

**Characteristics**

The pilot operated proportional DC valves series of the D\*1FH series are high-performance valves with electronic spool position feedback. These valves are available in sizes NG10 to NG32 (CETOP05 to CETOP10).

Typical applications are:

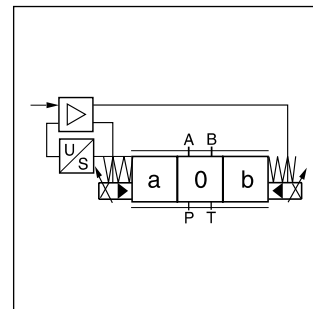
High precision and reproducible adjustment of flow rates, applications in rapid / creep speed with spool position monitoring for presses and dynamic position and p/Q closed loop systems.

**Technical features**

- Very low hysteresis
- Zero lap and overlap spool design available
- High dynamics
- Spool position feedback
- Center position monitoring optional
- D31FH – NG 10 (CETOP05)
- D41FH – NG 16 (CETOP07)
- D81/91FH – NG 25 (CETOP08)
- D111FH – NG 32 (CETOP10)



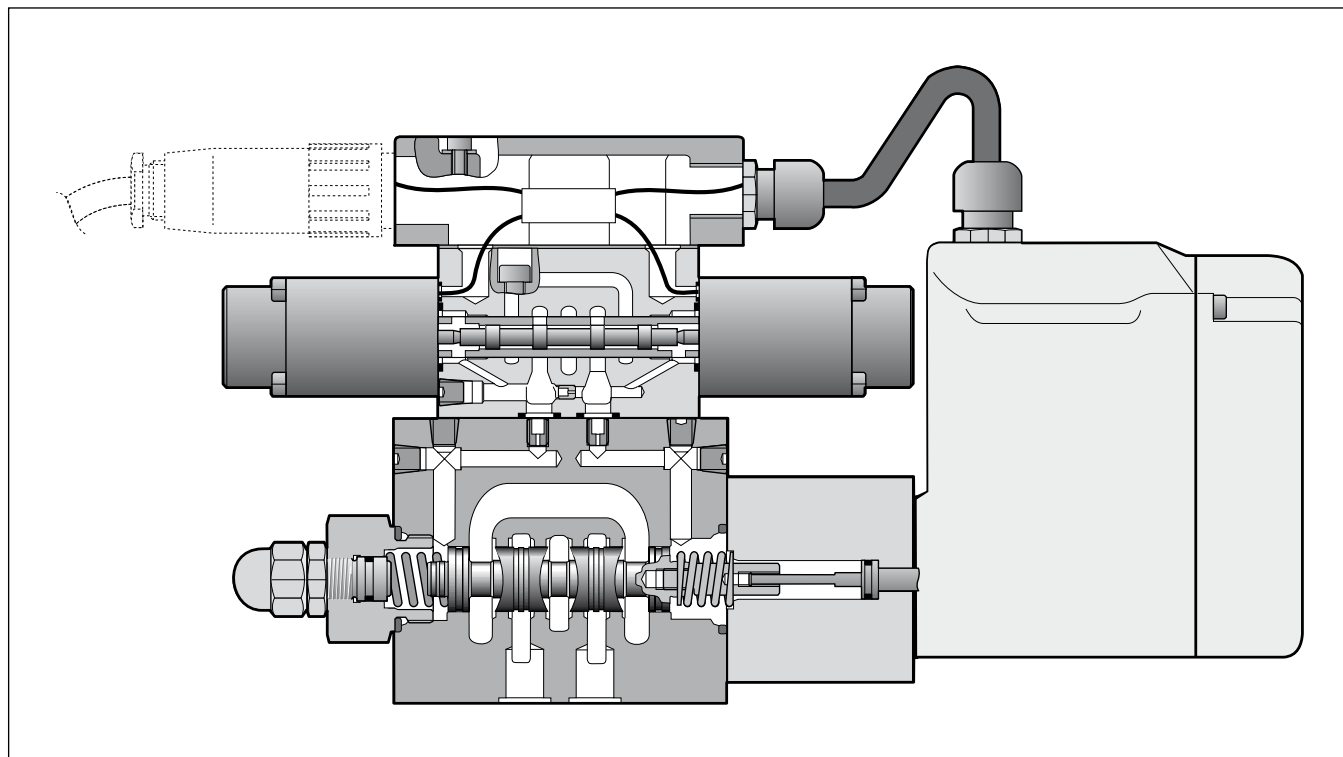
D91FH



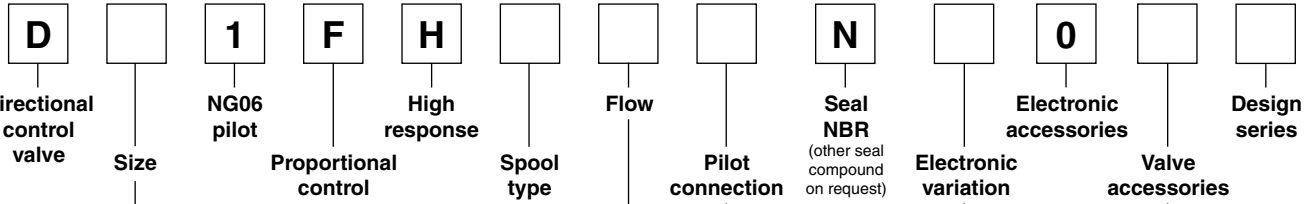
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**D\*1FH**



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Code	Size
<b>3</b>	<b>NG10 / CETOP05</b>
<b>4</b>	<b>NG16 / CETOP07</b>
<b>8</b>	<b>NG25 / CETOP08</b>
<b>9</b> <sup>1)</sup>	<b>NG25 / CETOP08</b>
<b>11</b>	<b>NG32 / CETOP10</b>

<sup>1)</sup> with enlarged connections  
 Ø 32 mm

Code	Spool type overlap
<b>E01</b>	
<b>E02</b>	
<b>B31</b>	$Q_B = Q_A / 2$ 
<b>B32</b>	$Q_B = Q_A / 2$ 
<b>B11</b> <sup>2)</sup>	$Q_B = Q_A / 2$ 
<b>B12</b> <sup>2)</sup>	$Q_B = Q_A / 2$ 

<sup>2)</sup> only Flow code for  
 D31FH\* = Code C  
 D41FH\* = Code F  
 D81/91 FH\* = Code H  
 D111FH\* = Code L

Code	Valve accessories
<b>0</b>	<b>Standard</b>
<b>8</b> <sup>3)</sup>	<b>Monitor switch</b>

<sup>3)</sup> not for spool B11 and B12 at NG10

Code	Electronic variation
<b>B</b>	<b>Voltage input 0...±10V standard</b>
<b>E</b>	<b>Current input 0...±20mA</b>
<b>S</b>	<b>Current input 4...20mA</b>

Code	Inlet	Drain
<b>1</b>	<b>Internal</b>	<b>External</b>
<b>2</b>	<b>External</b>	<b>External</b>
<b>4</b>	<b>Internal</b>	<b>Internal</b>
<b>5</b>	<b>External</b>	<b>Internal</b>

Code	Flow [l/min] at Δp = 5bar per metering edge				
	D31	D41	D81	D91	D111
<b>A</b>	55	—	—	—	—
<b>B</b>	—	<b>105</b>	—	—	—
<b>C</b>	<b>80 (65)</b>	<b>140</b>	—	—	—
<b>E</b>	—	<b>190</b>	<b>250</b>	<b>250</b>	—
<b>F</b>	—	<b>240 (190)</b>	<b>310</b>	<b>310</b>	—
<b>H</b>	—	—	<b>400 (360)</b>	<b>400 (360)</b>	<b>500</b>
<b>L</b>	—	—	—	—	<b>1000 (850)</b>

( ) flow for spool B11/B12

**Bold letters = Short-term availability**

Please order plugs separately.  
 See chapter 3 accessories.

**Technical Data**

<b>General</b>		Pilot operated DC Valve with onboard electronic Proportional solenoid			
Design		Proportional solenoid			
Actuation					
Size		<b>NG10 (CETOP05)</b>	<b>NG16 (CETOP07)</b>	<b>NG25 (CETOP08)</b>	<b>NG32 (CETOP10)</b>
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA			
Mounting position		unrestricted			
Ambient temperature	[°C]	-20...+60			
Weight	[kg]	8.1	11.6	20.7	62
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6			
<b>Hydraulic</b>					
Max. operating pressure	[bar]	Ports P, A, B, T, X 350; Port Y 10			
Fluid		Hydraulic oil as per DIN 51524...535, other on request			
Fluid temperature	[°C]	-20...+60			
Viscosity					
permitted	[cSt] / [mm²/s]	20...380			
recommended	[cSt] / [mm²/s]	30...80			
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)			
Nominal flow at Δp=5bar per control edge <sup>1)</sup>	[l/min]	80	240	400	1000
Leakage at 100 bar	[ml/min]	100	200	600	1000
Pilot supply pressure	[bar]	20-350 (optimal dynamics at 50)			
Pilot flow	[l/min]	<1.2			
Pilot flow, step response	[l/min]	2.0	4.1	9.0	18.0
<b>Static / Dynamic</b>					
Step response at 100% step	[ms]	25	45	65	150
Hysteresis	[%]	<0.1			
Sensitivity	[%]	<0.05			
<b>Electrical characteristics</b>					
Duty ratio	[%]	100			
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)			
Supply voltage/ripple	[V]	18 ... 30, ripple <5% eff., surge free			
Current consumption max.	[A]	2.0			
Input signal <sup>2)</sup>					
Voltage	[V]	10...0...-10, ripple <0.01% eff., surge free, 0...+10V P→B			
Impedance	[kOhm]	100			
Current	[mA]	20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P→B			
Impedance	[Ohm]	500			
Current	[mA]	4...12...20, ripple <0.01% eff., surge free, 12...20mA P→A			
Impedance	[Ohm]	500			
Differential input max.	[V]	30 for terminal D and E against PE			
Pre-fusing	[A]	2.5 medium lag			
EMC		EN 50081-2 / EN50082-2			
Coil insulation class		F (155 °C)			
Electrical connection		6+PE acc. EN 175201-804			
Wiring min.	[mm²]	7x1.0 (AWG 18) overall braid shield			
Wiring lenght max.	[m]	50			
<b>Electrical monitor switch</b>					
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)			
Ambient temperature	[°C]	0-70			
Supply voltage/ripple	[V]	18...42, ripple <10% eff.			
Current consumption without load	[mA]	<30			
Max. output current per channel, ohmic	[mA]	400			
Min. output load per channel, ohmic	[kOhm]	100			
Max. output drop at 0.2A	[V]	<1.1			
Max. output drop at 0.4A	[V]	<1.6			
EMC		EN 50081-1 / EN50082-2			
Max. tol. ambient field strength	[A/m]	1200			
Min. distance to next AC solenoid	[m]	0.1			
Interface		4+PE acc. IEC 61076-2-101 (M12)			
Wiring min.	[mm²]	4x0.5 (AWG 20) overall braid shield			
Wiring lenght max.	[m]	50			

<sup>1)</sup> Flow rate for different Δp per control edge:

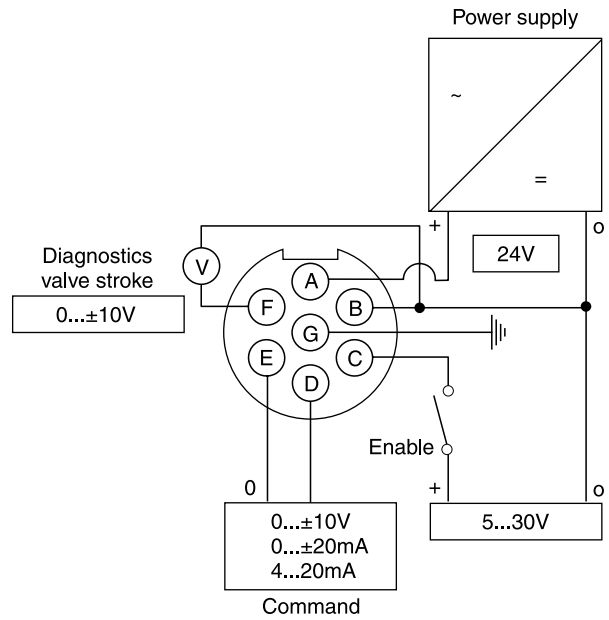
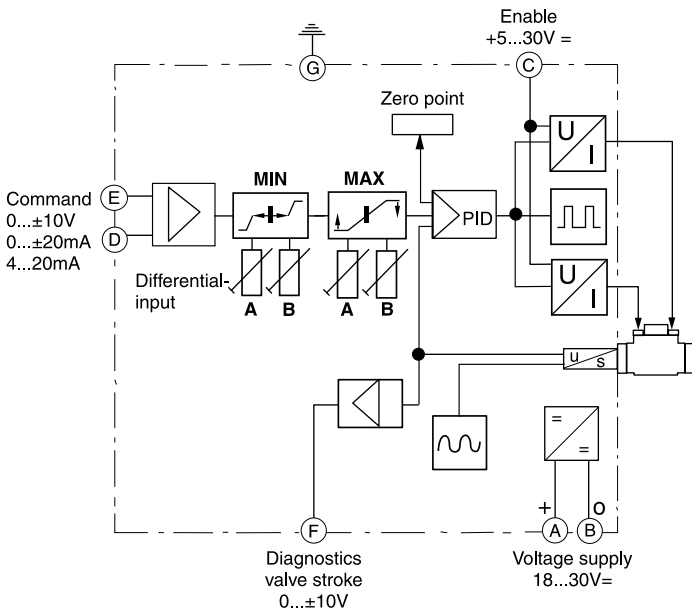
<sup>2)</sup> Inverse polarity on request

$$Q_x = Q_{Nom.} \cdot \sqrt{\frac{\Delta p_x}{\Delta p_{Nom.}}}$$



**Control system flow chart, valve electronics**

**Wiring**



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**Enable input**

The power stage is activated via pin C (enable input).

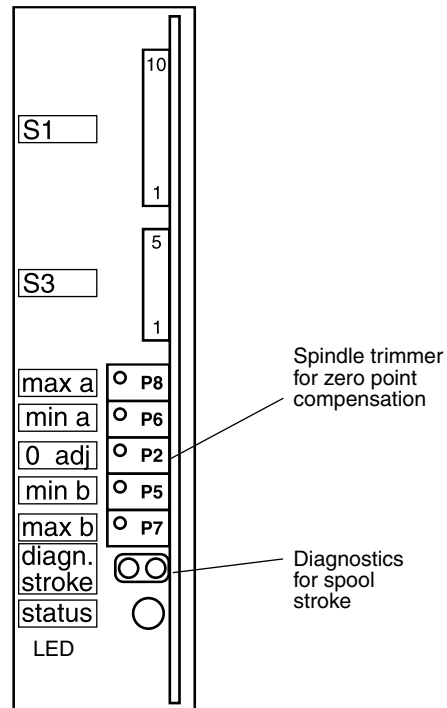
**Supply voltage monitoring**

If the minimal supply voltage drops below, it is internally monitored and displayed via the status LED.

**Control monitoring**

A control error is indicated if there is an error in the control circuit of the valve.

**Arrangement of the potentiometers**

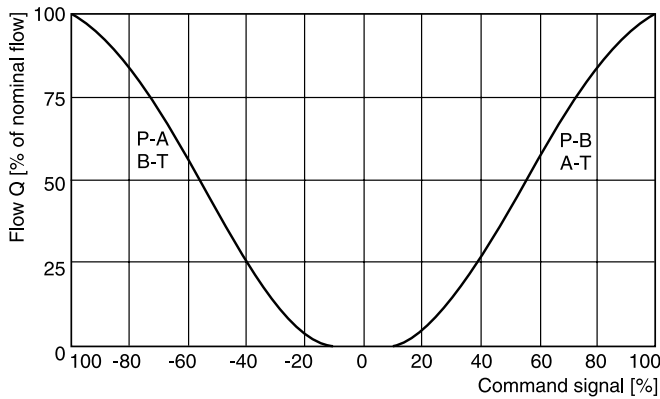


<b>Display is green</b>	Normal operation
<b>Display off</b>	Supply voltage is outside the permissible range of 18 ... 30V
<b>Display is red</b>	Control error

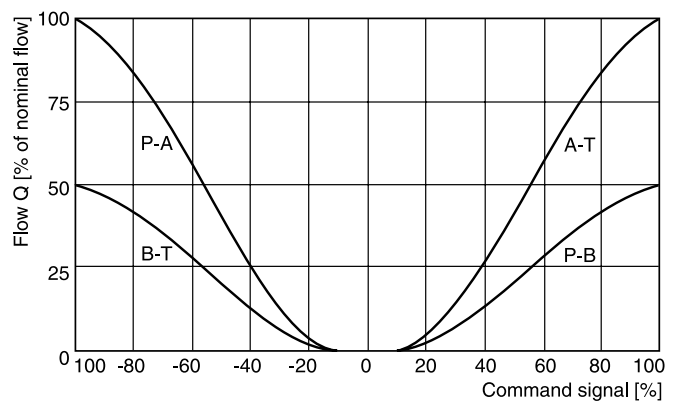
**Flow characteristics**

at  $\Delta p = 5\text{bar}$  per metering edge

**Spool types E01, E02**

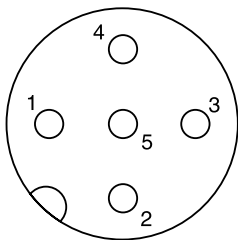


**Spool types B31, B32**

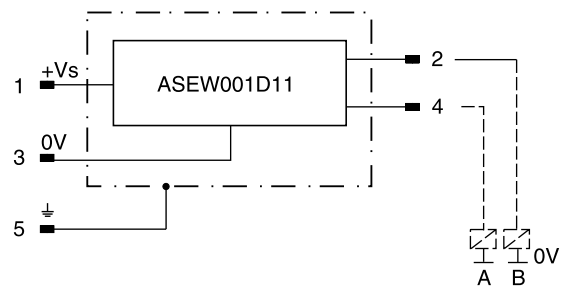


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**Monitor switch M12x1 pin assignment**



- 1 + Supply 18...42V
- 2 output B (normally closed)
- 3 0V
- 4 output A (normally closed)
- 5 Earth ground

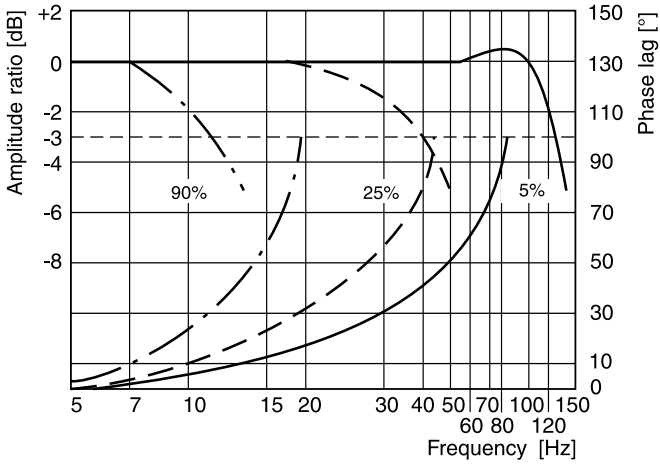


Signal	Output A (pin 4)	Output B (pin 2)
neutral	closed	closed
	open	closed
	closed	open

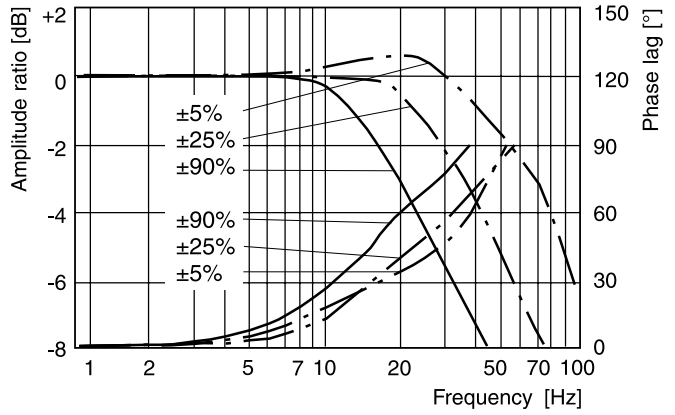
The neutral position is monitored. The signal changes after less than 10% of the spool stroke.

**Frequency response**

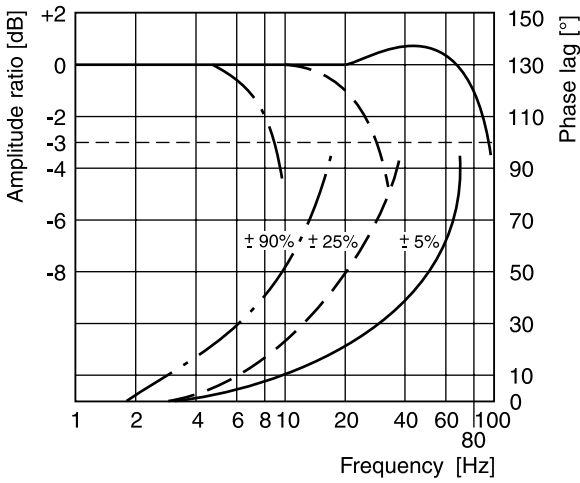
**D31FH**



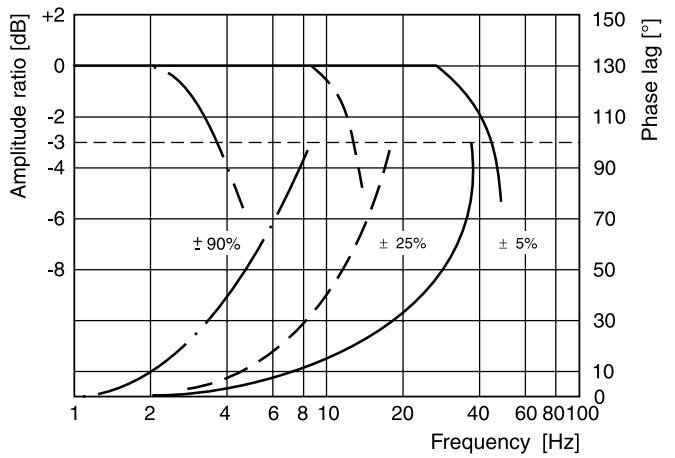
**D81/91FH**



**D41FH**



**D111FH**

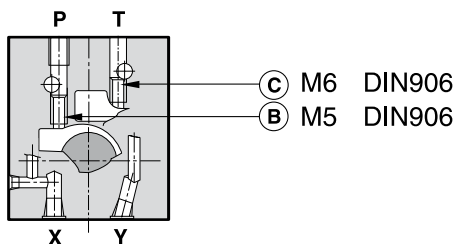


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**Pilot Flow**

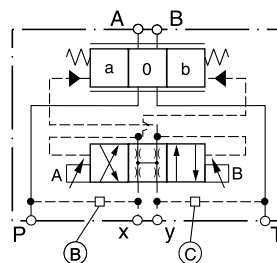
**Pilot oil inlet (supply) and outlet (drain)**

**D31FH**

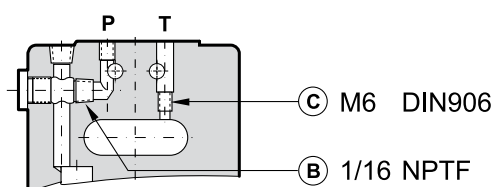


○ open, ● closed

Pilot oil		B	C
Inlet	Drain		
internal	external	○	●
external	external	●	●
internal	internal	○	○
external	internal	●	○

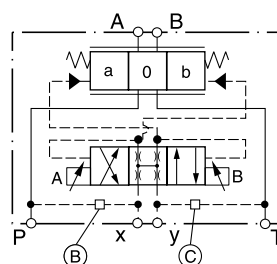


**D41FH**

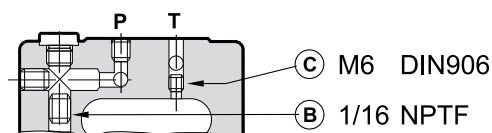


○ open, ● closed

Pilot oil		B	C
Inlet	Drain		
internal	external	○	●
external	external	●	●
internal	internal	○	○
external	internal	●	○

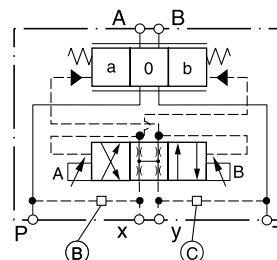


**D81/91FH**

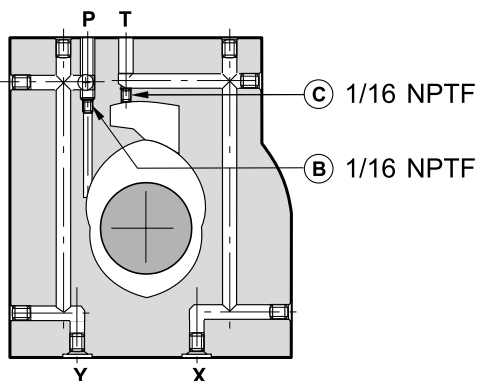


○ open, ● closed

Pilot oil		B	C
Inlet	Drain		
internal	external	○	●
external	external	●	●
internal	internal	○	○
external	internal	●	○

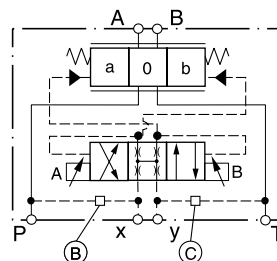


**D111FH**

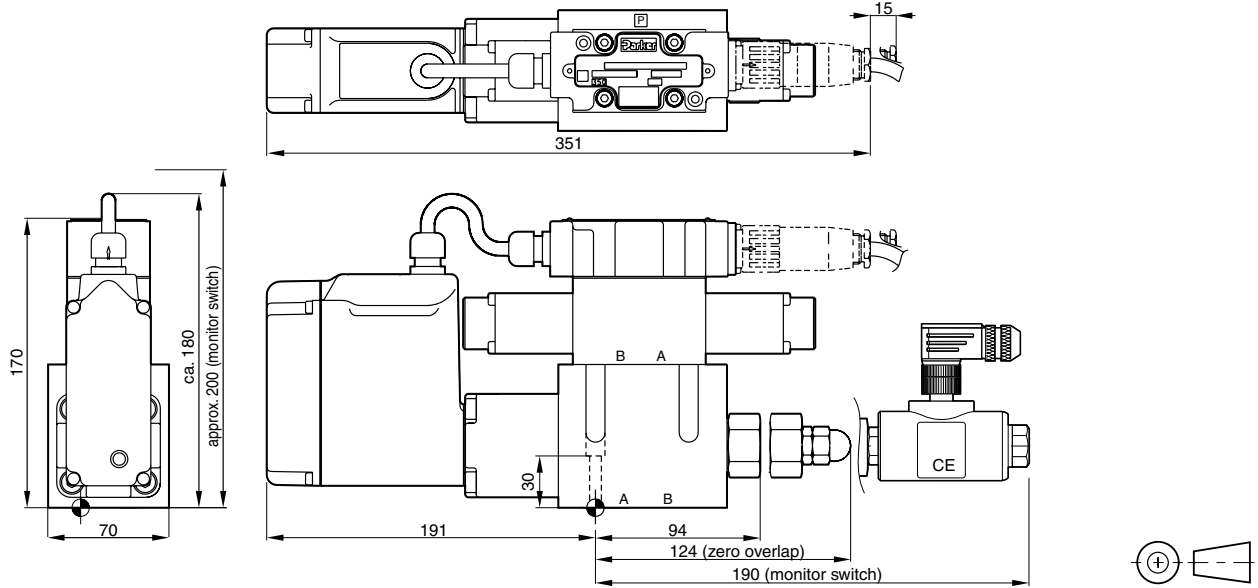


○ open, ● closed

Pilot oil		B	C
Inlet	Drain		
internal	external	○	●
external	external	●	●
internal	internal	○	○
external	internal	●	○

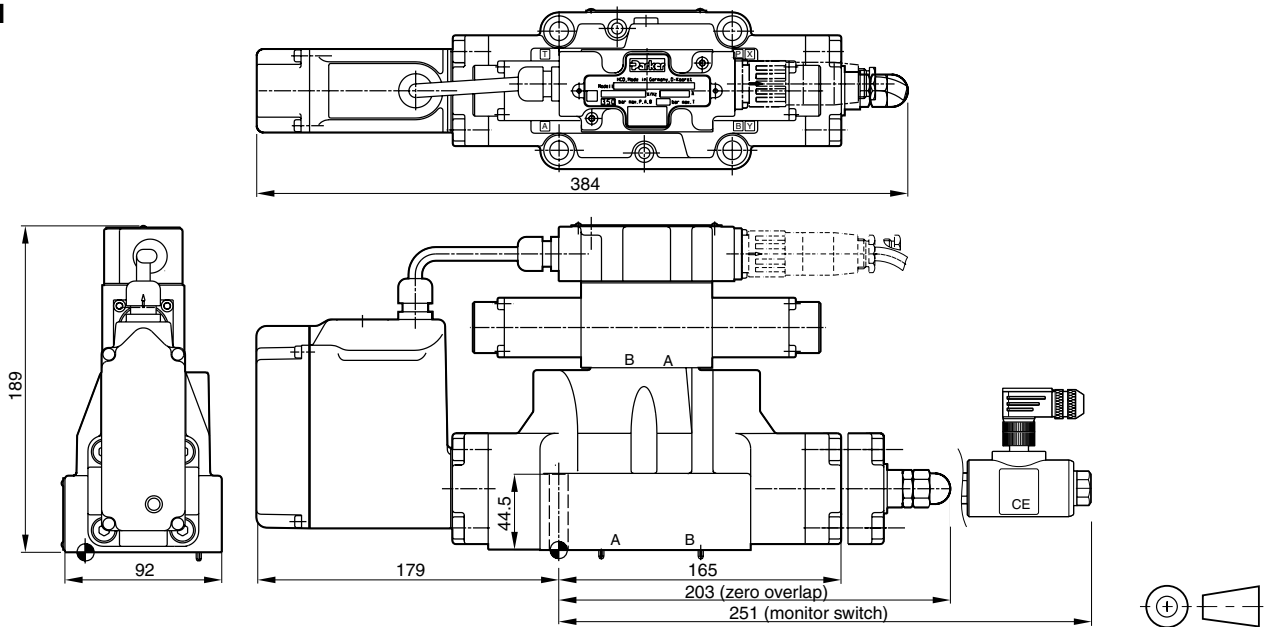


**D31FH**



<b>Surface finish</b>	<b>Kit</b>	<b>Wrench</b>	<b>Wrench</b>	<b>Kit</b>
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	<b>NBR</b>  SK-D31FHN

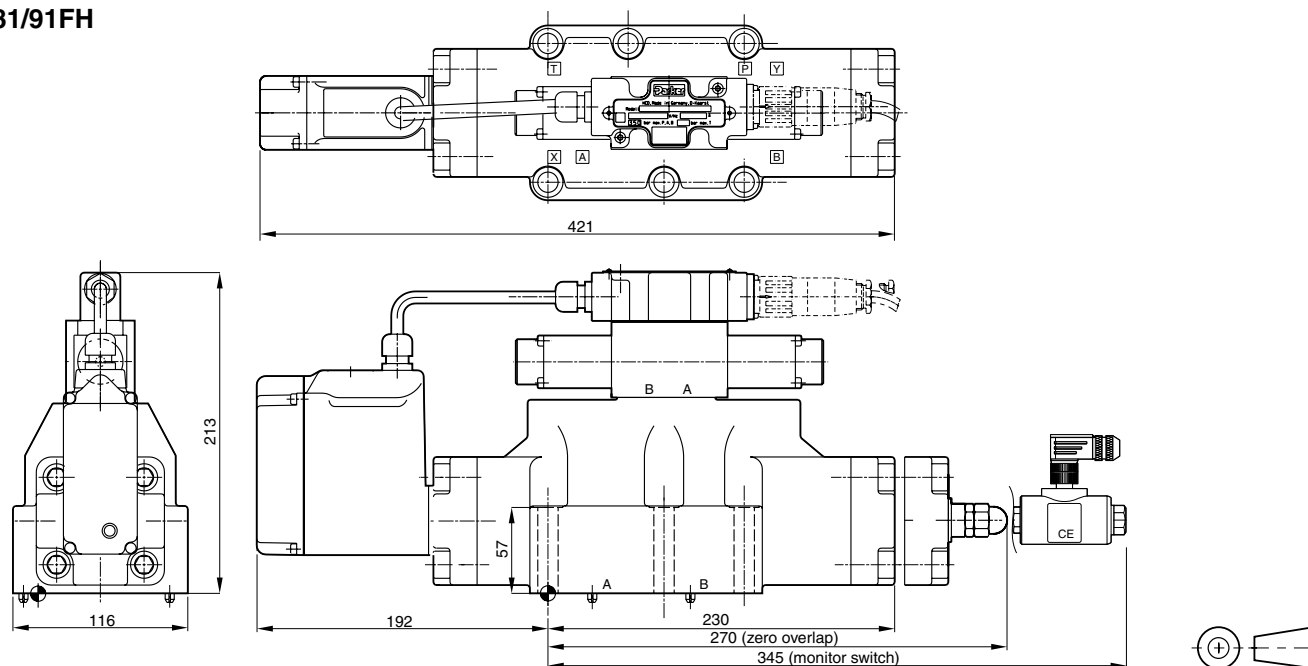
**D41FH**



<b>Surface finish</b>	<b>Kit</b>	<b>Wrench</b>	<b>Wrench</b>	<b>Kit</b>
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 Nm ±15%	<b>NBR</b>  SK-D41FHN

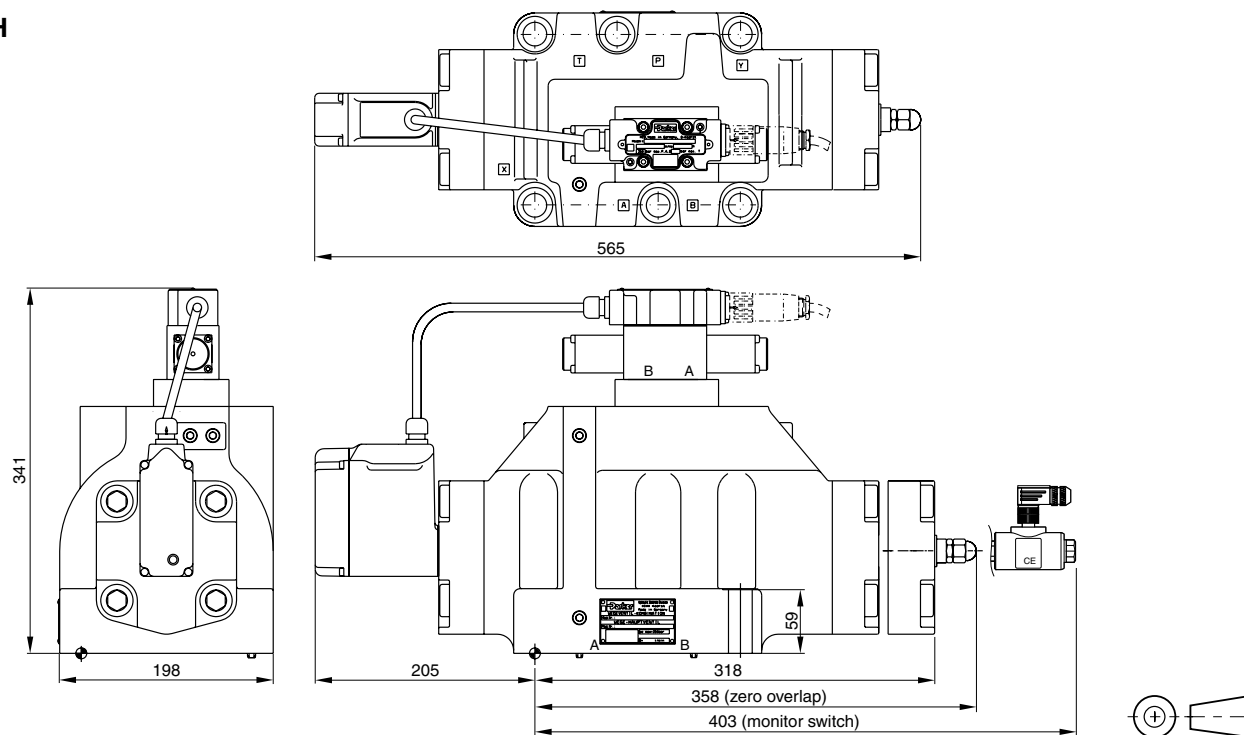


**D81/91FH**



<b>Surface finish</b>	<b>Kit</b>			<b>Kit</b> <b>NBR</b>
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	SK-D91FHN

**D111FH**



<b>Surface finish</b>	<b>Kit</b>			<b>Kit</b> <b>NBR</b>
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK386	6x M20x90 DIN 912 12.9	517 Nm ±15%	SK-D111FHN

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