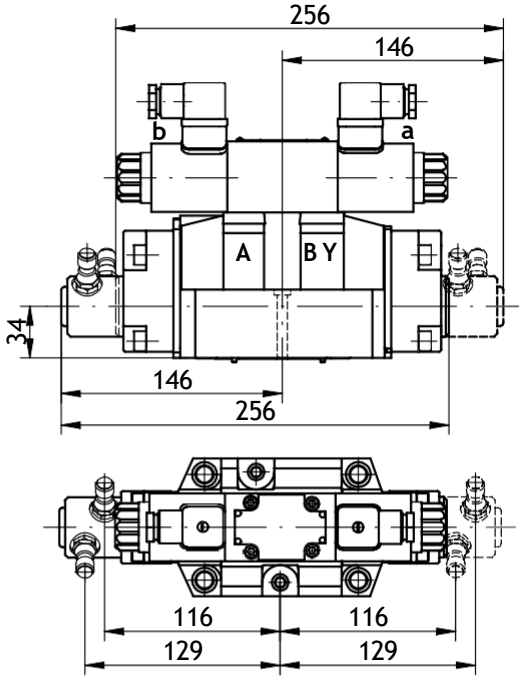
OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

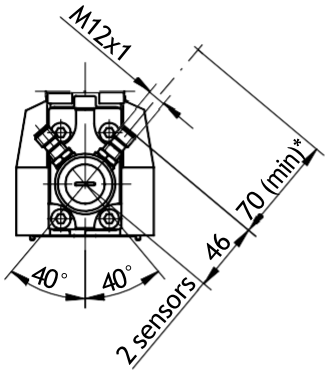
versions with end position monitor

3-position directional valves with spring centered main spool

end position monitor may be mounted:

- on side **A**
  versions: ...4WEH22.../...**18**...(contact breaker);...**22**...(contact maker)
- on side **B**
  versions: ...4WEH22.../...**19**...(contact breaker);...**23**...(contact maker)





...4WEH16.../...**18**...	...4WEH16.../...**19**...
...4WEH16.../...**22**...	...4WEH16.../...**23**...

NOTE:

(*****) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 - 2 pcs not shown on drawing, delivered with the valve)

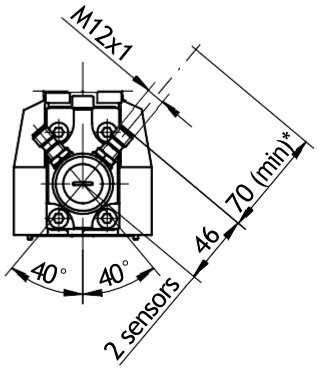
3-position directional valves with hydraulically centered main spool

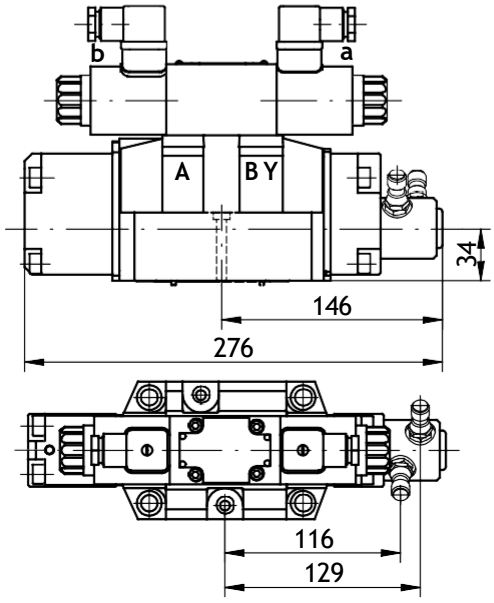
end position monitor may be mounted:

- on sde **B** - versions: ...4WEH16**H**.../...**19**... (contact breaker)
  ...4WEH16**H**.../...**23**... (contact maker)

...4WEH16**H**.../...**19**...

...4WEH16**H**.../...**23**...





NOTE:

(*****) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 -2 pcs not shown on drawing, delivered with the valve)

OVERALL DIMENSIONS OF THE VALVE WITH OPTIONAL ACCESSORIES

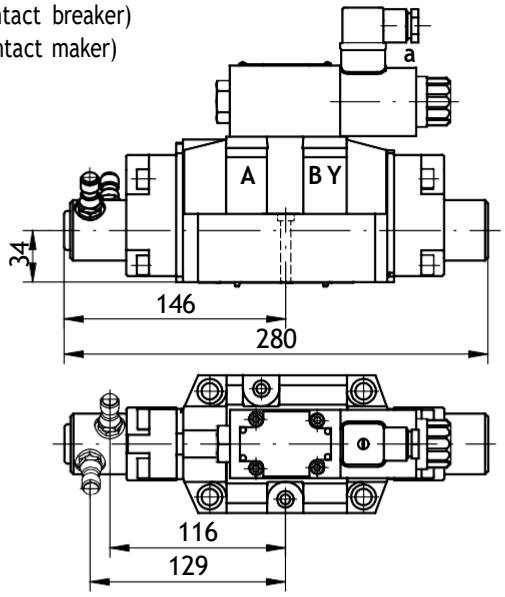
versions with end position monitor

2-position directional valves with spring positioned main spool

end position monitor may be mounted:

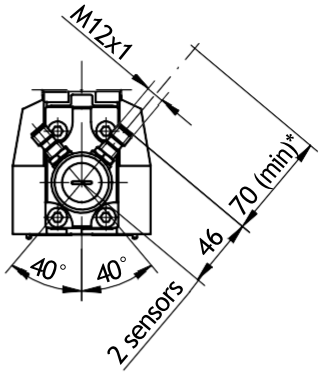
- on side **A**

  versions: ...4WEH16.../...**18**... (contact breaker)
  ...4WEH16.../...**22**... (contact maker)



...4WEH16.../...**18**...

...4WEH16.../...**22**...



NOTE:
(*) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 - 2 pcs not shown on drawing, delivered with the valve)

2-position directional valves with hydraulically positioned main spool

end position monitor may be mounted:

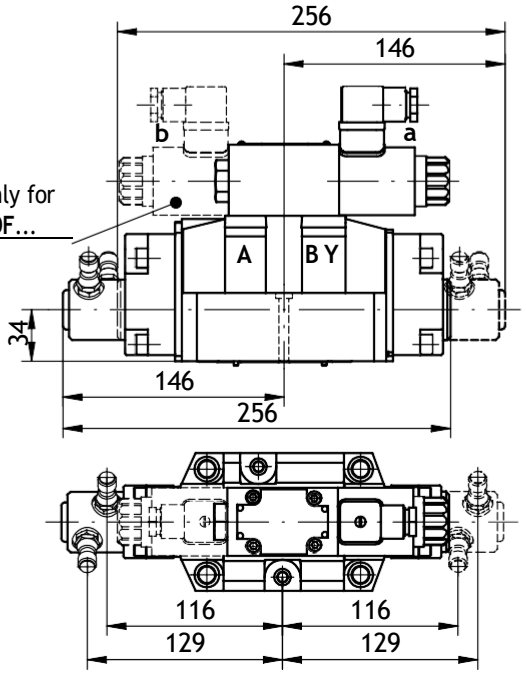
- on side **A**

  versions: ...4WEH16**H**.../...**18**... (contact breaker) ;...**22**... (contact maker)

- on side **B**

  versions: ...4WEH16**H**.../...**19**... (contact breaker) ;...**23**... (contact maker)

2 solenoids (on side **a**, **b**) only for versions 4WEH16**H**.../**O**...; **OF**...

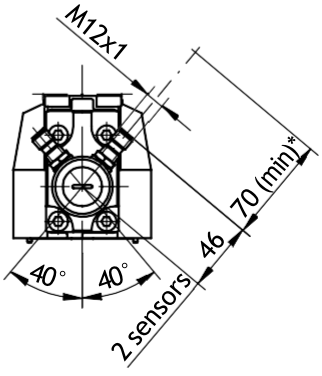


...4WEH16**H**.../...**18**...

...4WEH16**H**.../...**22**...

...4WEH16**H**.../...**19**...

...4WEH16**H**.../...**23**...



NOTE:
(*) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 - 2 pcs not shown on drawing, delivered with the valve)

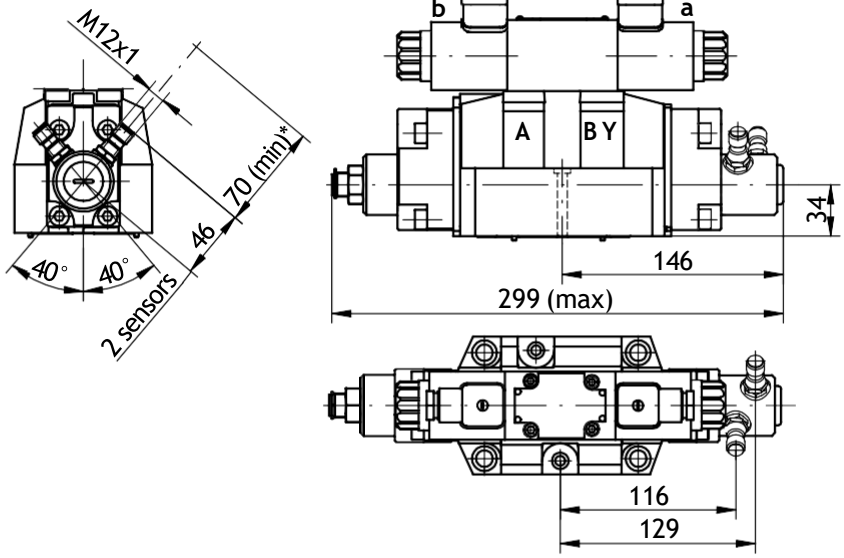
OVERALL DIMENSIONS OF DIRECTIONAL VALVE WITH OPTIONAL ACCESSORIES

versions with stroke limiter and end position monitor

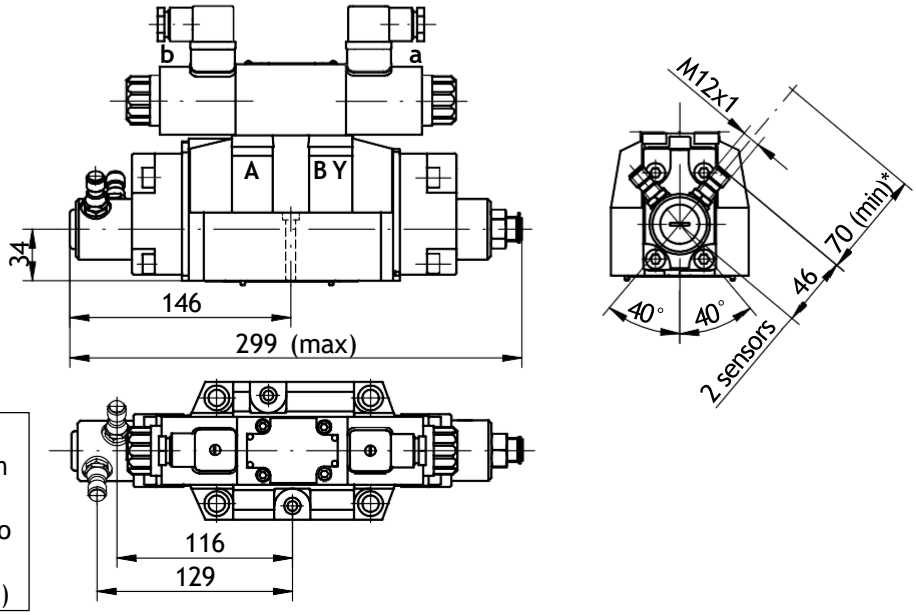
3-position directional valves with spring centered main spool
stroke limiter and end position monitor may be mounted:

- stroke limiter on side **A** and end position monitor **contact breaker** on side **B** - version ...4WEH16.../...**20**...
- stroke limiter on side **A** and end position monitor **contact maker** on side **B** - version ...4WEH16.../...**24**...
- stroke limiter on side **B** and end position monitor **contact breaker** on side **A** - version ...4WEH16.../...**21**...
- stroke limiter on side **B** and end position monitor **contact maker** on side **A** - version ...4WEH16.../...**25**...

...4WEH16.../...**20**...
...4WEH16.../...**24**...



...4WEH16.../...**21**...
...4WEH16.../...**25**...



NOTE:
(*) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 - 2 pcs not shown on drawing, delivered with the valve)

OVERALL DIMENSIONS OF DIRECTIONAL VALVE WITH OPTIONAL ACCESSORIES

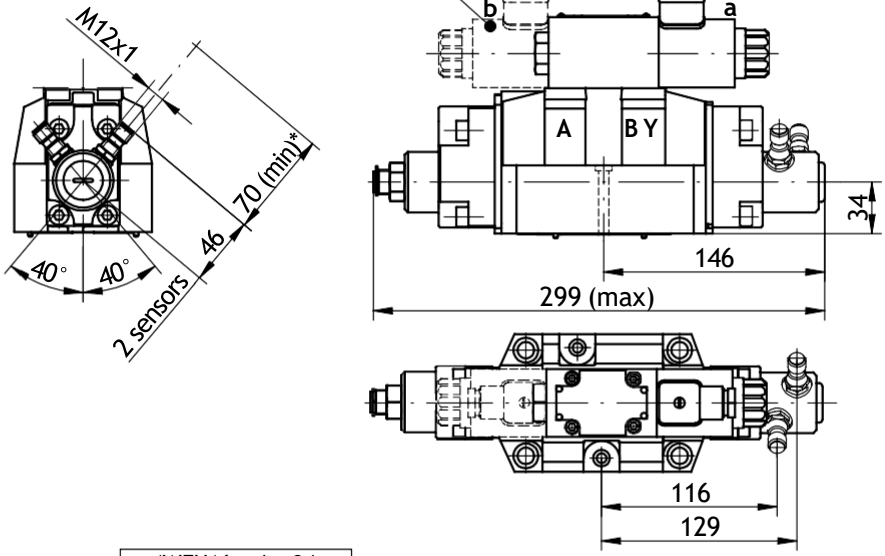
versions with stroke limiter and end position monitor

2-position directional valves with hydraulically positioned main spool
stroke limiter and end position monitor may be mounted:

- stroke limiter on side **A** and end position monitor **contact breaker** onside **B** - version ...4WEH16.../...**20**...
- stroke limiter on side **A** and end position monitor **contact maker** on side **B** - version ...4WEH16.../...**24**...
- stroke limiter on side **B** and end position monitor **contact breaker** on side **A** - version ...4WEH16.../...**21**...
- stroke limiter on side **B** and end position monitor **contact maker** on side **A** - version ...4WEH16.../...**25**...

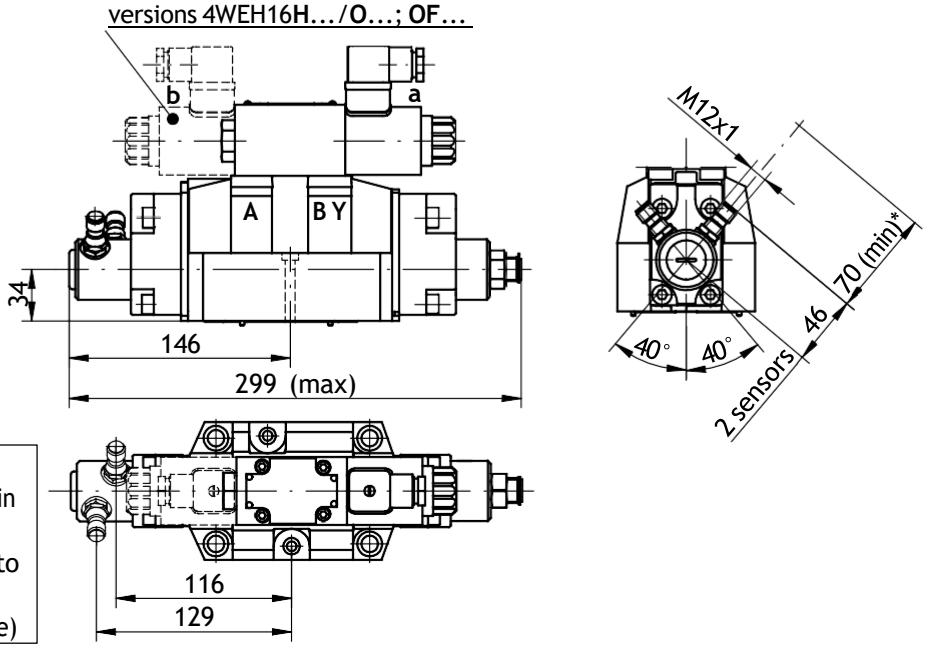
...4WEH16.../...**20**...
...4WEH16.../...**24**...

2 solenoids (on side **a**, **b**) only for versions 4WEH16**H**.../**O**...; **OF**...



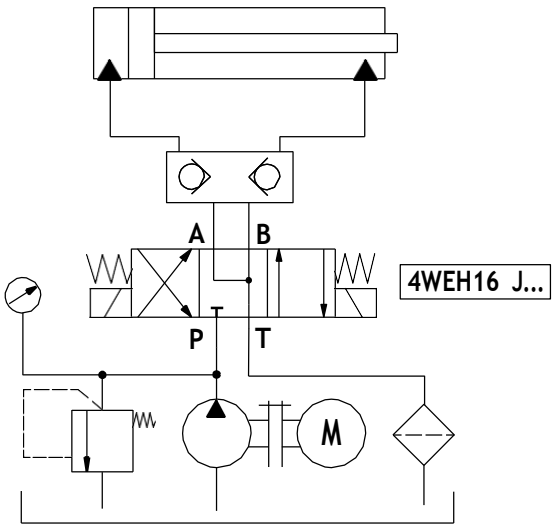
...4WEH16.../...**21**...
...4WEH16.../...**25**...

2 solenoids (on side **a**, **b**) only for versions 4WEH16**H**.../**O**...; **OF**...



NOTE:
(*) - Distance for mounting plug-in connector and cable of sensor (plug-in connectors according to page 4 - 2 pcs not shown on drawing, delivered with the valve)

EXAMPLE OF APPLICATION IN HYDRAULIC SYSTEM



SUBPLATES AND FIXING SCREWS

Subplates must be ordered according to Data Sheet **WK 450 788**. Subplate types:

G174/01 - threaded connections **P, T, A, B - G 1**
X, Y ,L - G1/4
G174/02 - threaded connections P, T, A, B - M33 x 2
X, Y ,L - M14 x 1,5
G172/01 - threaded connections P, T, A, B - G3/4
X, Y, L - G1/4
G172/02 - threaded connections P, T, A, B - M27 x 2
X, Y ,L - M14 x 1,5

Fixing screws for mounting directional spool valve in accordance with **PN - EN ISO 4762**:
M10 x 60 -10,9 - 4 pcs/set
M6 x 60 -10.9 - 2 pcs/set
must be ordered separately.
Tightening torques for screws:
M10 x 60 - Md = 62 Nm
M 6 x 60 - Md = 12,5 Nm
NOTE:
Subplate symbol in bold are preferred versions in short delivery time.

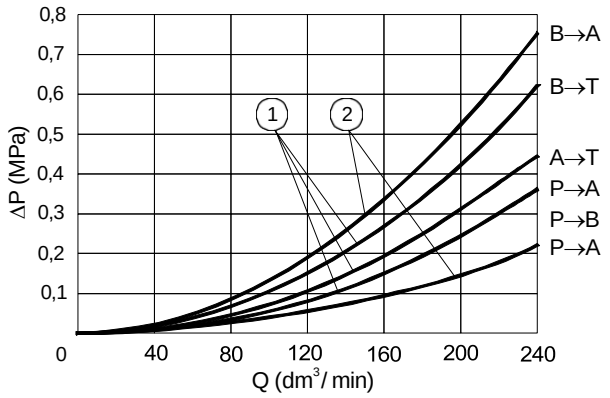
PERFORMANCE CURVES

measured at viscosity $\nu = 41\ mm^2/s$ and temperature $t = 50^oC$

Flow resistance curves

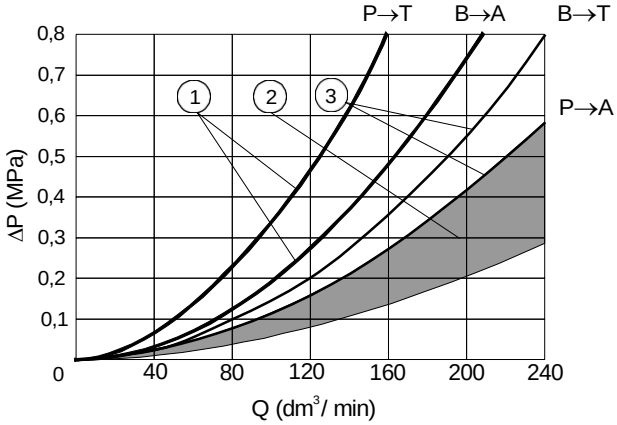
Performance curves Δ**p** (**Q**) for directional valve type **...4WEH16...** with spools **E** and **R**

1 - spools: **E, R**
2 - spool **R** - flow direction **P→A** and **B → A**

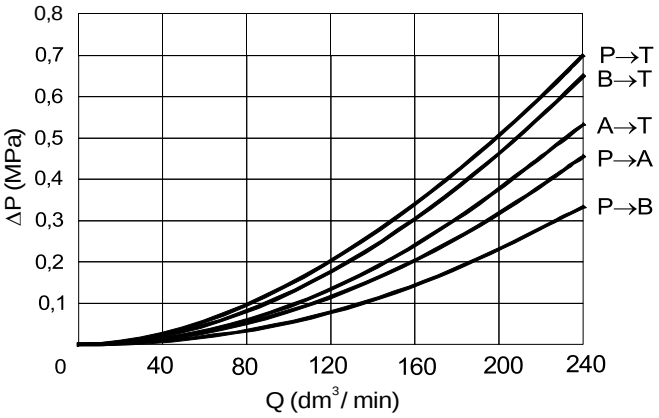


Performance curves Δ**p** (**Q**) for directional valve type **...4WEH16...** with spools: **F, H, J, L, M, Q, S, U, V, W, C, D, D1, K, Z**

1 - spool **S**
2 - spools: **F, H, J, L, M, Q, U, V, W, C, D, K, Z**
3 - spool **D1**



Performance curves Δ**p** (**Q**) for directional valve type **4WEH16...** with spools **G** and **T**



Operating limits

spool type (diagrams see page 8)	**pressure p [MPa]**				
	7	14	21	28	35
	flow rate Q [dm³/min]				
E, J, L, M, Q, R, U, V, W, C, D, K, Z	240	240	205	180	170
F	200	145	115	100	90
G, H, S, T	220	160	130	110	100

HOW TO ORDER

	+	4	WEH					/					+

Design version - working pressure
up to 28 MPa = **no designation**
up to 35 MPa = **H**

Number of service ports
4-way = **4**

Nominal size (NS)
NS16 = **16**

Centering/ spool positioning of the main valve
spring centering = **no designation**
hydraulic off -set = H

Symbol of the main spool
spool diagrams - according to **page 8**

Series number
(70-79) - installation and connection dimensions unchanged = 7X
series 73 = **73**

Centering/positioning of spool of the pilot valve (applicable only to 2-position versions WEH16**HC**... / ...**HD**... /...**HD1**.../ ...**HK**... / ...**HZ**...)
by means of spring (solenoid on side **a**) = **no designation**
without spring (solenoids on side **a** and **b**) = O
without spring, with detent (solenoids on side **a** and **b**) = OF

Supply voltage for solenoids at pilot valve
12V DC = G12
24V DC = **G24**
110V DC = G110
110V AC 50Hz (plug-in-connector with rectifier) = W110R
220V AC 50Hz (plug-in-connector with rectifier) = W220R
230V AC 50Hz (plug-in-connector with rectifier) = **W230R**
230V AC 50 Hz (direct supply with AC current) = W230-50

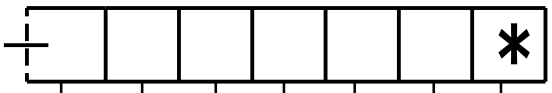
Manual override
solenoids with manual override = **N**
solenoids without manual override - only versions with spool position sensor type **M**) = no designation

Pilot oil supply and pilot oil drain
external pilot oil supply, **external pilot oil drain** = **no designation**
internal pilot oil supply, external pilot oil drain = E
internal pilot oil supply, internal pilot oil drain = ET
external pilot oil supply, internal pilot oil drain = T

Switching time adjustment
without switching time adjustment = **no designation**
switching time adjustment as meter-in control = S
switching time adjustment as meter-out control = S2

Electrical connection
plug-in-connector type ISO 4400 (DIN 43650 - A) **without LED** = **Z4**
plug-in-connector type ISO 4400 (DIN 43650 - A) with LED = Z4L
connector type **AMP Junior Timer**, 2-poles male - for...**G12**...; ...**G24**... options only; without plug-in-connector = J
connector type **DEUTSCH DT04 -2P** - for ...**G24**... option only; without plug-in-connector = D

HOW TO ORDER



Further requirements in clear text
(to be agreed with the manufacturer)

Sealing

NBR (for fluids on mineral oil base)	= **no designation**
FKM (for fluids on phosphate ester base)	= V

Pressure ratio valve

without pressure ratio valve	= **no designation**
with pressure ratio valve	= D1

Pre-load valve

without pre-load valve	= **no designation**
pre-load valve with cracking pressure 0,45 MPa	= P 4,5
pre-load valve with cracking pressure 0,7 MPa	= P 7

Throttle insert in port P of the pilot valve

without throttle insert	= **no designation**
throttle insert φ 0,8	= B 08
throttle insert φ 1,0	= B 10
throttle insert φ 1,2	= B 12

Accessories

(for versions with spool position sensor type **M** available options ...**11**... ...**12**... only)

without accessories	= **no designation**
stroke limiter on valve ends **A** and **B**	= 10
stroke limiter on valve end **A** *	= 11
stroke limiter on valve end **B** **	= 12
end position monitor contact breaker on valve end **A**	= 18
end position monitor contact breaker on valve end **B** (not applicable for 2-position valves with spring positioning)	= 19
stroke limiter on valve end **A** and end position monitor contact breaker on valve end **B**	= 20
stroke limiter on valve end **B** and end position monitor contact breaker on valve end **A**	= 21
end position monitor contact maker on valve end **A**	= 22
end position monitor contact maker on valve end **B** (not applicable for 2-position valves with spring positioning)	= 23
stroke limiter on valve end **A** and end position monitor contact maker on valve end **B**	= 24
stroke limiter on valve end **B** and end position monitor contact maker on valve end **A**	= 25

Spool position sensor type M

without spool position sensor	= **no designation**
0 - **zero** position monitoring *(3-position versions, springs centered and 2-position versions with positions (**a**, **0**) or (**0**, **b**))*	= M0
a position monitoring *(3-position versions with 1 sensor at the **B** side and 2-position versions with positions (**a**, **0**) or (**a**, **b**))*	= MA
b position monitoring *(3-position versions with 1 sensor and 2-position versions with positions (**0**, **b**) or (**a**, **b**))*	= MB
a and **b** position monitoring *(3-position versions, springs centered and 2-position hydraulically positioned versions with 2 sensors at the **A** and **B** side)*	= MAB

NOTES:

Optional accessories for versions with sensor type **M**:

(*) - version ...**11**... available only for ...**MA**... in a 3-position version (sensor at the side of port **B**, **a** position monitoring)

(**) - version ...**12**... available only for ...**MB**... in a 3-position version (sensor at the side of port **A**, **b** position monitoring)

The directional spool valve should be ordered according to the above coding.

The symbols in bold indicate the preferred versions, available in short delivery time.

Coding example: H- 4 WEH16 E 13/G24 N ET Z4

CONTACT
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