

Series		Description	Direct operated		Pilot operated				Onboard electronics	Spool feedback	Page
Parker	Denison		06	10	10	16	25	32			
		DIN / ISO	06	10	10	16	25	32			
		Standard dynamics, standard repeatability									
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D3FB	—			•							3-15
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D41FW	—					•					
D91FW	—						•				
—	4DP02 V				•						3-35
—	4DP03					•					
—	4DP06						•				
D1FT	—		•						•		3-45
D31FT	—				•				•		3-51
D41FT	—					•			•		
D91FT	—						•		•		
		High dynamics, high repeatability									
D31FH	—				•				•	•	3-59
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D81/91FH	—						•		•	•	
D111FH	—							•	•	•	
		VCD® dynamics*, for closed loop applications									
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D3FP*0	—	Spool / sleeve design		•					•	•	3-81
D3FP*3	—	Spool / body design		•					•	•	3-87
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D81/91FP	—						•				
D111FP	—							•			
		Accessories									
		Plug-in connectors									3-101
		Mounting patterns									

* VCD® = Voice Coil Drive technology

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin, dark gray lines. There are 20 columns and 20 rows of squares, creating a total of 400 square units. The background is white, and the grid covers the entire area of the page.

Characteristics

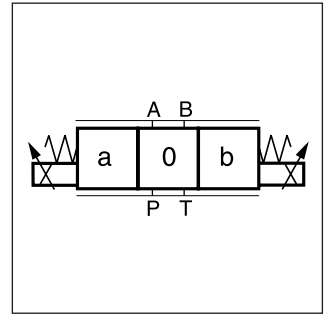
Direct Operated Proportional DC Valve Series D1FB

The D1FB directional control valve of the nominal size NG6 (CETOP3) provides variable flow rates.

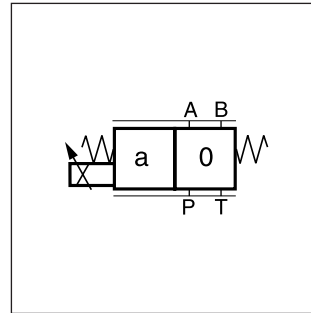
Due to a spool and sleeve combination with wire EDM window geometry and a special manufacturing adjustment, the valve achieves excellent repeatability from valve to valve and high precision. The D1FB is suited for standard applications particularly with regard to functions on identical machines, which need only to be adjusted once. In combination with the digital power amplifier PWD00A-400, the valve parameters can be saved, changed and duplicated.

Technical features

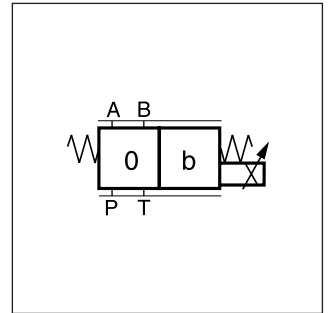
- Spool/sleeve design
- High repeatability from valve to valve
- Low hysteresis
- Manual override
- Fail-safe centre position



D1FB*C

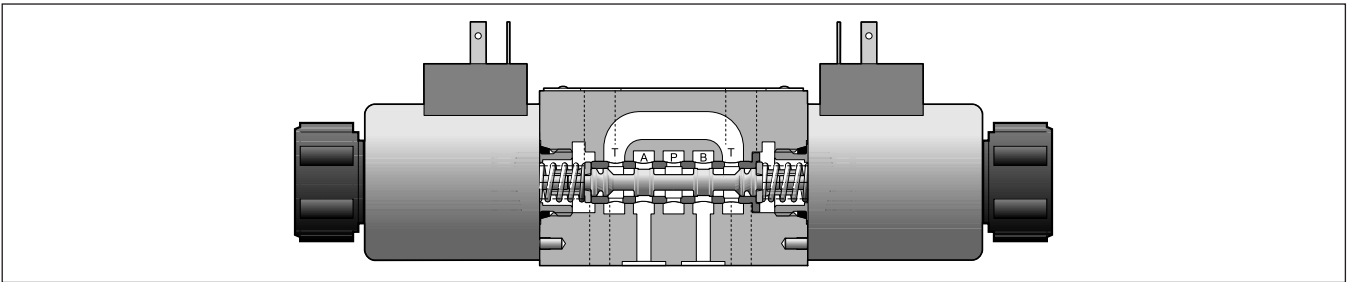


D1FB*E

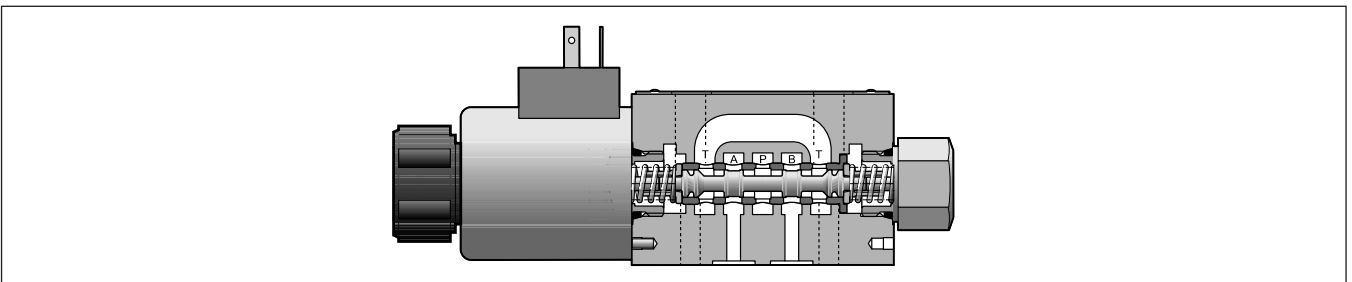


D1FB*K

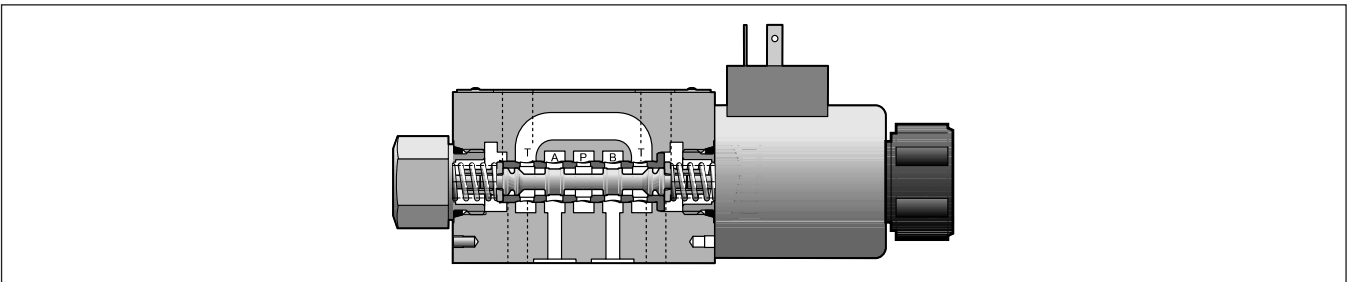
D1FB*C



D1FB*E



D1FB*K



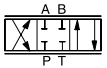
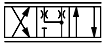
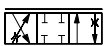
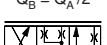
D1FB_UK.INDD CM_28.01.08.1

Ordering Code

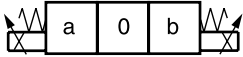
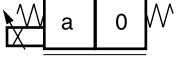
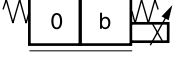
Direct Operated Proportional DC Valve
Series D1FB

D	1	F	B			0	N	M	W	0
Directional control valve	Size DIN NG06 CETOP 03 NFFA D03	Proportional control	Standard dynamics standard repeatability	Spool type	Spool position		Seals NBR (other seal compounds on request)	Solenoid description 9V/2.7A (other voltage on request)	Connector as per EN 175301-803 without plug*	Spool/sleeve design

3

Code	Spool type	Flow [l/min] at Δp 5bar per metering edge
E01H E01F E01C		20 12 6
E02H E02F E02C		20 12 6
E03H E03F E03C		20 12 6
B31H B31F	$Q_B = Q_A / 2$ 	20 / 10 12 / 6
B32H B32F	$Q_B = Q_A / 2$ 	20 / 10 12 / 6

Bold letters =
Short-term availability

Code	Spool position
C	
E	
K	

* Please order plugs separately.
See chapter 3 accessories.

General		
Design		Direct operated proportional DC valve
Actuation		Proportional solenoid
Size		NG06/CETOP 03/NFPA D03
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+60
Weight	[kg]	2.2
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350;
	[bar]	Port T 210
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 *	[l/min]	6 / 12 / 20
Leakage at 100 bar	[ml/min]	<50
Static / Dynamic		
Hysteresis	[%]	<4
Electrical characteristics		
Duty ratio	[%]	100
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Solenoid		Code "M"
Supply voltage	[V]	9
Current consumption	[A]	2.7
Resistance	[Ohm]	2.7
Coil insulation class		F (155 °C)
Solenoid connection		Connector as per EN 175301-803
Wiring min.	[mm²]	3x1.5 (AWG 16) overall braid shield
Wiring length max.	[m]	50

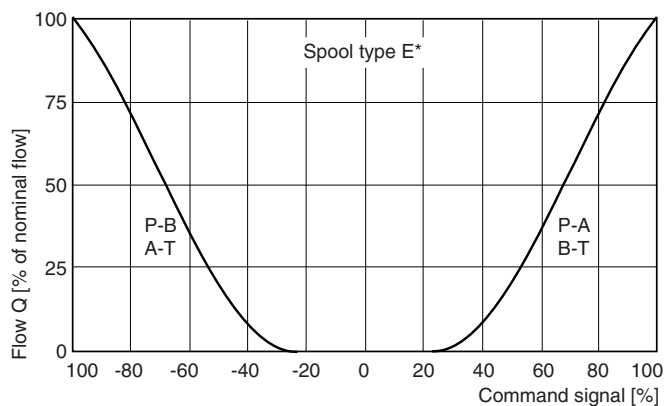
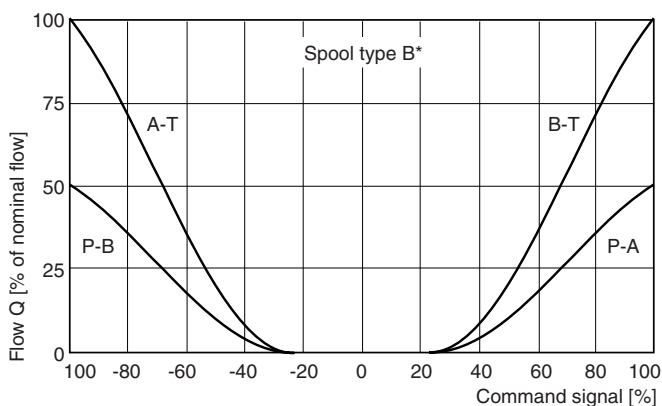
* Flow rate for different Δp per control edge:

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

Flow characteristics

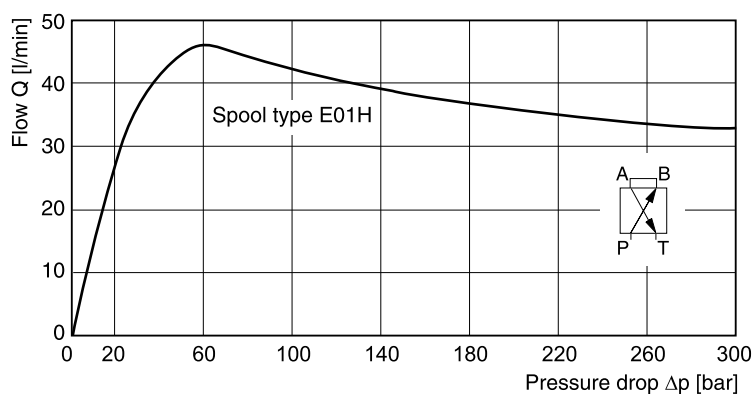
at $\Delta p = 5$ bar per metering edge

Fluid viscosity 40cSt at 50°C



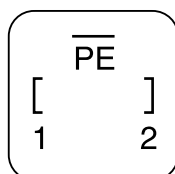
Flow limit

100% command signal



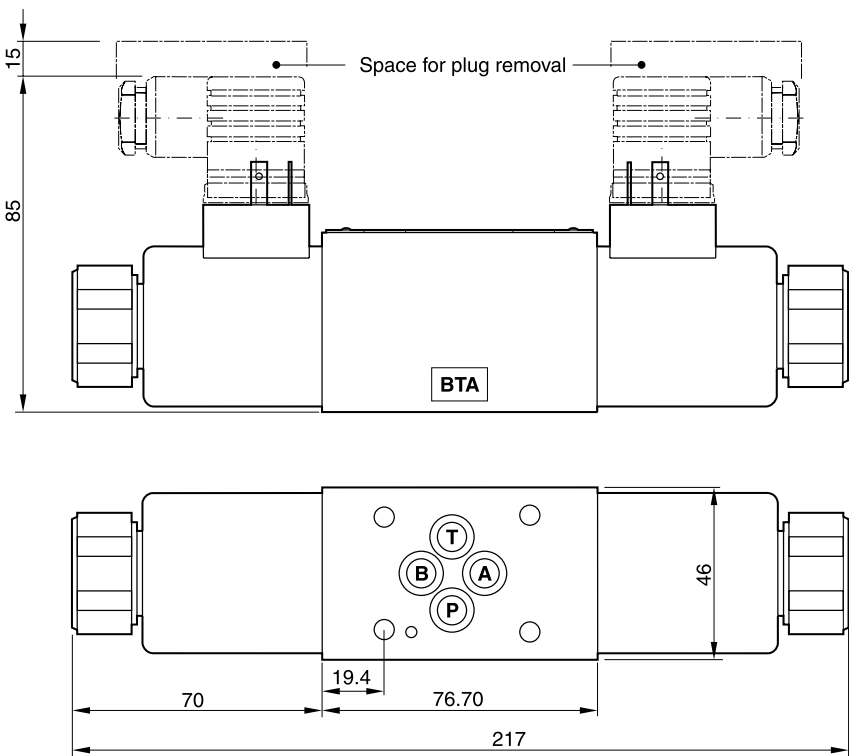
Plug

Solenoid coil

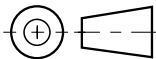
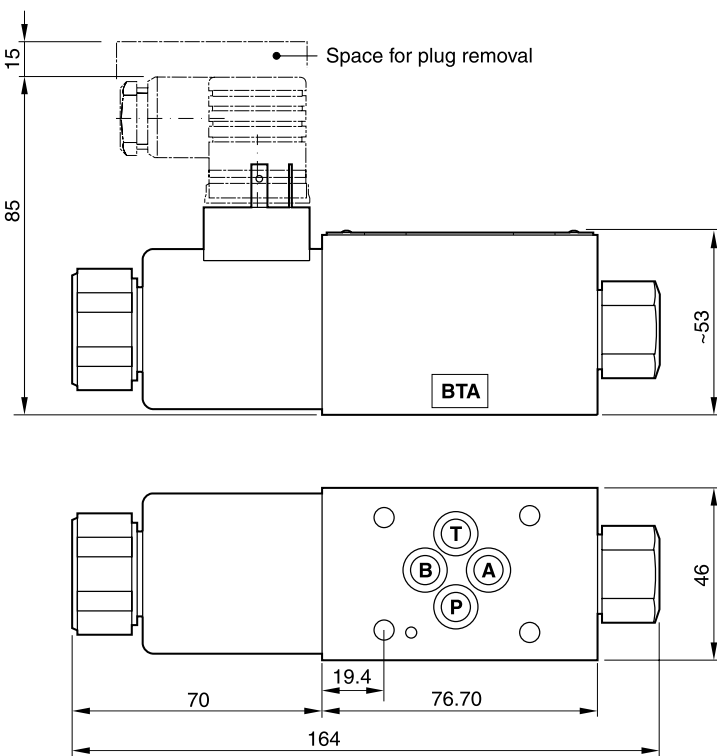


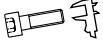
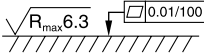
- 1 = coil connection
- 2 = coil connection
- PE = ground potential

D1FB*C



D1FB*K



Surface finish	 Kit			 Kit NBR
	BK375	4x M5x30 DIN 912 12.9	7.6 Nm ±15%	SK-D1FB-N

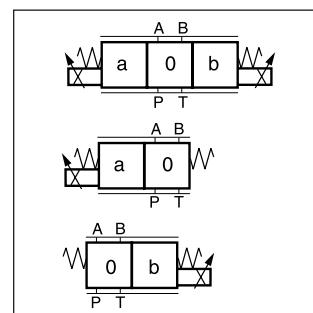
3

[illegible]

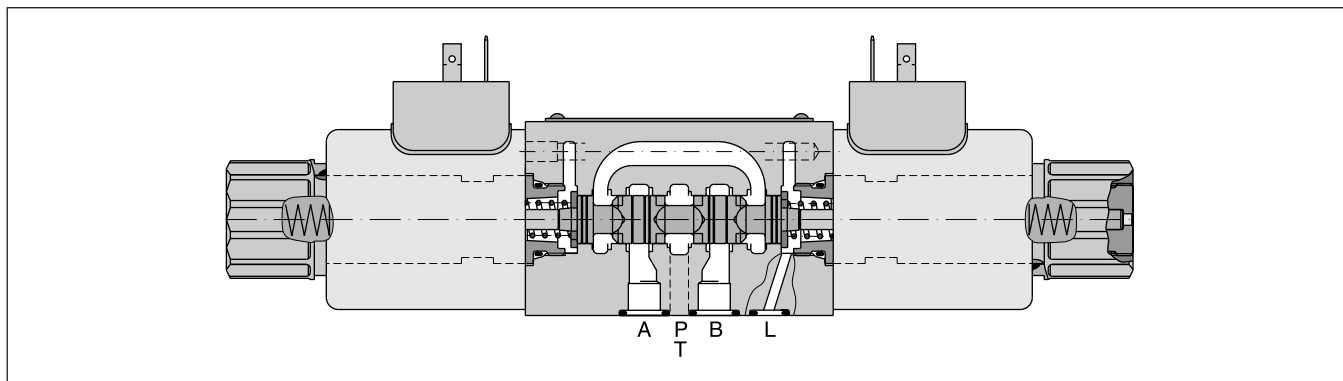
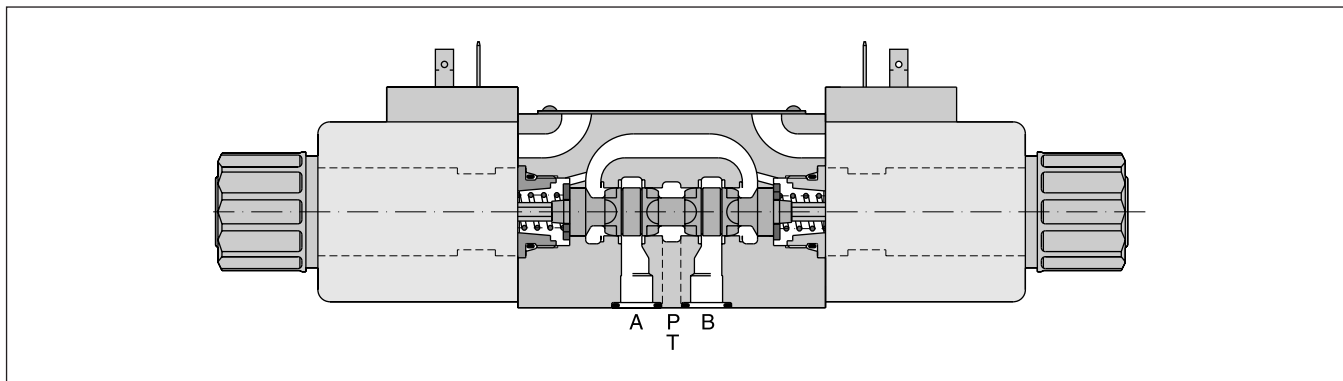
The proportional directional valves 4DP01 and 4DPE01 (NG06) are offered under Denison brand name.

The spool in body design provides high flow rates at a good level of precision. The 4DPE01 series has a 3-chamber body and is suitable for basic proportional functions such as following a flow profile with acceleration and deceleration ramps.

In combination with the digital power amplifier PWD00A-400, the valve parameters can be saved, changed and duplicated.

**Technical features**

- Spool in body design
- High flow rates
- Low hysteresis
- Manual override
- Fail-safe centre position
- Economical series 4DPE01

4DP01**4DPE01**

Ordering Code

Direct Operated Proportional DC Valves
Series 4DP01, 4DPE01 (Denison)

4DP **01** - **E** - **G12**

Directional prop. control valve Series Size DIN NG06 CETOP 03 NFPA D03 Body Control Spool type Flow Spool position Design series Seals Solenoid ¹⁾ 12V/2.2A Connector as per EN 175301-803

Code	Series
omit	Standard
E	Economic

Code	Body
3	Standard
L	With drain port "L" (only 4DP01: for tank pressure > 160bar)

3 position spools	
Code	Spool type
Spool position 03	
02	a 0 b
43	

2 position spools	
Code	Spool type
Spool position 05	
12	0 b
13	
Spool position 06	
12	a 0
13	

Code	Flow
4DP01	
F10	10 l/min
F20	20 l/min
F30	30 l/min
4DPE01	
Q10	10 l/min
Q20	20 l/min
Q30	30 l/min

Code	Connectors
omit	Not supplied
C1	PG11

Code	Seals
1	NBR
5	FPM

Code	Design series
B	4DP01
A	4DPE01

3 position spools	
Code	Spool position
03	3 positions. Spring offset in position "0".
05	2 positions. Spring offset in position "0". Energized to "b".
06	2 positions. Spring offset in position "0". Energized to "a".

¹⁾ Onboard electronics on request

General		
Design		Direct operated proportional DC valve
Actuation		Proportional solenoid
Size		DIN NG6 / CETOP 03 / NFPA D03
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted, preferably horizontal
Ambient temperature	[°C]	-20...+50
Weight	[kg]	1.8 (1 solenoid) 2.3 (2 solenoids)
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350; 4DP01 with port L: T 210, L10; without port L: T 160 4DPE01 port T: 110
Fluid		Hydraulic oil as per DIN 51524/25, other on request
Fluid temperature	[°C]	-20...+80
Viscosity		
permitted	[cSt] / [mm²/s]	10...650
recommended	[cSt] / [mm²/s]	30
Filtration		ISO 4406 (1999) 18/16/13
Nominal flow at $\Delta p=5\text{bar}$ per control edge *	[l/min]	10 / 20 / 30
Leakage at 100 bar	[ml/min]	<50
Static / Dynamic		
Hysteresis	[%]	4DPE01 ≤ 10, 4DP01 ≤ 5
Electrical characteristics		
Duty ratio	[%]	100 ED
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Solenoid		Code G12, G24 (only 4DP01)
Supply voltage	[V]	12, 24
Current max.	[A]	2.2
Resistance	[Ohm]	3.7
Coil insulation class		H (180 °C)
Solenoid connection		Connector as per EN 175301-803
Wiring min.	[mm²]	3x1.5 (AWG 16) overall braid shield
Wiring length max.	[m]	50

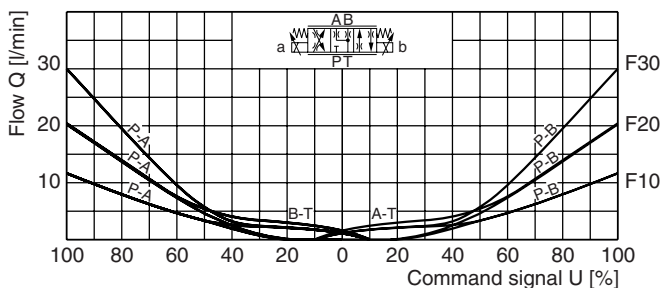
* Flow rate for different Δp per control edge:

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

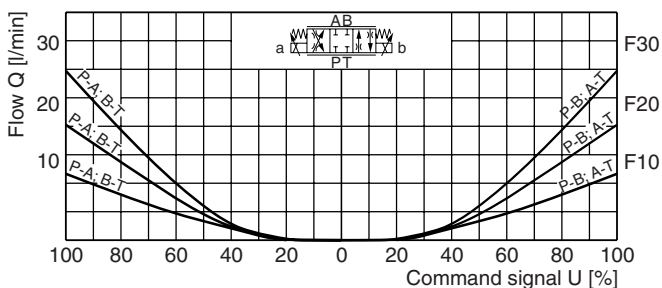
Flow characteristics 4DP01

at $\Delta p = 5$ bar per metering edge
 Fluid viscosity 40cSt at 50°C

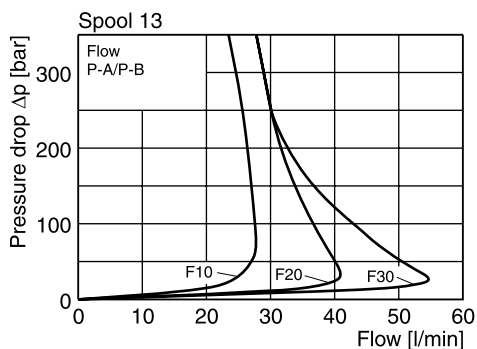
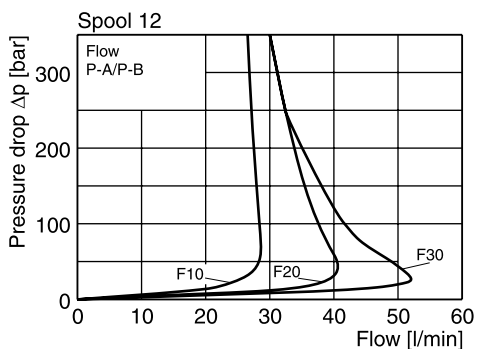
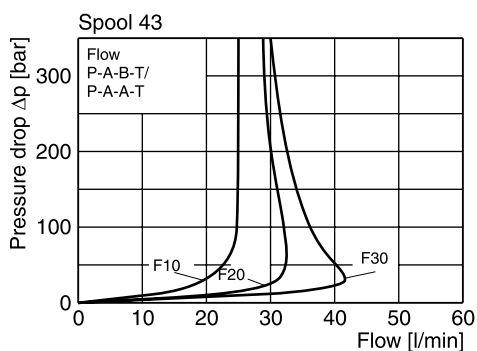
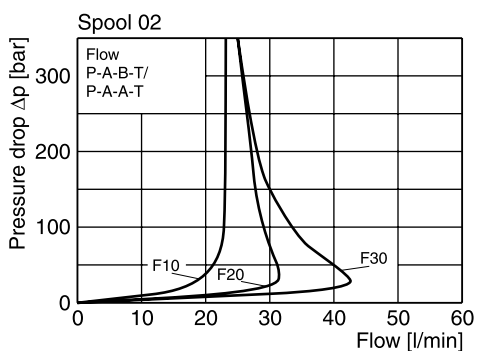
Spool 02



Spool 43



Flow limit



Characteristic Curves

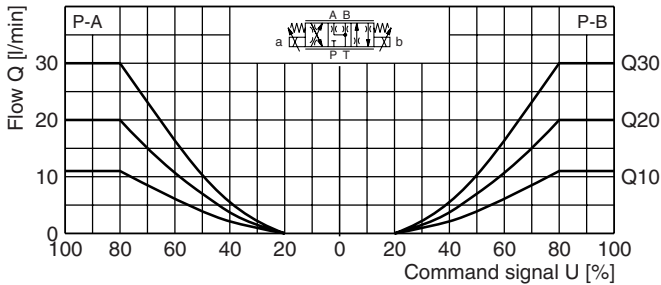
Direct Operated Proportional DC Valve Series 4DPE01 (Denison)

Flow characteristics 4DPE01

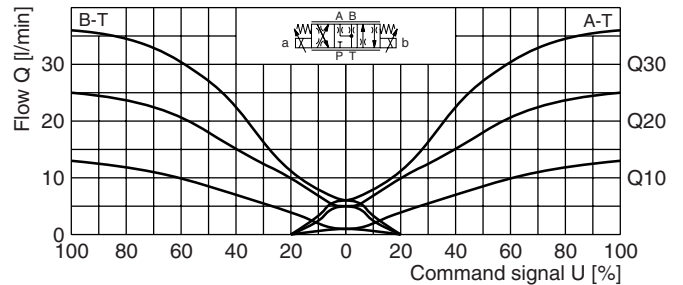
at $\Delta p = 5$ bar per metering edge

Fluid viscosity 40cSt at 50°C

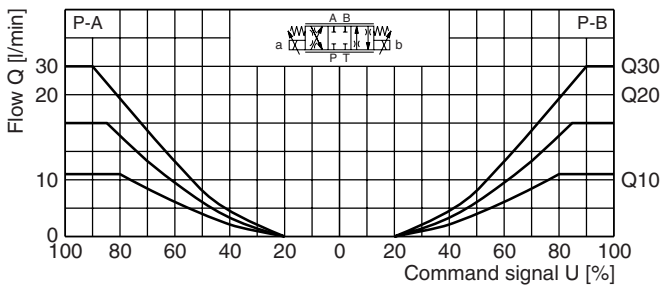
Spool 02



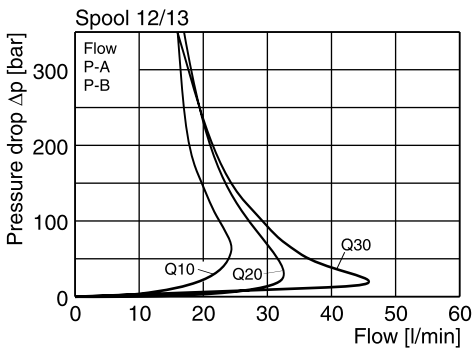
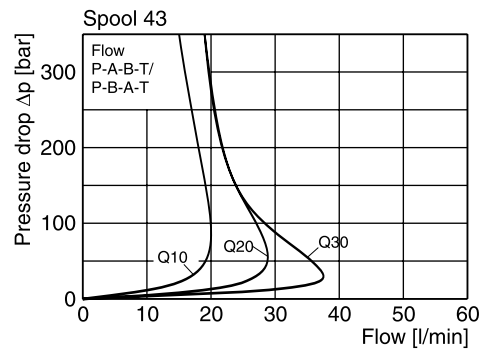
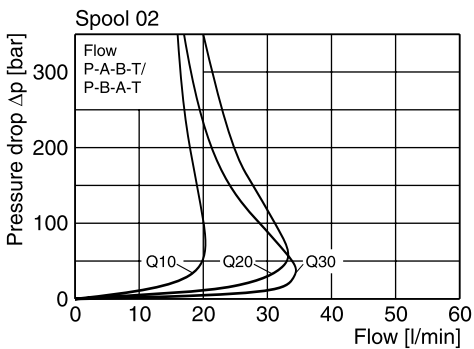
Spool 02



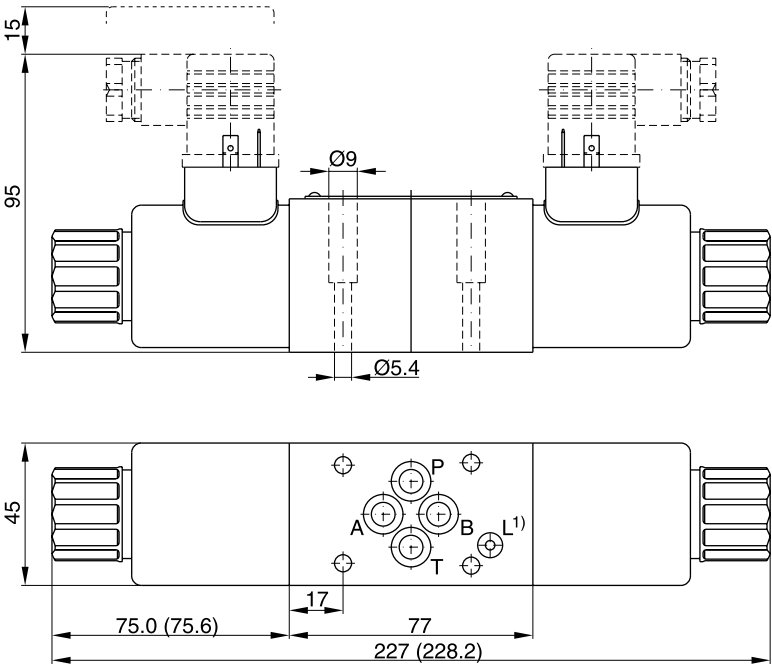
Spool 43



Flow limit

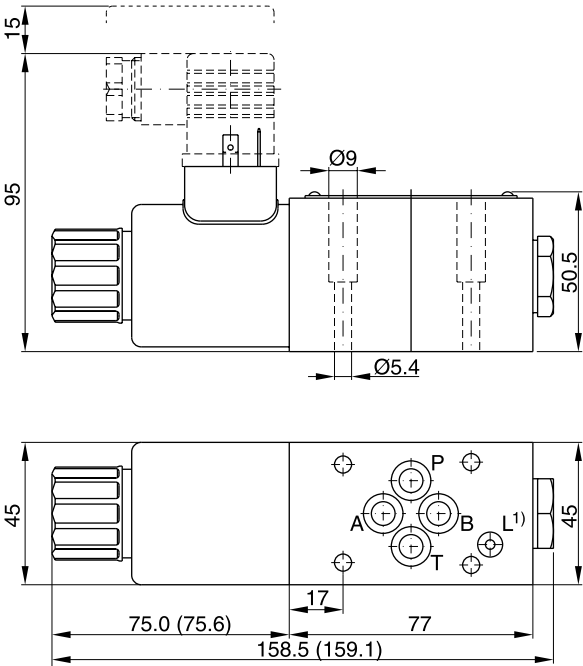


4DP01*03
4DPE01*03

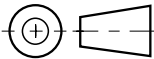


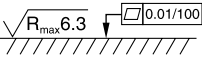
¹⁾only 4DP01

4DP01*06
4DPE01*06



¹⁾only 4DP01

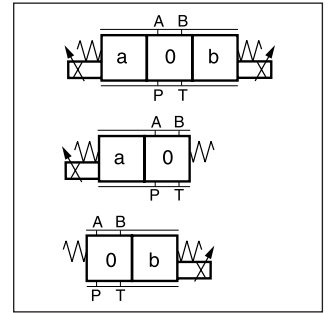


Surface finish	 Kit	 4x M5x30 DIN 912 10.4	 8.3 Nm	 Kit NBR
	BK375			SK-D1FB-N

The D3FB directional control valve of the nominal size NG10 (CETOP 05) provides variable flow rates.

The D3FB is available as spool in sleeve design (code 0) for maximum precision as well as spool in body design (code 3) for high flow rates.

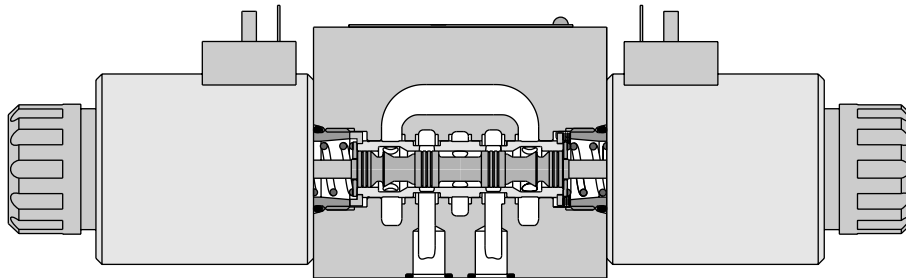
In combination with the digital power amplifier PW-D00A-400, the valve parameters can be saved, changed and duplicated.

**Technical features**

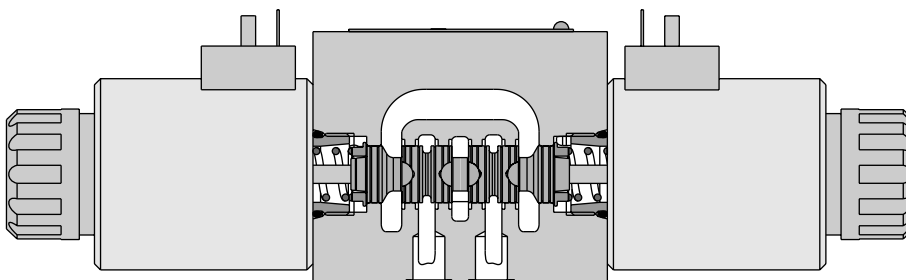
- Spool/sleeve design, spool/body design
- High repeatability from valve to valve
- Low hysteresis
- Manual override
- Fail-safe centre position

D3FB*C*0

(Spool in sleeve design)

**D3FB*C*3**

(Spool in body design)



D3FB*0

Spool in sleeve design

D

3

F

B

0

N

K

W

0

DC valve

Size
DIN NG10
CETOP 05
NFPA D05

Flow control

Spool type

Design

Seal NBR
(other seal compounds on request)

Solenoid
12 VDC/2.95A

Connector
as per EN 175301-803 without plug*

Spool sleeve design

Code	Spool type	Flow [l/min] at Δp 5bar per metering edge
E01M E01S		40 60
E02M E02S		40 60
B31M B31S	$Q_B = Q_A/2$ 	40 / 20 60 / 30
B32M B32S	$Q_B = Q_A/2$ 	40 / 20 60 / 30

Code	Design
C	
E	
K	

D3FB*3

Spool in body design

D

3

F

B

0

N

K

W

3

DC valve

Size
DIN NG10
CETOP 05
NFPA D05

Flow control

Spool type

Design

Seal NBR
(other seal compounds on request)

Solenoid
12 VDC/2.95A

Connector
as per EN 175301-803 without plug*

Spool body design

Code	Spool type	Flow [l/min] at Δp 5bar per metering edge
E01U		80
E02U		80
E01M E01S	$Q_B = Q_A/2$ 	40 60
E02M E02S	$Q_B = Q_A/2$ 	40 60

Code	Design
C	
E	
K	

* Please order plugs separately.
See chapter 3 accessories.

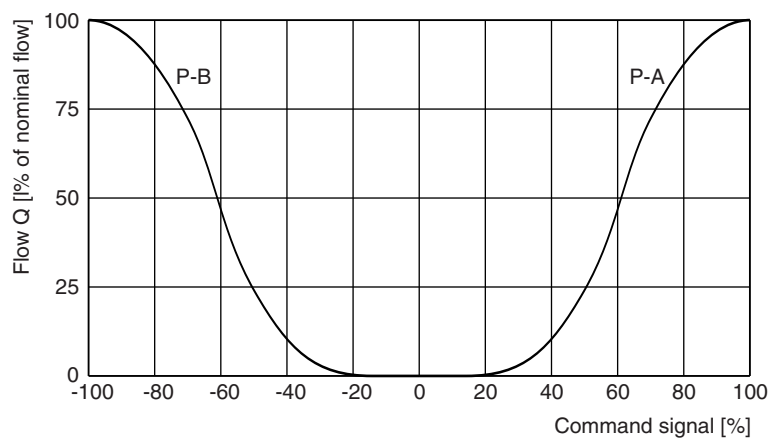
General		
Design		Direct operated proportional DC valve
Actuation		Proportional solenoid
Size		NG10 / CETOP 05 / NFPA D05
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+60
Weight	[kg]	7.6
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350, T 210
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 *		
D3FB*0	[l/min]	40 and 60
D3FB*3	[l/min]	80
Leakage at 100 bar	[ml/min]	<100
Static		
Hysteresis	D3FB*0 [°%]	<4
	D3FB*3 [°%]	<5
Electrical characteristics		
Duty ratio	[%]	100 ED; CAUTION: Coil temperature up to 155°C possible
Protection class		IP 65 in accordance with EN 60529 (plugged and mounted)
Solenoid	Code	K
Supply voltage	[V]	12
Current consumption	[A]	2.95
Power consumption	[W]	35.4
Resistance	[Ohm]	3.84
Solenoid connection		Connector as per EN 175301-803
Wiring min.	[mm²]	3 x 1.5 recommended
Wiring length max.	[m]	50 recommended

* Flow rate for different Δp per control edge:

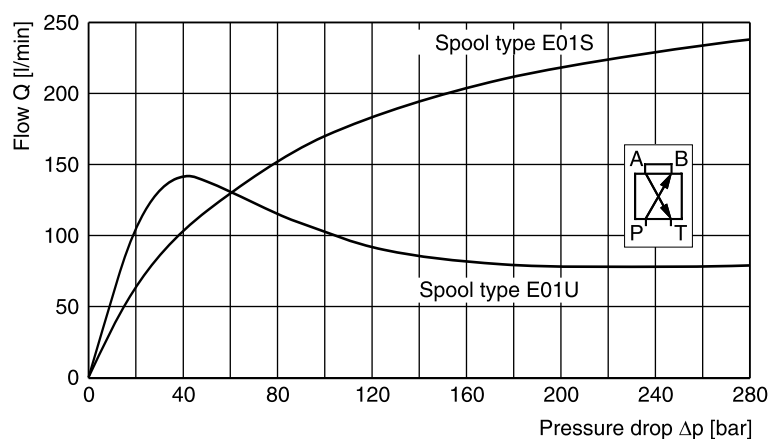
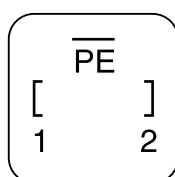
$$Q_x = Q_{Nom.} \cdot \sqrt{\frac{\Delta p_x}{\Delta p_{Nom.}}}$$

Flow characteristicsat $\Delta p = 5$ bar per metering edge

Fluid viscosity 40cSt at 50°C

**Flow limit**

100% command signal

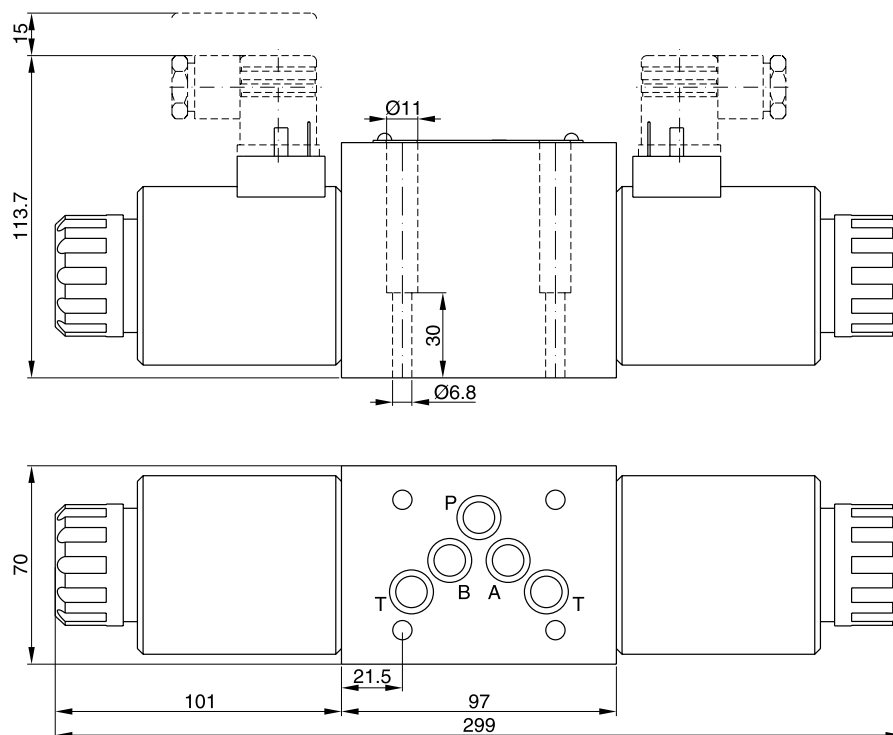
**Plug****Solenoid coil**

1 = coil connection

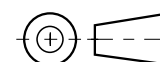
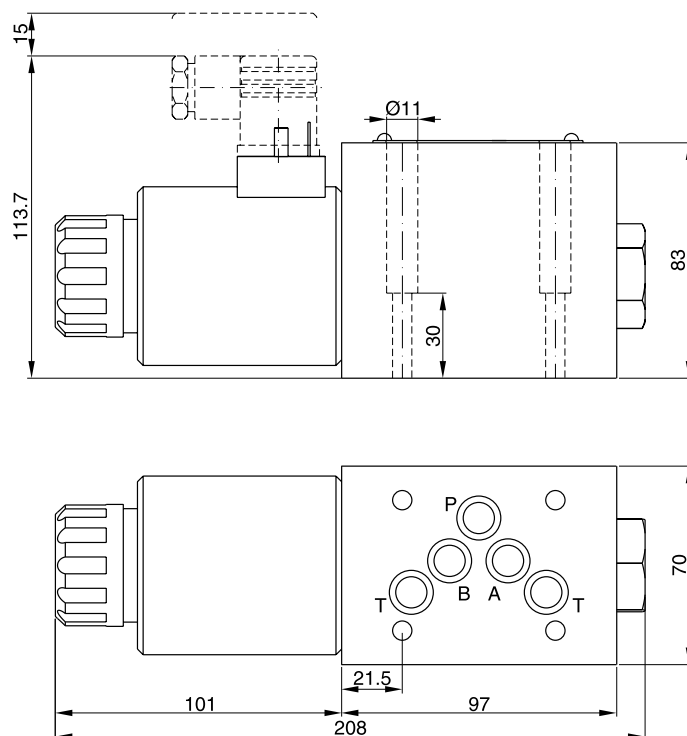
2 = coil connection

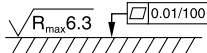
PE = ground potential

D3FB*C



D3FB*K



Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	SK-D3FB-N

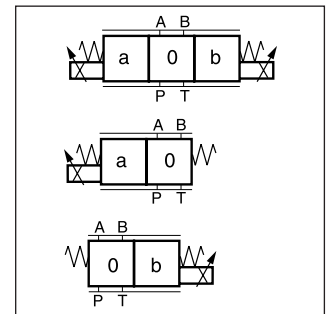
D3FB_UK.INDD CM_28.01.08.1

A full-page view of a blank sheet of graph paper. The grid consists of thin, light gray horizontal and vertical lines forming small squares across the entire page. There are no margins, text, or other markings on the paper.

The proportional directional valves 4DP02 of the nominal size NG10 (CETOP 05) are offered under Denison brand name.

The spool in body design provides high flow rates at a good level of precision.

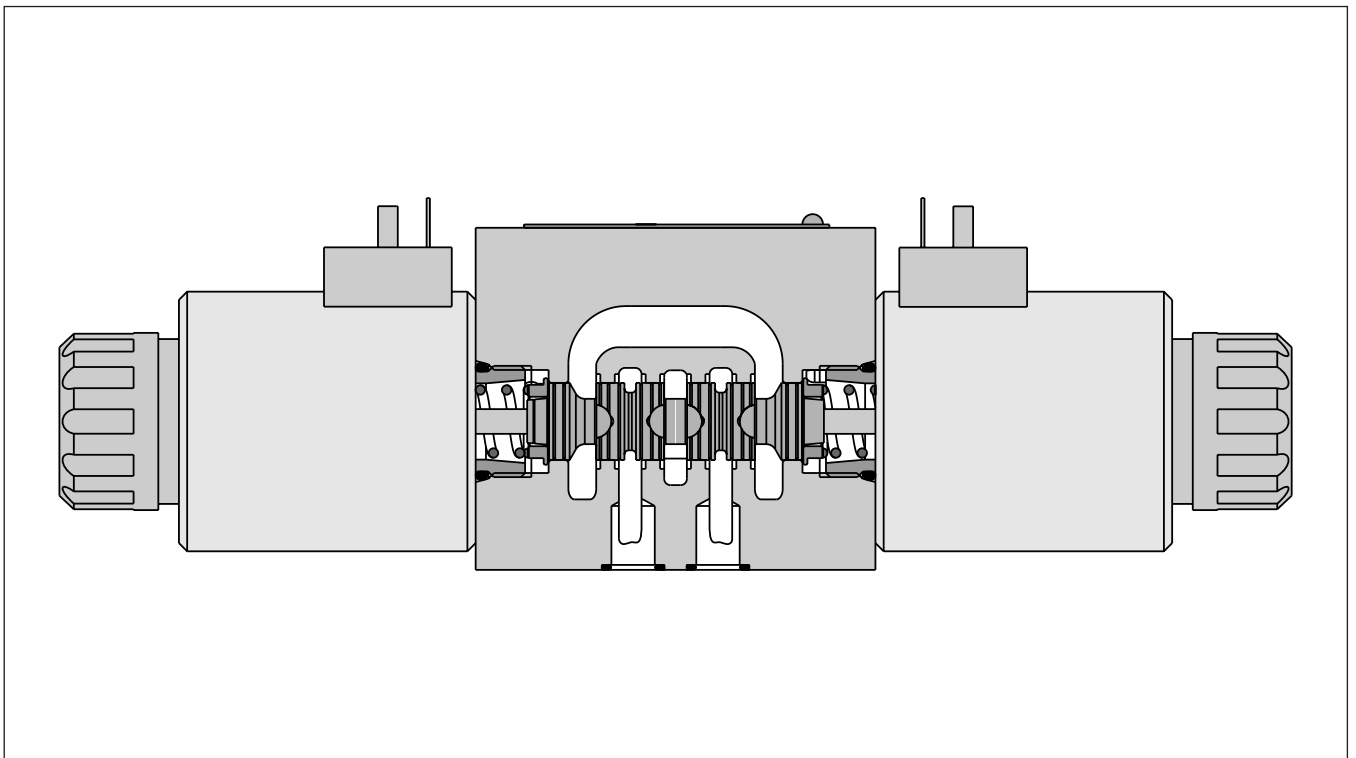
In combination with the digital power amplifier PWD00A-400, the valve parameters can be saved, changed and duplicated.



Technical features

- Spool in body design
- High flow rates
- Low hysteresis
- Manual override
- Fail-safe centre position

4DP02



4DP

Prop. directional valve

02

Size
DIN NG10
CETOP 05
NFPA D05

—

3

Body

E

Control

Spool type

Flow

—

Spool position

C

Design series

Seals

G12

Solenoid
12V/2.95A

Connector
as per EN
175301-803

Spool position 03	
Code	Spool type
02	
43	

Spool position 05	
Code	Spool type
12	
13	

Spool position 06	
Code	Spool type
12	
13	

Code	Flow
F40	40 l/min
F60	60 l/min
F80	80 l/min

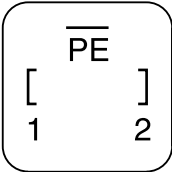
Code	Connector
omit	not supplied
C1	PG11

Code	Seals
1	NBR
5	FPM

Code	Spool position	
03		3 positions spring offset in pos. "0".
05		2 positions spring offset in pos. "0", energized to "a".
06		2 positions spring offset in pos. "0", energized to "b".

Plug

Solenoid coil



- 1 = coil connection
- 2 = coil connection
- PE = ground potential

General		
Design		Direct operated proportional DC valve
Actuation		Proportional solenoid
Size		NG10 / CETOP 05 / NFPA D05
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+60
Weight	[kg]	7.6
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350, T 210
Fluid		Hydraulic oil as per DIN 51524...535, other on request
Fluid temperature	[°C]	-20...+60
Viscosity permitted	[mm²/s]	20...380
Viscosity recommended	[mm²/s]	30...80
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)
Flow nominal at Δp=5bar per control edge *	[l/min]	40, 60 and 80
Leakage at 100 bar	[ml/min]	<100
Static / Dynamic		
Hysteresis	[%]	<5
Electrical characteristics		
Duty ratio	[%]	100 ED; CAUTION: Coil temperature up to 155°C possible
Protection class		IP 65 in accordance with EN 60529 (plugged and mounted)
Solenoid	Code	K
Supply voltage	[V]	12
Current consumption	[A]	2.95
Power consumption	[W]	35.4
Resistance	[Ohm]	3.84
Solenoid connection		Connector as per EN 175301-803
Wiring min.	[mm²]	3 x 1.5 recommended
Wiring lenght max.	[m]	50 recommended

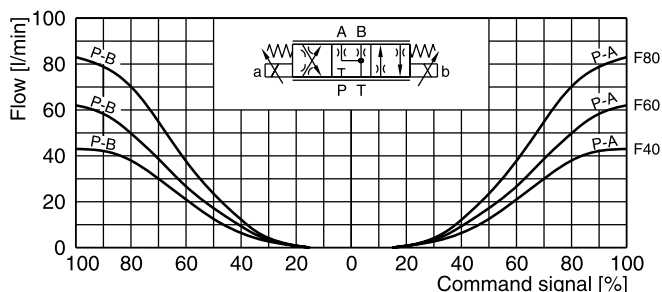
* Flow rate for different Δp per control edge:

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

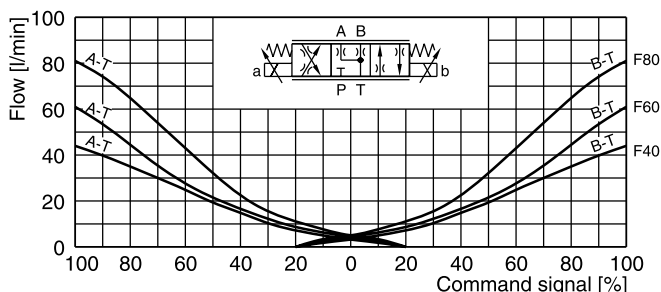
Flow characteristics

at $\Delta p = 5$ bar per metering edge
 Fluid viscosity 40cSt at 50°C

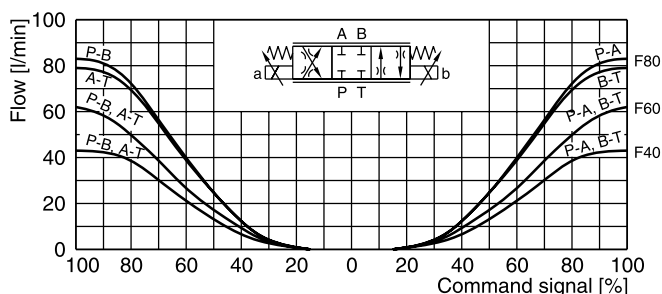
Spool 02 / P-A; P-B



Spool 02 / A-T; B-T

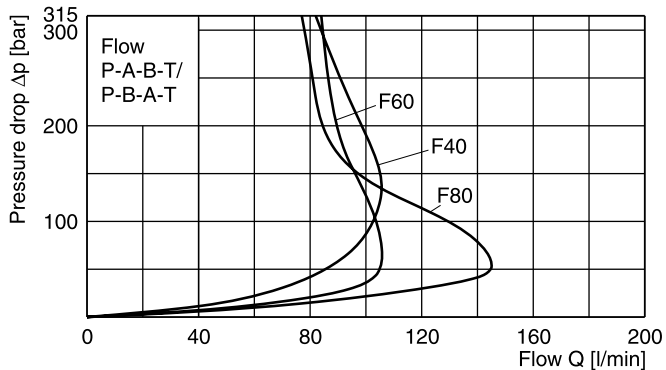


Spool 43

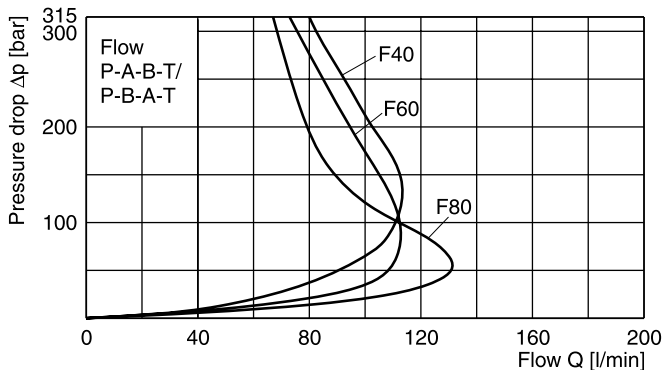


Flow limit

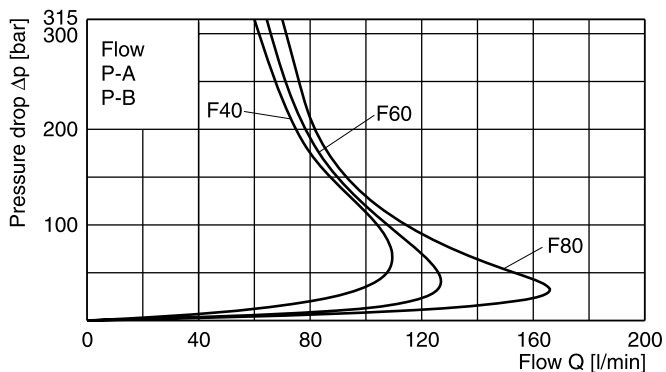
Spool 43



Spool 02

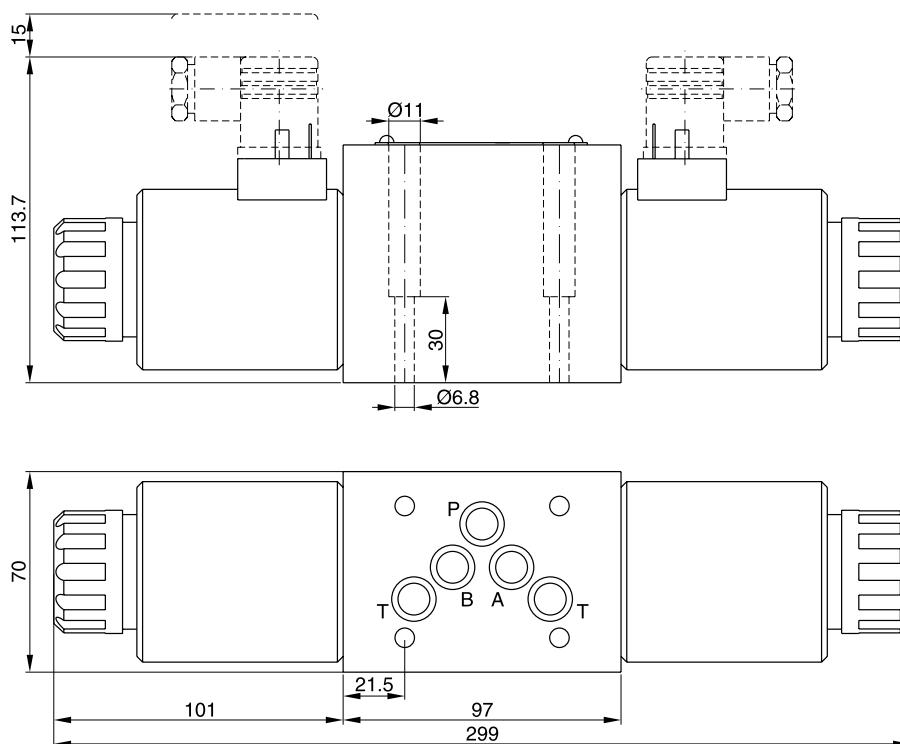


Spool 12/13

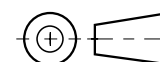
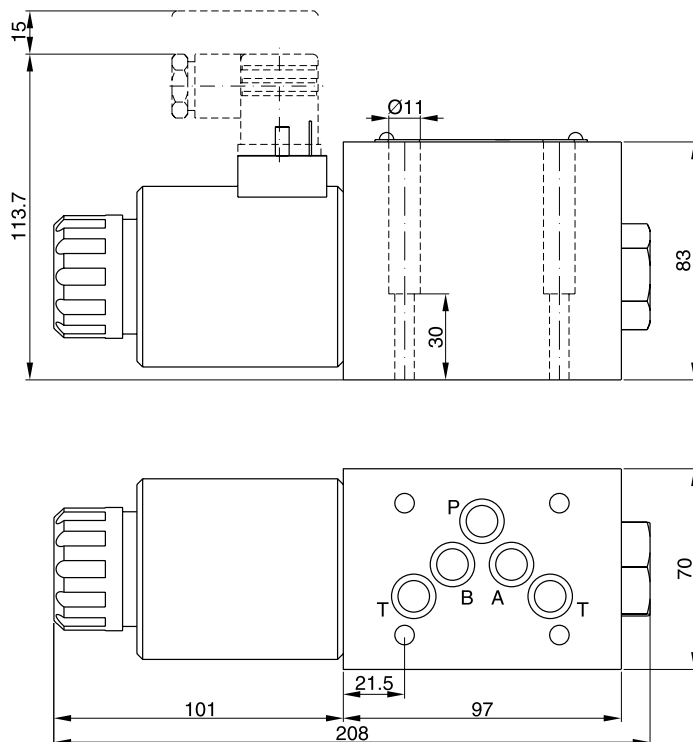


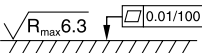
4DP02_UK.INDD CM_10.03.08.1

4DP02*03



4DP02*05



Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	11 Nm ±15%	SK-D3FB-N

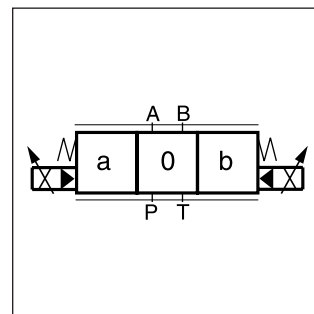
4DP02_UK.INDD CM_10.03.08.1

A full-page sheet of white graph paper featuring a light gray grid. The grid consists of small, equal-sized squares covering the entire area. There are no margins, text, or other markings on the page.

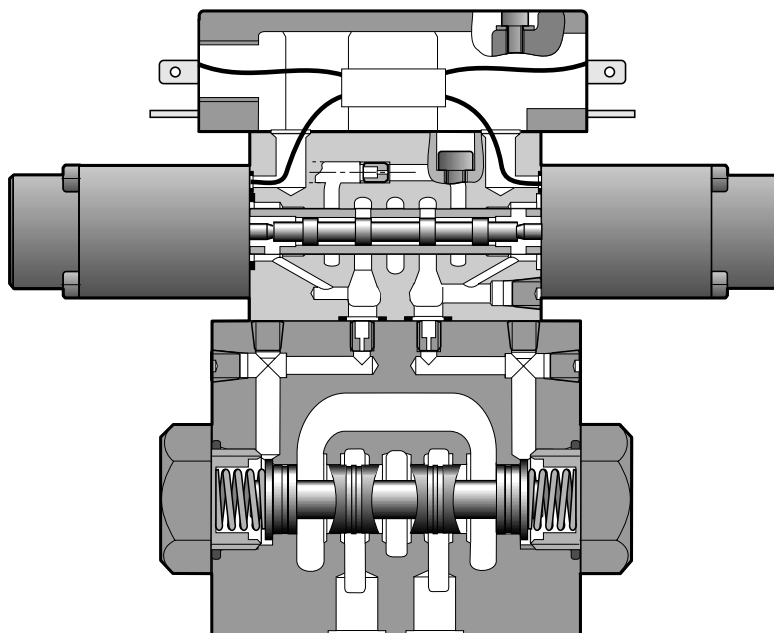
The D*1FW pilot operated proportional DC valve is available in sizes NG10 (CETOP05), NG16 (CETOP07) and NG25 (CETOP08).

Typical applications include reproducible control of actuator speed in rapid / slow speed profiling and smooth acceleration and deceleration performance.

In combination with the digital power amplifier PWD00A-400, the valve parameters can be saved, changed and duplicated.

**Technical features**

- Progressive flow characteristics for sensitive adjustment of flow rate
- Fail-safe centre position
- Centre position monitoring optional
- D31FW - NG10 (CETOP05)
- D41FW - NG16 (CETOP07)
- D91FW - NG25 (CETOP08)

3**D31FW**

Ordering Code

Pilot Operated Proportional DC Valve
Series D*1FW

D

Directional control valve

Size

1

NG06 pilot

F

Proportional control

W

Dynamics standard

Spool type

Flow

C

Spool position

Pilot connection

N

Seal NBR
(other seal compound on request)

Solenoid description
(other voltage on request)

W

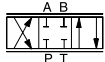
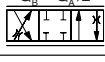
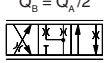
Connector as per EN 175301-803 without plug*

Valve accessories

Design series

Code	Nominal size
3	NG10 / CETOP05
4	NG16 / CETOP07
9 ¹⁾	NG25 / CETOP08

¹⁾ with enlarged connections
Ø 32 mm

Code	Spool type
E01	
E02	
B31	 $Q_B = Q_A / 2$
B32	 $Q_B = Q_A / 2$

Code	Flow [l/min] at Δp = 5bar per metering edge		
	D31	D41	D91
C	75	-	-
D ²⁾	90	-	-
E ²⁾	120	-	-
F	-	200	-
H	-	-	400

²⁾ heigh flow version

Code	Valve accessories
0	Standard
8 ³⁾	Monitor switch

³⁾ not available for spool D and E

Code	Solenoid description
L	6 V/2.5A
K ⁴⁾	12 V/2.2A

⁴⁾ Flow code D/E (heigh flow)

Code	Inlet	Drain
1	Internal	External
2	External	External
4	Internal	Internal
5	External	Internal

Bold letters =

Short-term availability

* Please order plugs separately.
See chapter 3 accessories.

Technical Data

General		Pilot operated DC Valve			
Design		Proportional solenoid			
Actuation					
Size		NG10 (CETOP05) Standard version High flow version NG16 (CETOP07) NG25 (CETOP08)			
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA			
Mounting position		unrestricted			
Ambient temperature		[°C] -20...+60			
Weight		[kg] 7.1 8.1 10.8 19			
Hydraulic					
Max. operating pressure		[bar] Pilot drain internal: P, A, B, X 350; T, Y 105 (high flow version: T, Y 15)			
Fluid		[bar] Pilot drain external: P, A, B, T, X 350; Y 105 (high flow version: Y 15)			
Fluid temperature		[°C] Hydraulic oil as per DIN 51524...535, other on request			
Viscosity		-20...+60			
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=5 bar per control edge *		[l/min] 75 90 (code D) 120 (code E) 200 400			
Leakage at 100 bar		[ml/min] 100 130 200 600			
Pilot supply pressure		[bar] 20-350 (optimal dynamics at 50)			
Pilot flow at 100bar		[l/min] <1.2 <0.5 <1.2 <1.2			
Pilot flow, step response		[l/min] 0.8 3.5 1.7 3.8			
Static / Dynamic					
Step response at 100% step		[ms] 60 50 75 100			
Hysteresis		[%] <5			
Electrical characteristics					
Duty ratio		[%] 100			
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)			
Solenoid		Code L K L L			
Supply voltage		[V] 6 12 6 6			
Current consumption		[A] 2.5 2.2 2.5 2.5			
Resistance		[Ohm] 2.2 3.7 2.2 2.2			
Coil insulation class		F (155 °C)			
Electrical connection		Connector as per EN 175301-803			
Wiring min.		[mm²] 3x1.5 (AWG 16) overall braid shield			
Wiring lenght max.		[m] 50			
Electrical monitor switch					
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			
EMV		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] 5x0.5 (AWG 20) overall braid shield			
Wiring lenght max.		[m] 50			

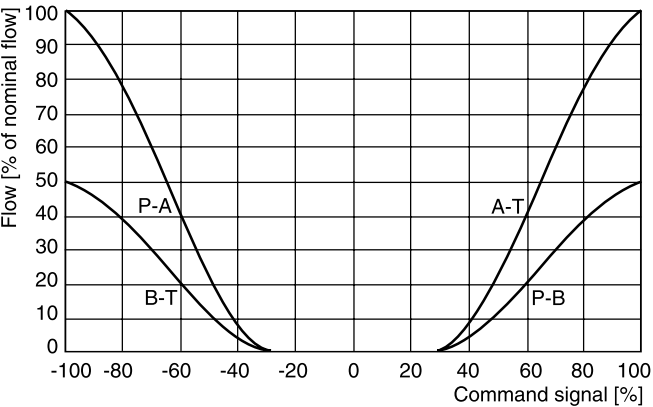
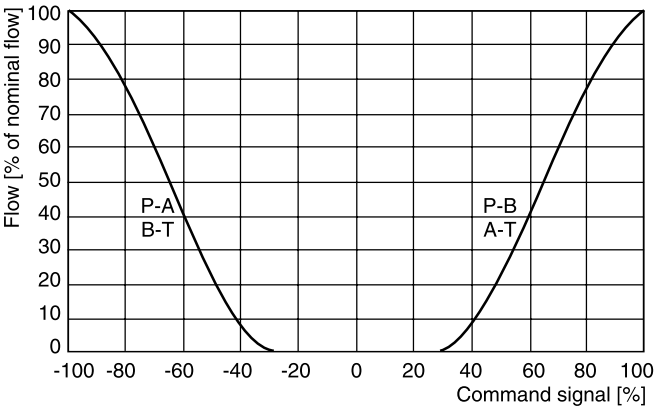
* Flow rate for different Δp per control edge:

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

Flow characteristics
at $\Delta p = 5$ bar per metering edge

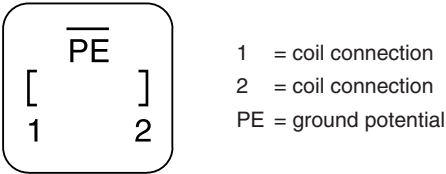
D*1FW
Spool code E*

Spool code B*

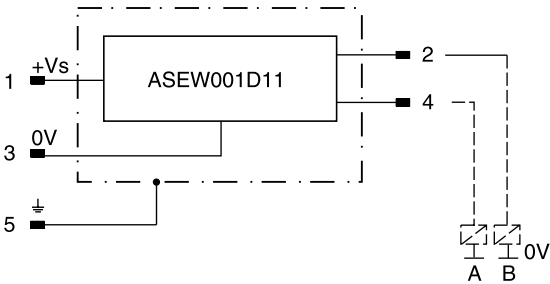
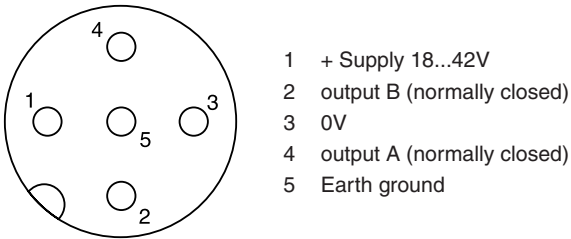


Plug

Solenoid coil

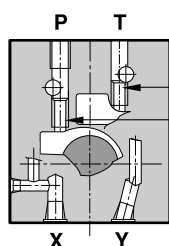


Monitor switch M12x1 pin assignment



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

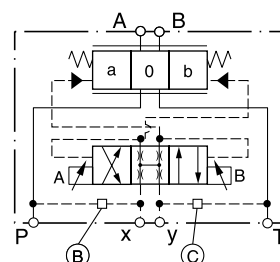
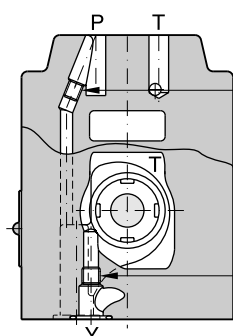
The neutral position is monitored. The signal changes after less than 10% of the spool stroke.

Pilot oil inlet (supply) and outlet (drain)**D31FW (standard version)**

③ M6 DIN906
② M5 DIN906

○ open, ● closed

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

**D31FW (high flow version)**

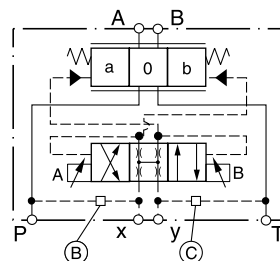
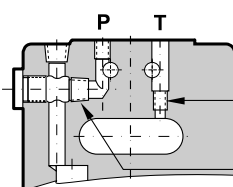
③ M6 DIN906

② M6 DIN906

(drawn offset)

○ open, ● closed

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

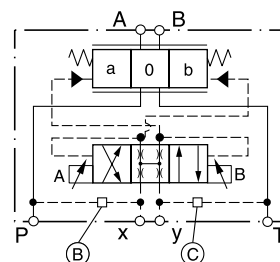
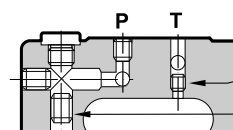
**D41FW**

③ M6 DIN906

② 1/16 NPTF

○ open, ● closed

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

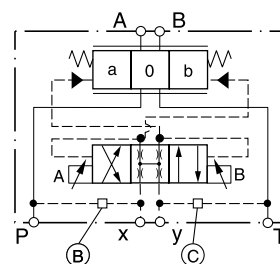
**D91FW**

③ M6 DIN906

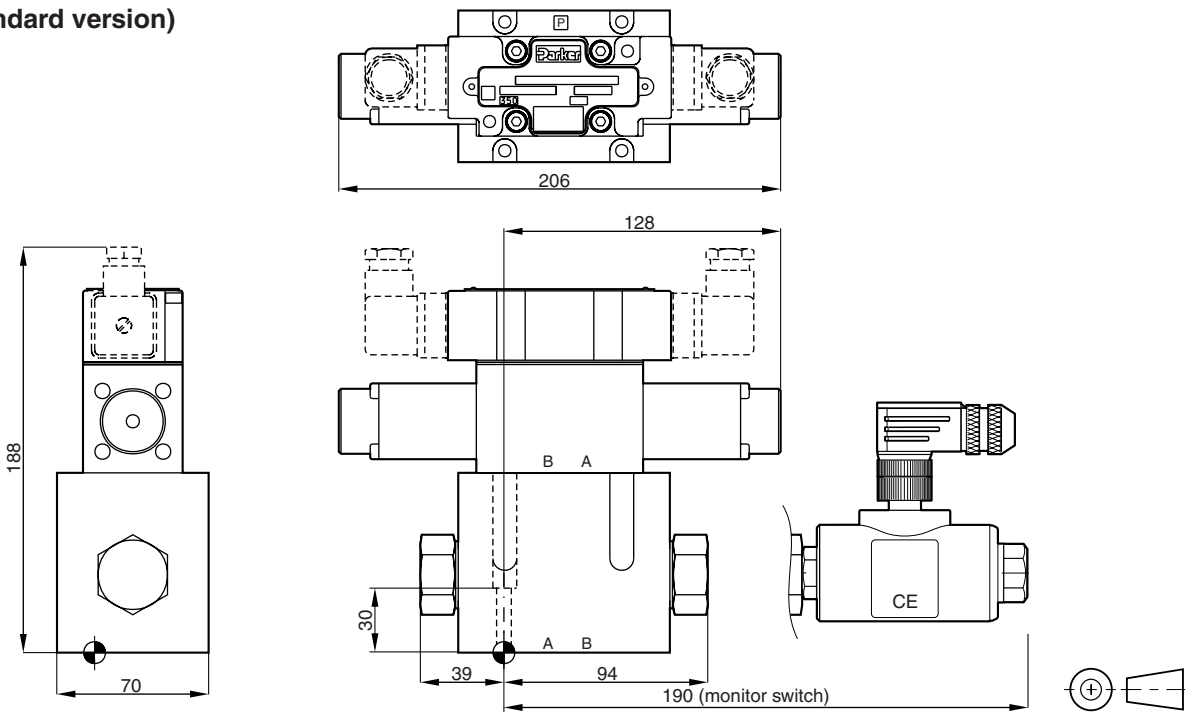
② 1/16 NPTF

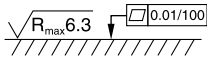
○ open, ● closed

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

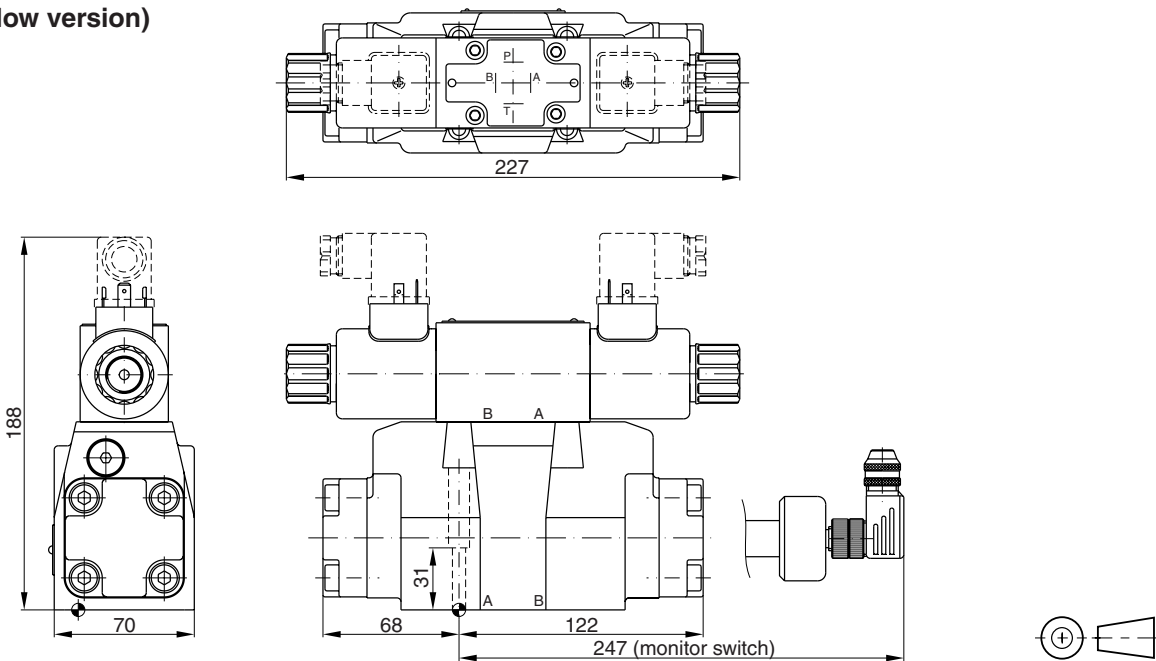


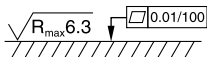
D31FW (standard version)



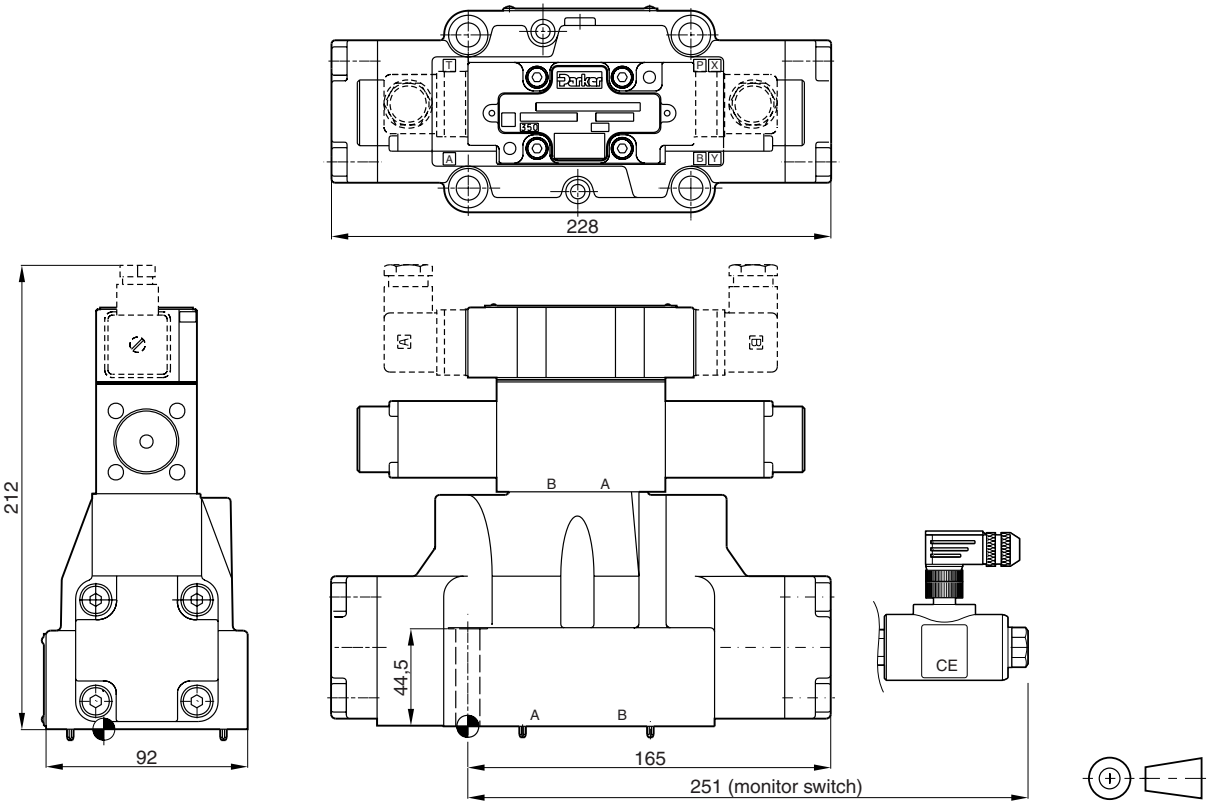
Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	SK-D31FTN

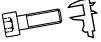
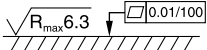
D31FW (high flow version)



Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	on request

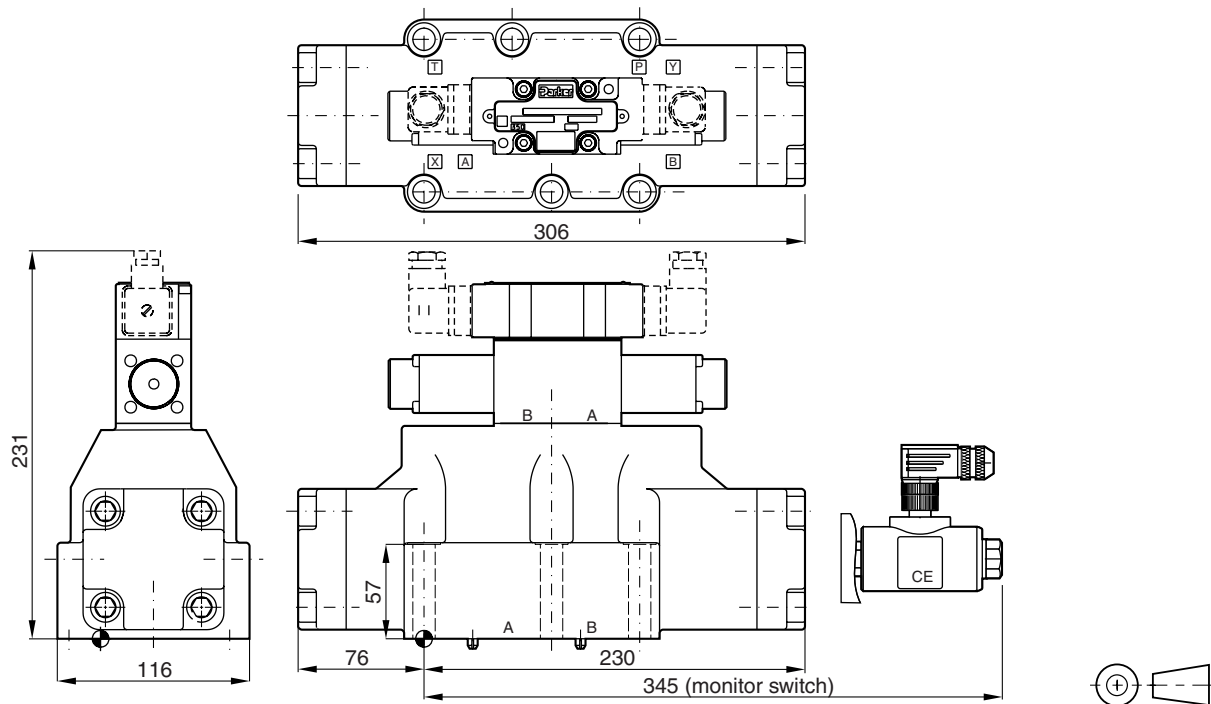
D41FW

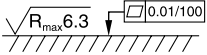


Surface finish	 Kit			 Kit NBR
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 Nm ±15%	SK-D41FTN

D91FW

3



Surface finish	 Kit			 Kit NBR
	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	SK-D91FTN

Characteristics

The pilot operated proportional DC valves 4DP02V (NG10), 4DP03 (NG16) and 4DP06 (NG25) are offered under Denison brand name.

Typical applications include reproducible control of actuator speed in rapid / slow speed profiling, and smooth acceleration and deceleration performance.

In combination with the digital power amplifier PW-D00A-400, the valve parameters can be saved, changed and duplicated.

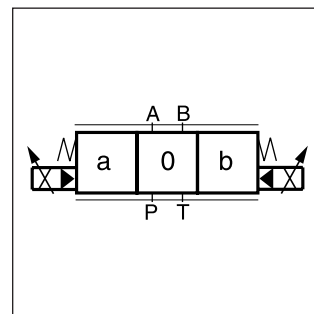
Technical features

- Progressive flow characteristics for sensitive adjustment of flow rate
- Fail-safe centre position
- Centre position monitoring optional

Pilot Operated Proportional DC Valves Series 4DP02V, 4DP03, 4DP06 (Denison)



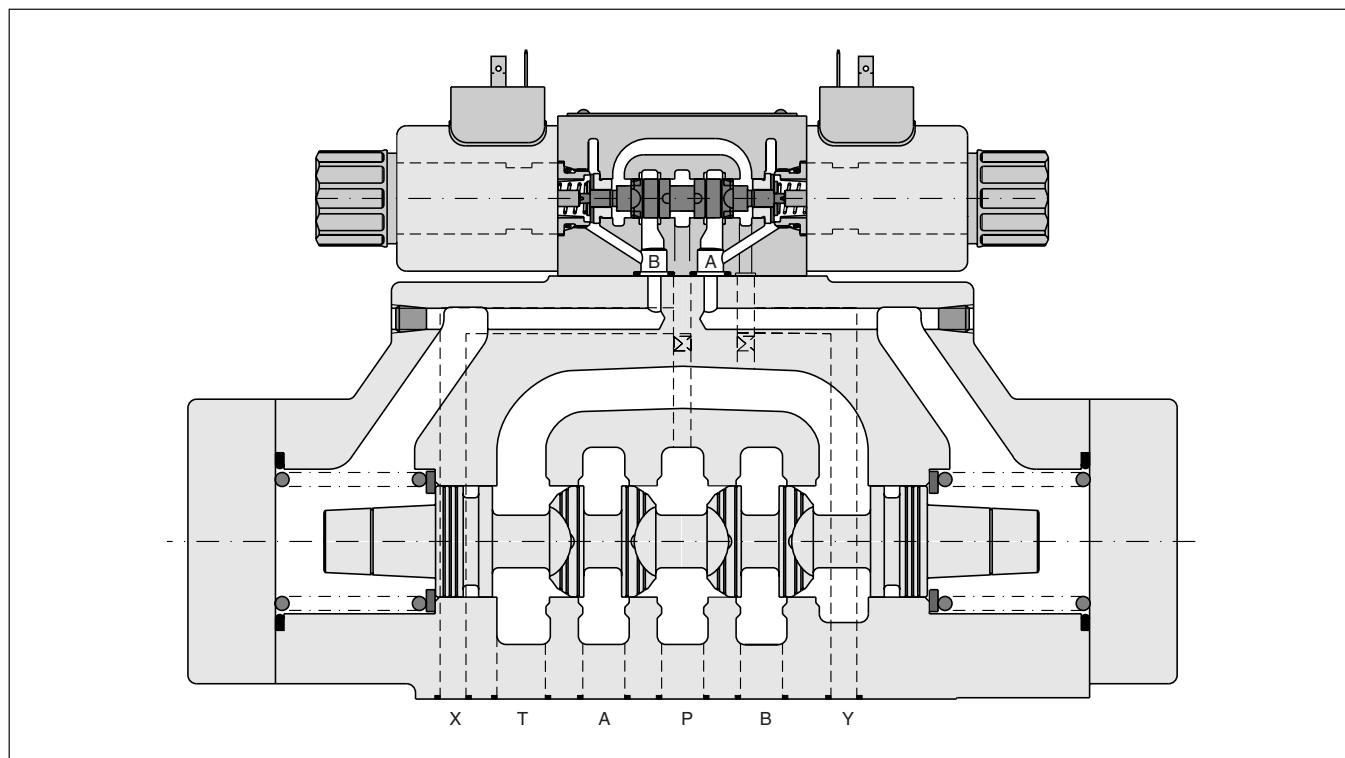
4DP02V



4DP03



4DP06

4DP06

Ordering Code

Pilot Operated Proportional DC Valves
Series 4DP02V, 4DP03, 4DP06 (Denison)

4DP

Directional prop. control valve

Size

Code	Size
02	NG10
03	NG16
06	NG25

Body

Code	Body
V	for 4DP02V
3	for 4DP03/06

E

Control solenoid operated

Spool type

Code	Spool type
02	
43	
B2	$Q_B = Q_A / 2$
B3	$Q_B = Q_A / 2$

Flow

Code	Flow
4DP02V	
F90 ¹⁾	90 l/min
F120	120 l/min
4DP03	
F100 ¹⁾	100 l/min
F130 ¹⁾	130 l/min
F200	200 l/min
4DP06	
F200 ¹⁾	200 l/min
F250 ¹⁾	250 l/min
F400	400 l/min

Spool position

3 position spools	
Code	Spool position
03	3 positions. Spring offset in position "0".
05	2 positions. Spring offset in position "0". Energized to "b".
06	2 positions. Spring offset in position "0". Energized to "a".

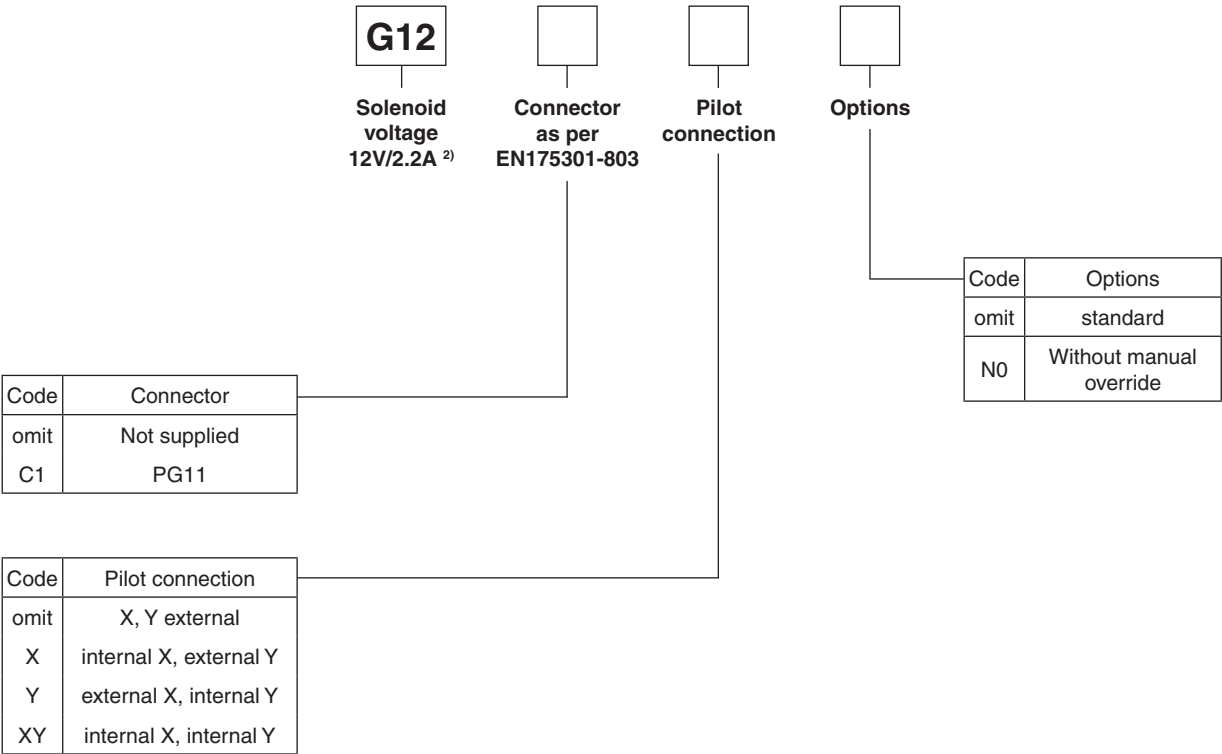
Design series

Code	Design series
A	4DP02V
B	4DP03
B	4DP06

Seals

Code	Seals
1	NBR
5	FPM

¹⁾ Not available for spools B2 and B3



²⁾ Onboard electronics on request

General							
Design		Pilot operated DC Valve					
Actuation		Proportional solenoid					
Size		4DP02V NG10 (CETOP 05)		4DP03 NG16 (CETOP 07)		4DP06 NG25 (CETOP 08)	
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA					
Mounting position		unrestricted, preferably horizontal					
Ambient temperature	[°C]	-20...+50					
Weight	[kg]	7.6 (1 sol.)	8.1 (2 sol.)	10.5 (1 sol.)	10.9 (2 sol.)	18.7 (1 sol.)	19.1 (2 sol.)
Hydraulic							
Max. operating pressure	[bar]	Pilot drain internal: P, A, B, X 350; T, Y 105 (4DP02V: T, Y 15)					
	[bar]	Pilot drain external: P, A, B, T, X 350; Y 105 (4DP02V: Y 15)					
Fluid		Hydraulic oil as per DIN 51524...535, other on request					
Fluid temperature	[°C]	-20...+80					
Viscosity							
permitted	[cSt] / [mm²/s]	10...650					
recommended	[cSt] / [mm²/s]	30					
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)					
Flow nominal at ΔP=5 bar per control edge *	[l/min]	90/120		200		400	
Leakage at 100 bar	[ml/min]	100		200		600	
Pilot supply pressure	[bar]	20-350 (optimal dynamics at 50)					
Pilot flow at 100bar	[l/min]	<1.2					
Pilot flow, step response	[l/min]	0.8		1.7		3.8	
Static / Dynamic							
Step response at 100% step	[ms]	60		75		100	
Hysteresis	[%]	<5					
Electrical characteristics							
Duty ratio	[%]	100					
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)					
Solenoid		Code G12					
Supply voltage	[V]	12					
Current max.	[A]	2.2					
Resistance	[Ohm]	3.7					
Coil insulation class		F (155 °C)					
Solenoid connection		Connector as per EN 175301-803					
Wiring min.	[mm²]	3x1.5 (AWG 16) overall braid shield					
Wiring lenght max.	[m]	50					

* Flow rate for different Δp per control edge:

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

Characteristic Curves

Pilot Operated Proportional DC Valves Series 4DP02V, 4DP03, 4DP06 (Denison)

Flow characteristics

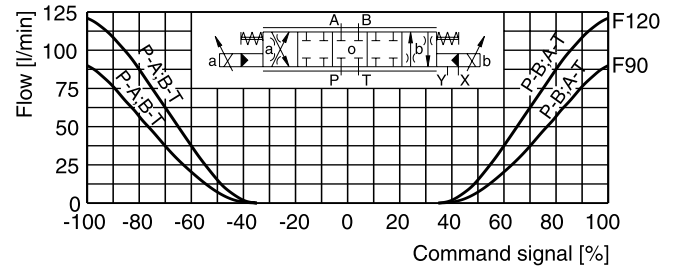
at $\Delta p = 5$ bar per metering edge

Fluid viscosity 40 cSt at 50°C

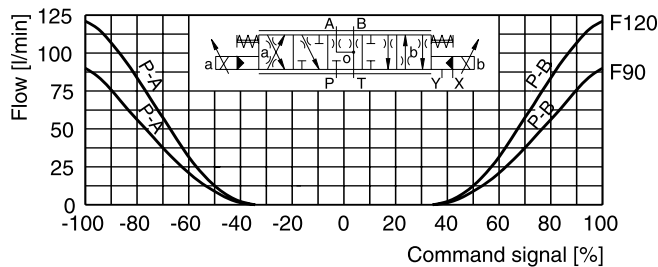
4DP02V

Spool code **02, 43**

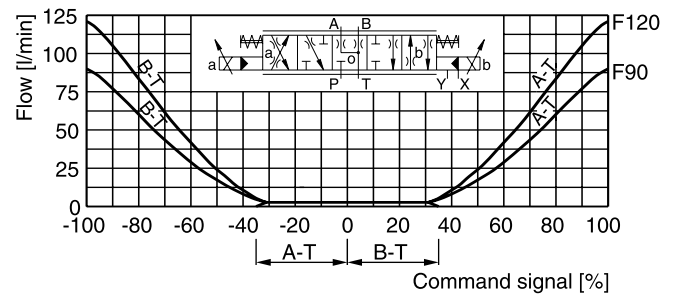
Spool 43



Spool 02 / P-A; P-B



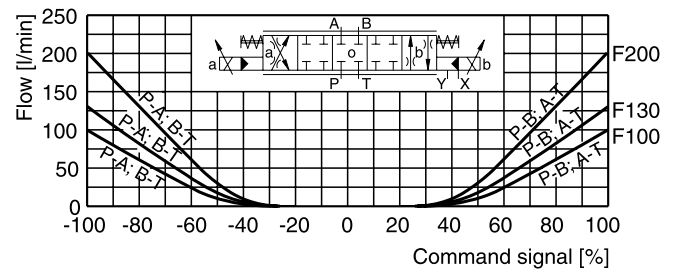
Spool 02 / B-T; A-T



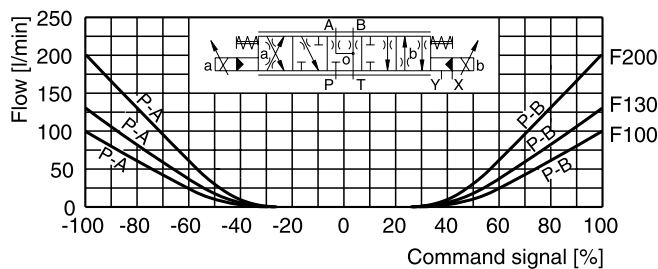
4DP03

Spool code **02, 43**

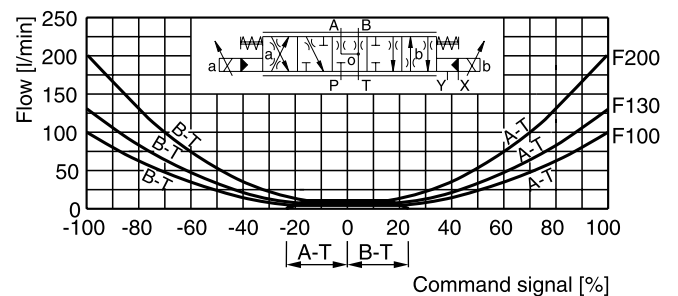
Spool 43



Spool 02 / P-A; P-B



Spool 02 / B-T; A-T

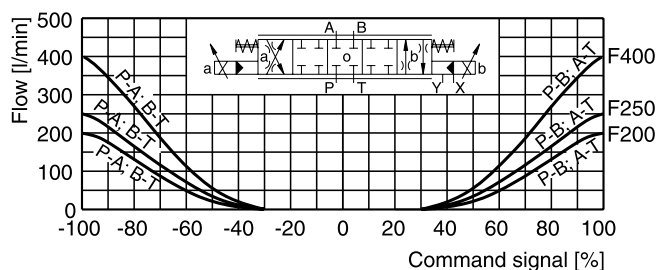


Flow characteristicsat $\Delta p = 5$ bar per metering edge

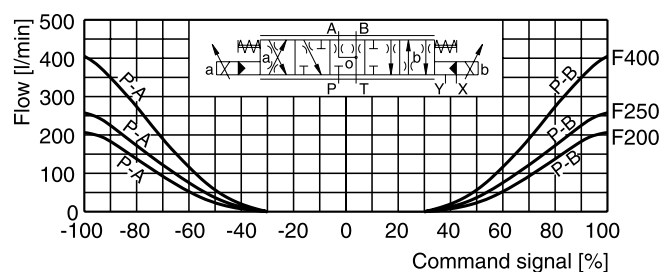
Fluid viscosity 40 cSt at 50°C

4DP06Spool code **02, 43**

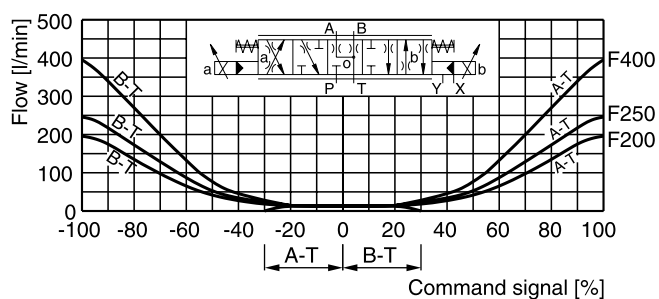
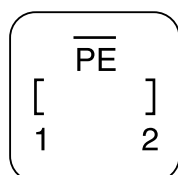
Spool 43



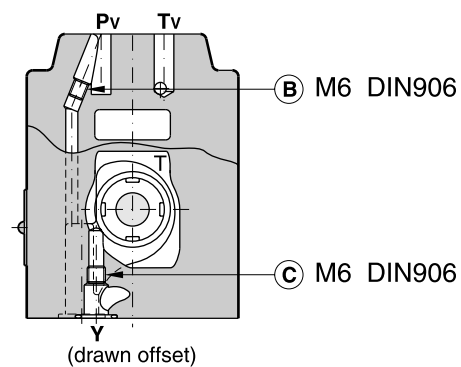
Spool 02 / P-A; P-B



Spool 02 / B-T; A-T

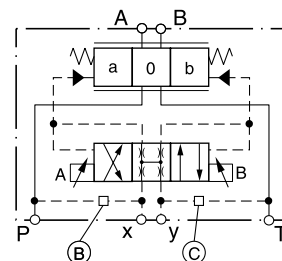
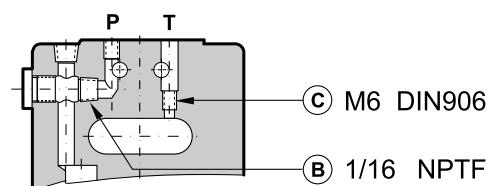
**Plug****Solenoid coil**

- 1 = coil connection
- 2 = coil connection
- PE = ground potential

Pilot oil inlet (supply) and outlet (drain)**4DP02V**

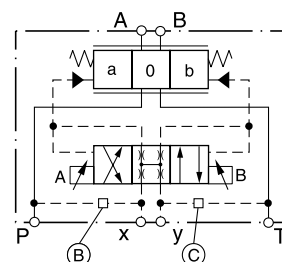
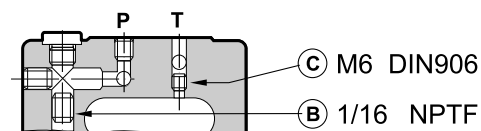
○ open, ● closed

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

**4DP03**

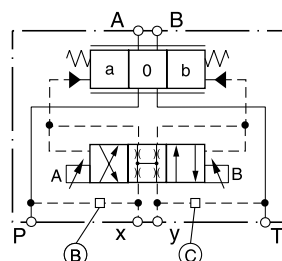
○ open, ● closed

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

**4DP06**

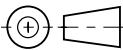
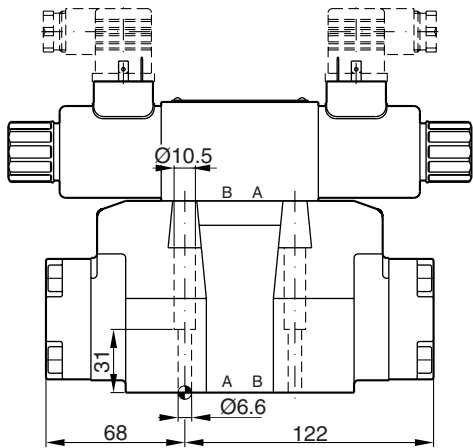
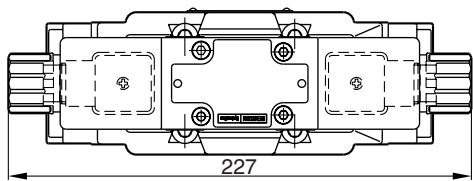
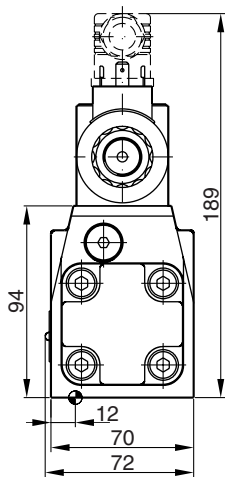
○ open, ● closed

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



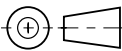
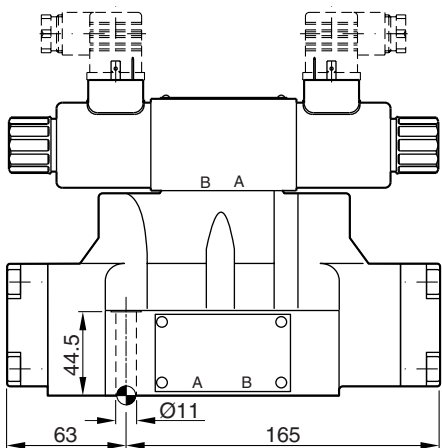
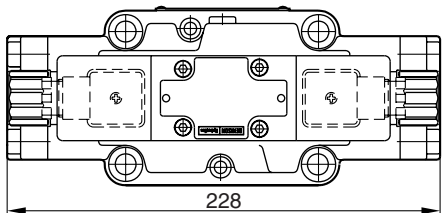
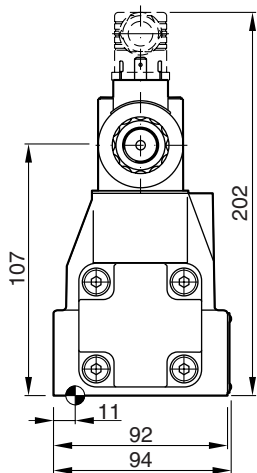
4DP02V

3



Surface finish	Kit			Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	Seal kit on request.

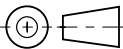
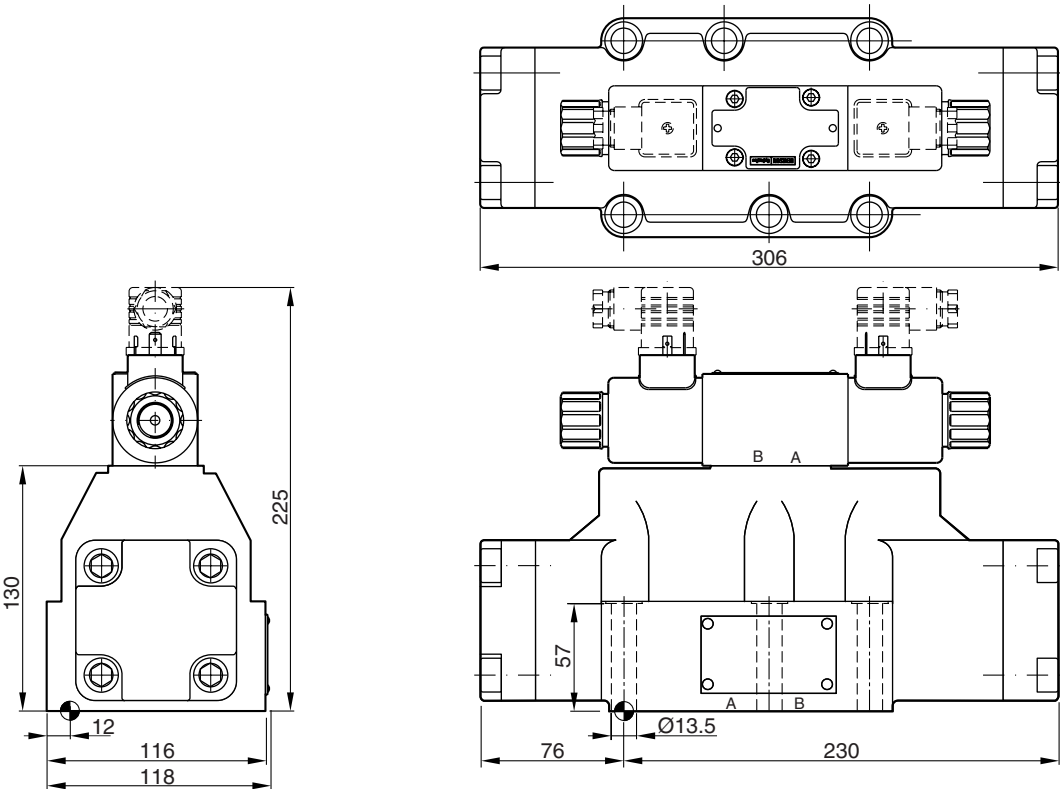
4DP03

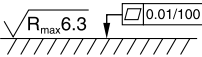


Surface finish	Kit			Kit NBR
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 Nm ±15%	Seal kit on request.

4DP02V-03-06_UK.INDD CM_28.01.08.1

4DP06



Surface finish	 Kit			 Kit NBR
	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	Seal kit on request.

[illegible]

Characteristics

The D1FT directional control valve of the nominal size NG6 (CETOP 3) is a proportional valve providing variable flow rates.

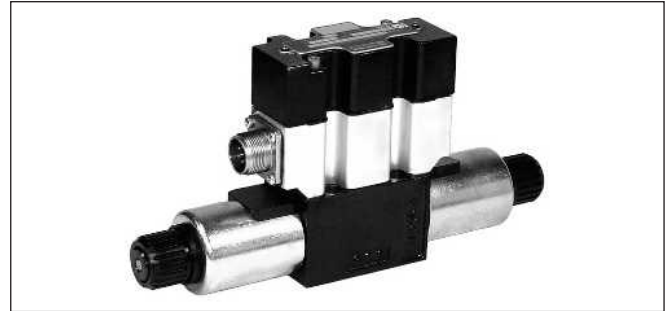
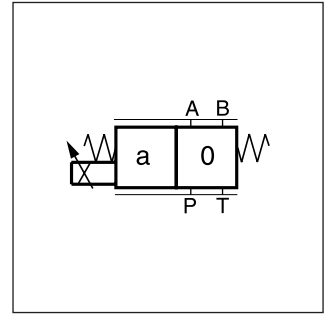
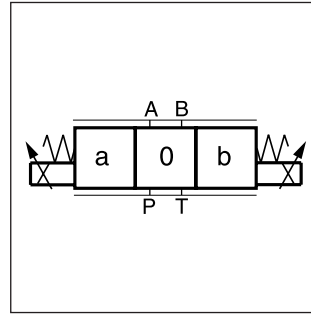
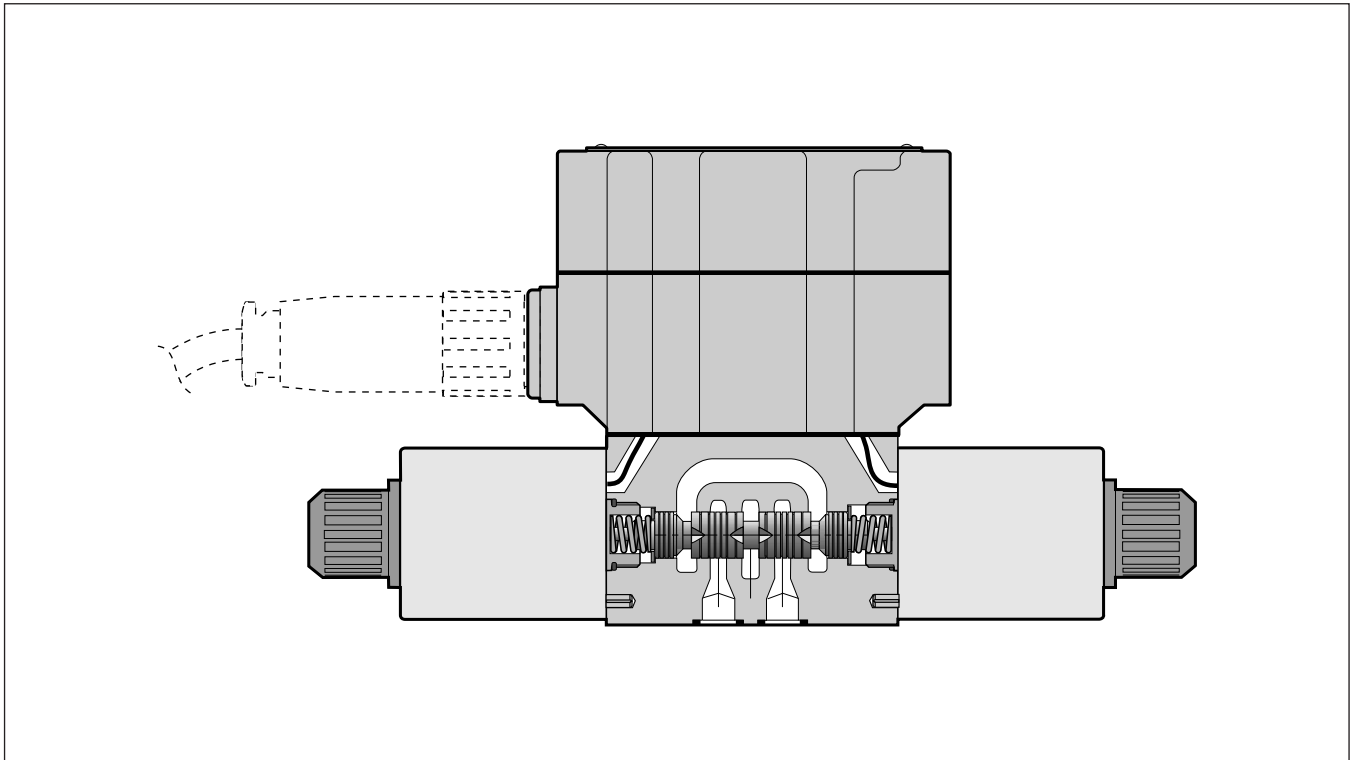
This valve is used with integrated control electronics. Typical applications are soft switching via adjustable ramps for the reduction of hydraulic and mechanical shocks, and electrically adjustable flow rates / speeds for automating machine functions.

Technical features

- Integrated control electronics with ramp adjustment
- Progressive flow characteristics for sensitive adjustment of flow rate
- Spring centred spool
- Manual override

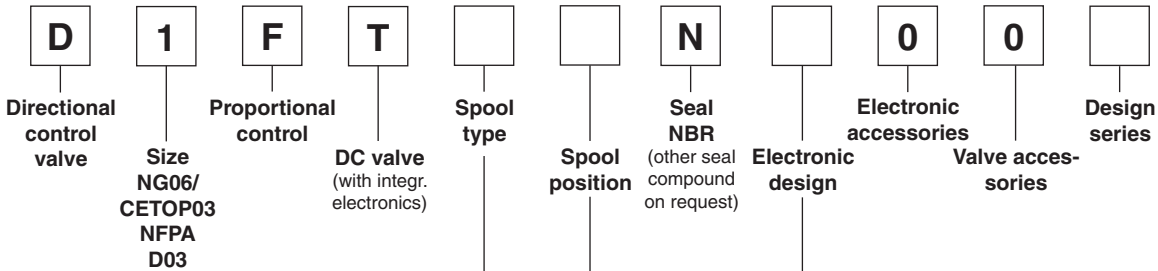


Direct Operated Proportional DC Valve Series D1FT

**3****D1FT**

Ordering Code

Direct Operated Proportional DC Valve
Series D1FT



Code	Spool type	Flow [l/min] at Δp 5bar per metering edge
E01C E01F E01H		7.5 15 20
E02C E02F E02H		7.5 15 20
B31F	$Q_B = Q_A / 2$ 	15 / 7.5
B32F	$Q_B = Q_A / 2$ 	15 / 7.5

Code	Voltage
F	Voltage input 0...±10V with reference output +10V / -10V
G	Current input 0...±20mA

Code	Spool position
C	
E	
K	

Please order plugs separately.
See chapter 3 accessories.

Technical Data

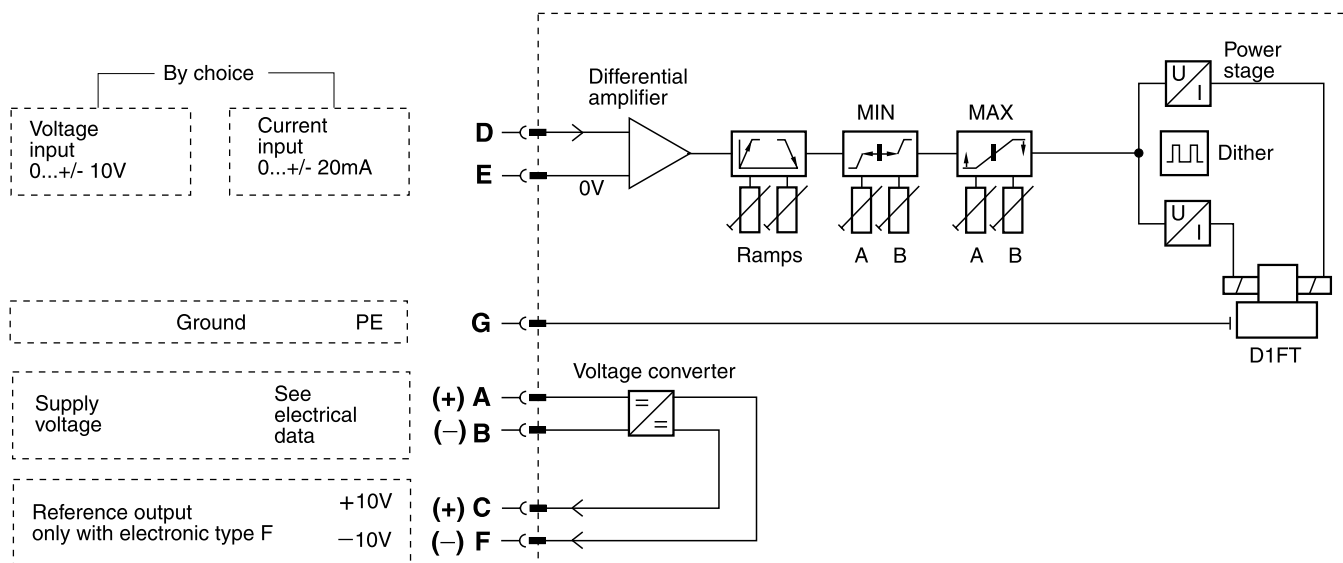
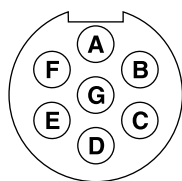
Series D1FT

General		
Design		Direct operated DC Valve with onboard electronics
Actuation		Proportional solenoid
Size		NG06 / (CETOP03) / NFPA D03
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+60
Weight	[kg]	1.9
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350; Port T 35
Fluid		Hydraulic oil as per DIN 51524...535, other on request
Fluid temperature	[°C]	0...60
Viscosity permitted	[cSt] / [mm²/s]	20...380
Viscosity recommended	[cSt] / [mm²/s]	30...80
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)
Nominal flow at $\Delta p=5\text{bar}$ per control edge ¹⁾	[l/min]	7.5 / 15 / 20
Leakage at 100 bar	[ml/min]	<200
Static / Dynamic		
Step response at 100% step	[ms]	90
Hysteresis	[%]	< 8
Electrical characteristics		
Duty ratio	[%]	100
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Supply voltage/ripple	[V]	14.5 ... 30, ripple <5% eff. surge free, 0...+10V P->A
Current consumption max.	[A]	2.8
Input signal ²⁾		
Voltage	[V]	10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A
Impedance	[kOhm]	100
Current	[mA]	20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P->A
Impedance	[Ohm]	500
Differential input max.	[V]	30 for terminal D and E against PE
Ramp	[s]	0...3
Pre-fusing	[A]	6.3 medium lag
EMC		EN 50081-1 / 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 length max.	[m]	50

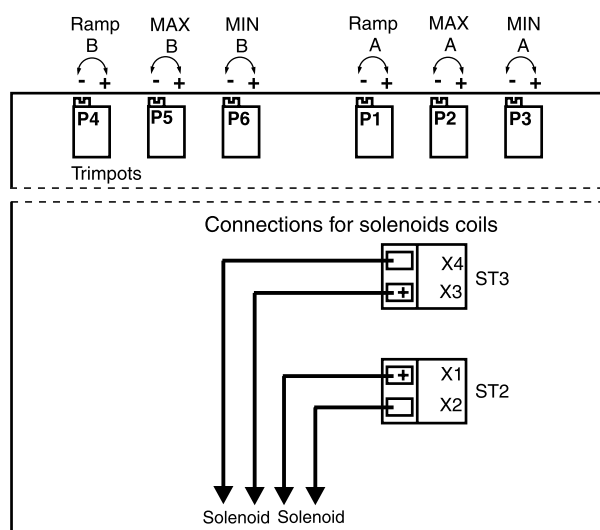
¹⁾ Flow rate for different Δp per control edge:

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

²⁾ Inverse polarity on request

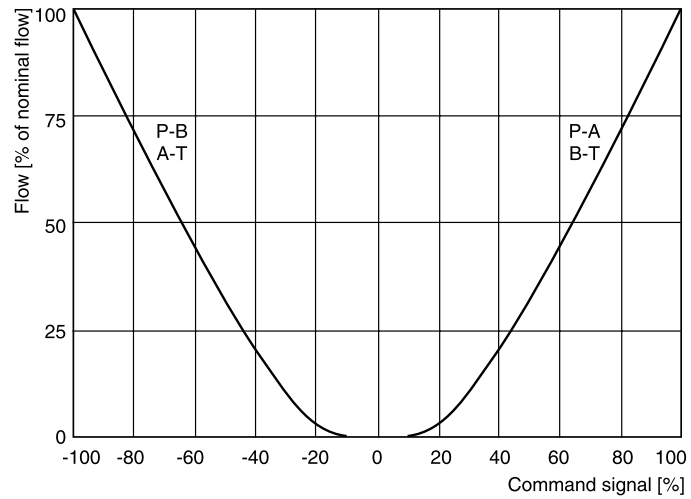
Block diagram**Central connector 6 + PE**

- A = supply (14.5...30 VDC)
- B = GND (0V)
- C = ref. +10 VDC
- D = input $\left\{ \begin{array}{l} (-10...+10 \text{ VDC}) \\ (-20...+20 \text{ mA}) \end{array} \right.$
- E = input
- F = ref. -10 VDC
- G = PE (Ground)

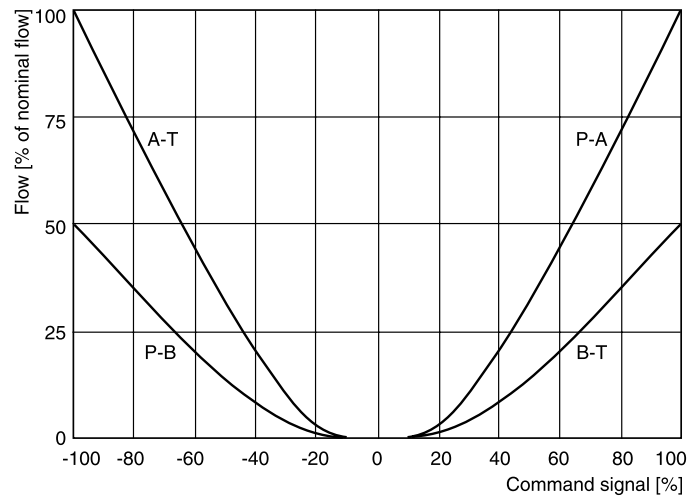
Arrangement of the potentiometers

Flow characteristics

Spool code **E***
 at Δp 5bar per metering edge

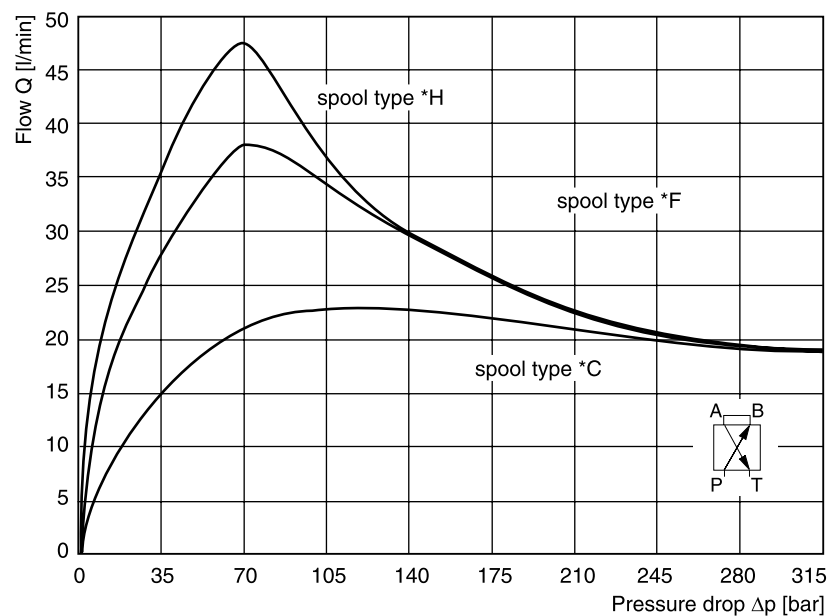


Spool code **B***

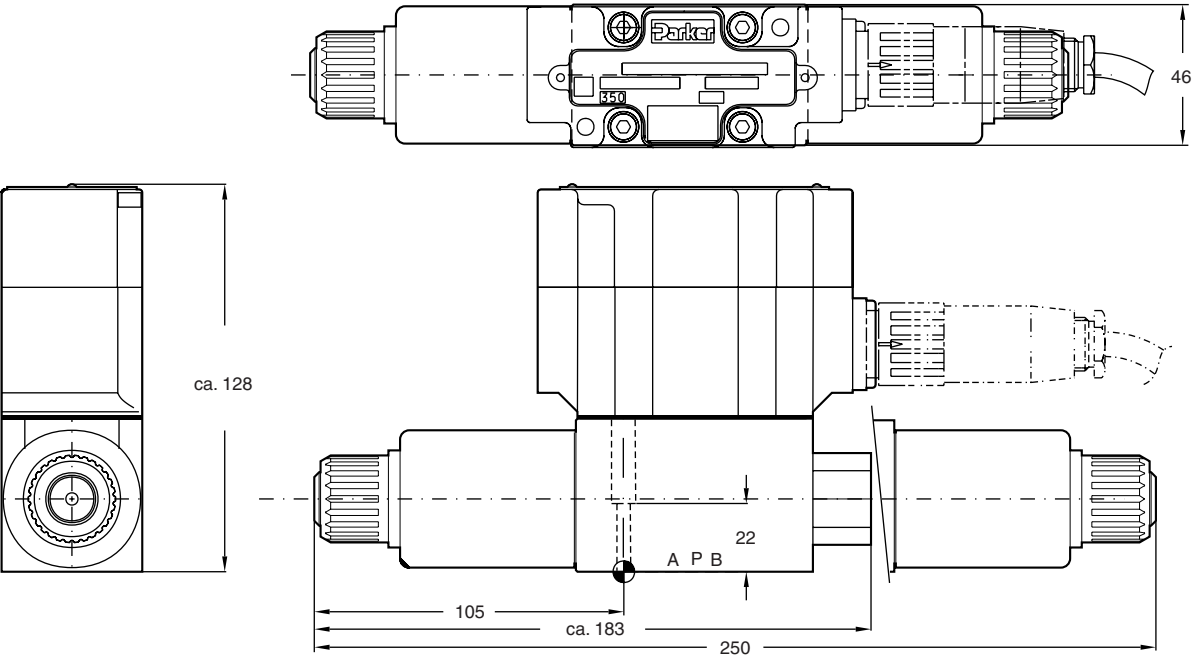


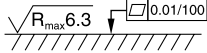
Flow limit

Spool code **E***
 (Spool code **B*** on request)
 100% command signal



3



Surface finish	 Kit			 Kit NBR
	BK375	4x M5x30 DIN 912 12.9	7.6 Nm ±15%	SK-D1FT-N30

Characteristics

The D*1FT pilot operated proportional DC valves are available in sizes NG10 (CETOP05), NG16 (CETOP07) and NG25 (CETOP08).

The D*1FT onboard electronics offers features as adjustable ramps and overlap compensation.

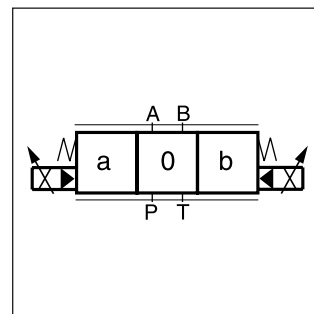
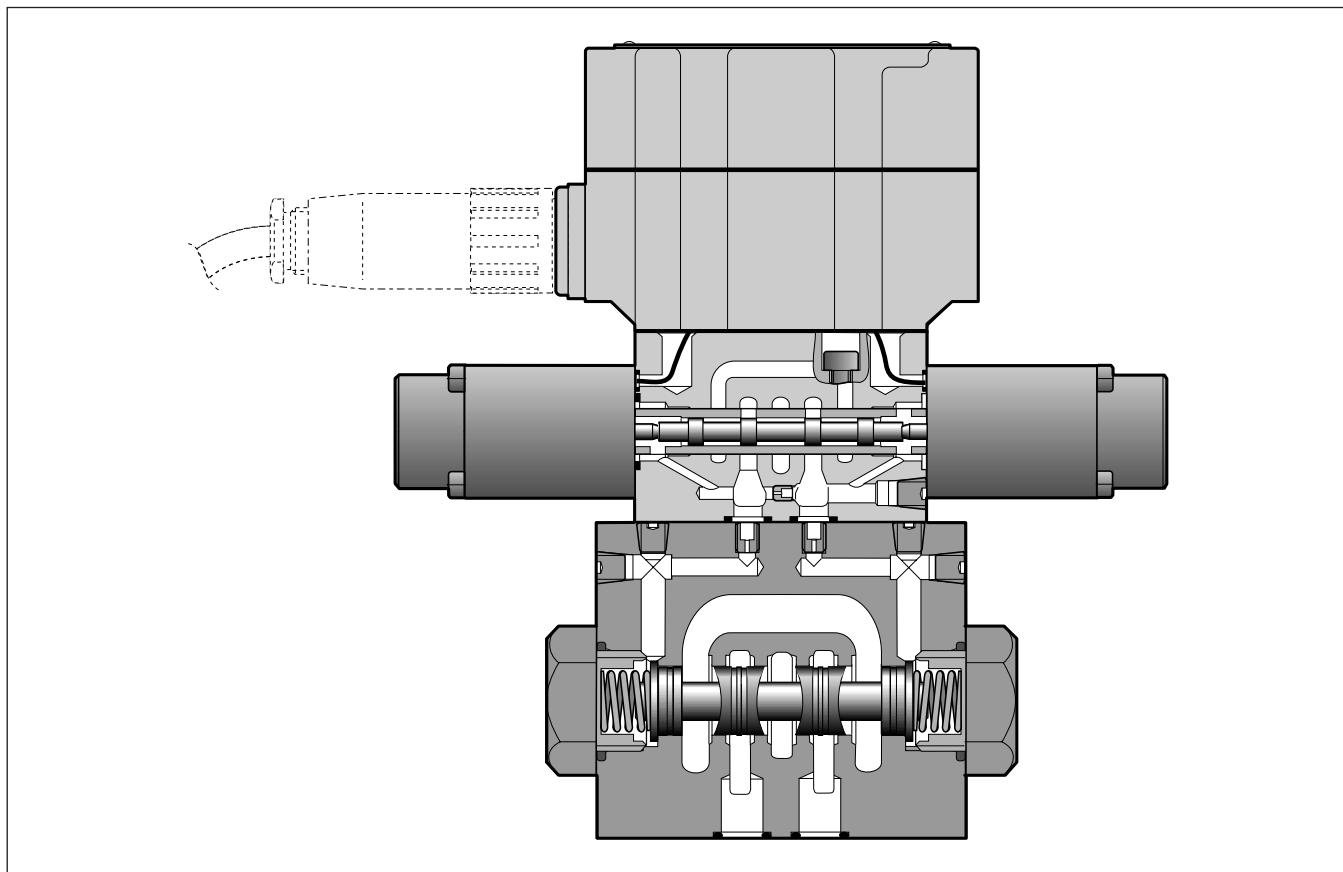
Typical applications include reproducible control of actuator speed in rapid / slow speed profiling, and smooth acceleration and deceleration performance.

Technical features

- Progressive flow characteristics for sensitive adjustment of flow rate
- Fail-safe centre position
- Center position monitoring optional
- Onboard electronics with adjustable
 - ramps
 - overlap compensation
 - zero offset
- D31FT – NG 10 (CETOP05)
- D41FT – NG 16 (CETOP07)
- D91FT – NG 25 (CETOP08)

**Pilot Operated Proportional DC Valve
Series D*1FT**


D31FT

**3****D31FT**

DFT_UK.INDD CM_28.01.08.1

Ordering Code

Pilot Operated Proportional DC Valve
Series D*1FT

D

1

F

T

C

N

0

Directional control valve

Size

NG06 pilot

Proportional control

Integrated electronics

Spool type

Flow

Spool position

Pilot connection

Seal NBR
(other seal compound on request)

Electronic variation

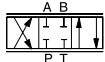
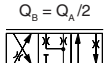
Electronic accessories

Valve accessories

Design series

Code	Size
3	NG10 / CETOP05
4	NG16 / CETOP07
9 *	NG25 / CETOP08

* with enlarged connections
Ø 32 mm

Code	Spool type
E01	
E02	
B31	$Q_B = Q_A / 2$ 
B32	$Q_B = Q_A / 2$ 

Code	Flow [l/min] at Δp = 5bar per metering edge		
	D31	D41	D91
C	75	-	-
F	-	200	-
H	-	-	400

Code	Valve accessories
0	Standard
8	Monitor switch

Code	Electronic variation
F	Voltage input 0...±10V, with reference output +10V/-10V
G	Current input 0...±20mA

Code	Inlet	Drain
1	Internal	External
2	External	External
4	Internal	Internal
5	External	Internal

Bold letters =
Short-term availability

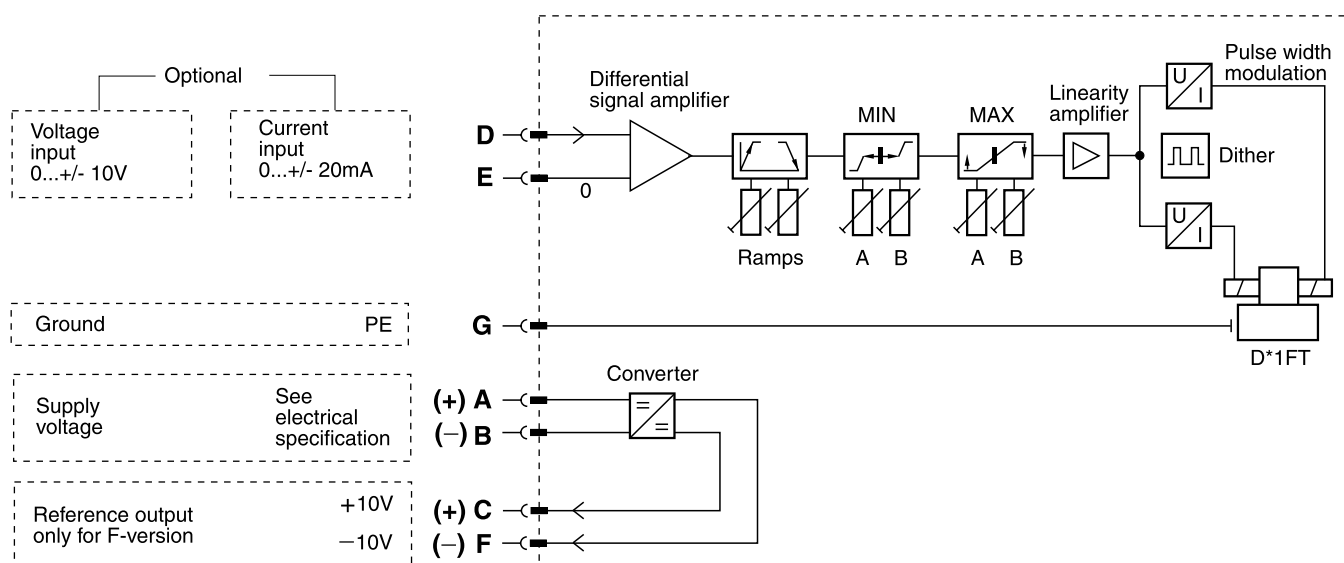
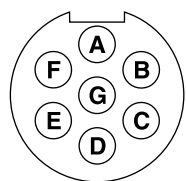
Please order plugs separately.
See chapter 3 accessories.

General		Pilot operated DC Valve		
Design		Proportional solenoid		
Actuation				
Size		NG10 (CETOP05)	NG16 (CETOP07)	NG25 (CETOP08)
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA		
Mounting position		unrestricted		
Ambient temperature		-20...+60		
Weight		7.3	11.1	19.3
Hydraulic				
Max. operating pressure		Pilot drain internal P, A, B, X 350; T, Y 105		
Fluid		Pilot drain external P, A, B, T, X 350; Y 105		
Fluid temperature		Hydraulic oil as per DIN 51524...535, other on request		
Viscosity permitted		-20...+60		
recommended		20...380		
Filtration		30...80		
Nominal flow ¹⁾		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)		
Leakage at 100 bar		75	200	400
Pilot supply pressure		100	200	600
Pilot flow at 100bar		20-350 (optimal dynamics at 50)		
Pilot flow, step response		< 1.2		
Static / Dynamic				
Step response at 100% step		0.8	1.7	3.8
Hysteresis		60	75	100
Sensitivity		< 5		
Electrical characteristics				
Duty ratio		< 1		
Protection class		100		
Supply voltage/ripple		IP65 in accordance with EN 60529 (plugged and mounted)		
Current consumption max.		14.5 ... 30, ripple < 5% eff. surge free		
Input signal ²⁾		2.8		
Voltage		10...0...-10, ripple < 0.01% eff., surge free, 0...+10V P → B		
Impedance		100		
Current		20...0...-20, ripple < 0.01% eff., surge free, 0...+20mA P → B		
Impedance		500		
Differential input max.		30 for terminal D and E against PE		
Ramp		0...3		
Pre-fusing		6.3 medium lag		
EMC		EN 50081-2 / EN50082-2		
Coil insulation class		F (155 °C)		
Electrical connection		6+PE acc. EN 175201-804		
Wiring min.		6x1.0 (AWG 18) overall braid shield		
Wiring lenght max.		50		
Electrical monitor switch				
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)		
Ambient temperature		0-70		
Supply voltage/ripple		18...42, ripple < 10% eff.		
Current consumption without load		< 30		
Max. output current per channel, ohmic		400		
Min. output load per channel, ohmic		100		
Max. output drop at 0.2A		< 1.1		
Max. output drop at 0.4A		< 1.6		
EMC		EN 50081-1 / EN50082-2		
Max. tol. ambient field strength		1200		
Min. distance to next AC solenoid		0.1		
Interface		4+PE acc. IEC 61076-2-101 (M12)		
Wiring min.		5x0.5 (AWG 20) overall braid shield		
Wiring lenght max.		50		

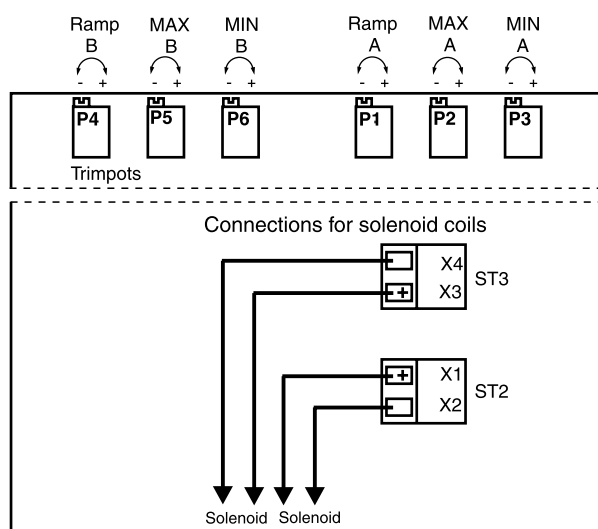
¹⁾ Flow rate for different Δp per control edge:

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

²⁾ Inverse polarity on request

Block diagram**Central connector 6 + PE**

- A = supply (14.5...30 VDC)
- B = GND (0V)
- C = ref. +10 VDC
- D = input $\left\{ \begin{array}{l} (-10...+10 \text{ VDC}) \\ (-20...+20 \text{ mA}) \end{array} \right.$
- E = input
- F = ref. -10 VDC
- G = PE (Ground)

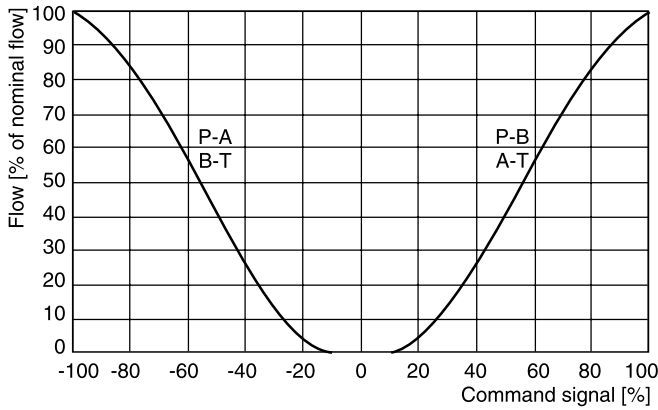
Mechanical arrangement of the potentiometers

Flow characteristics

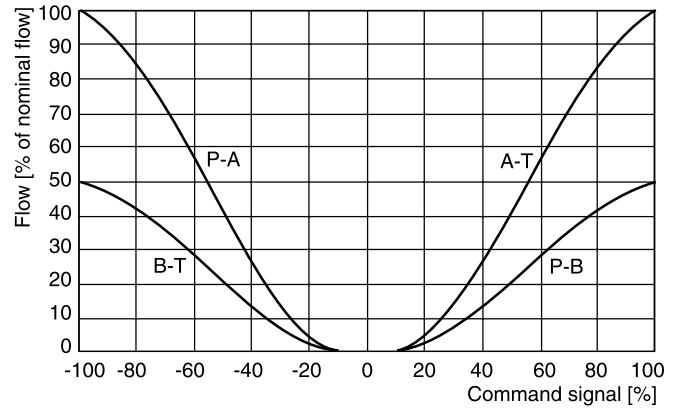
at $\Delta p = 5\text{bar}$ per metering edge

D*1FT

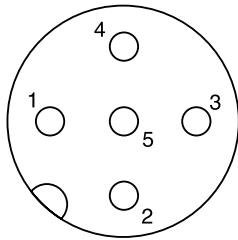
Spool code **E***



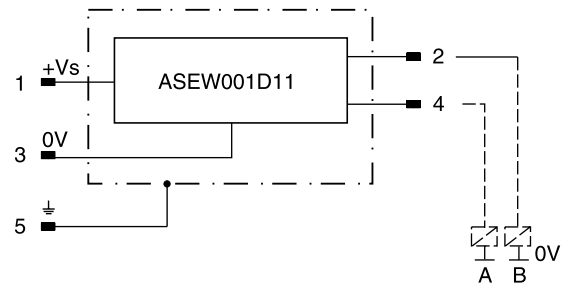
Spool code **B***



Monitor switch M12x1 pin assignment



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

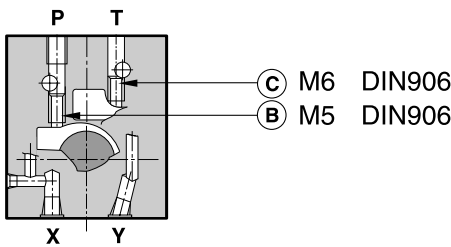


Signal	Output A (pin 4)	Output B (pin 2)
neutral	closed	closed
	open	closed
	closed	open

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

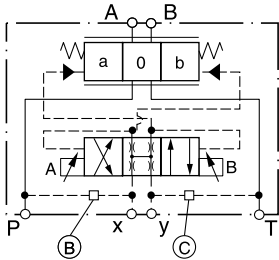
Pilot oil inlet (supply) and outlet (drain)

D31FT

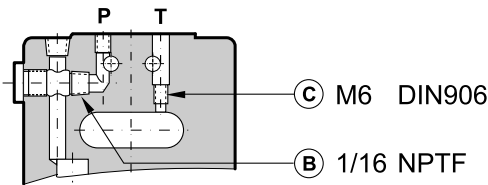


○ open, ● closed

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

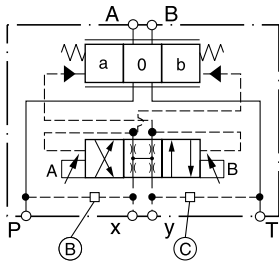


D41FT

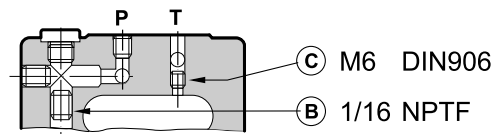


○ open, ● closed

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

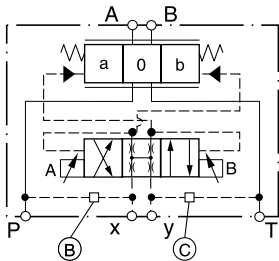


D91FT

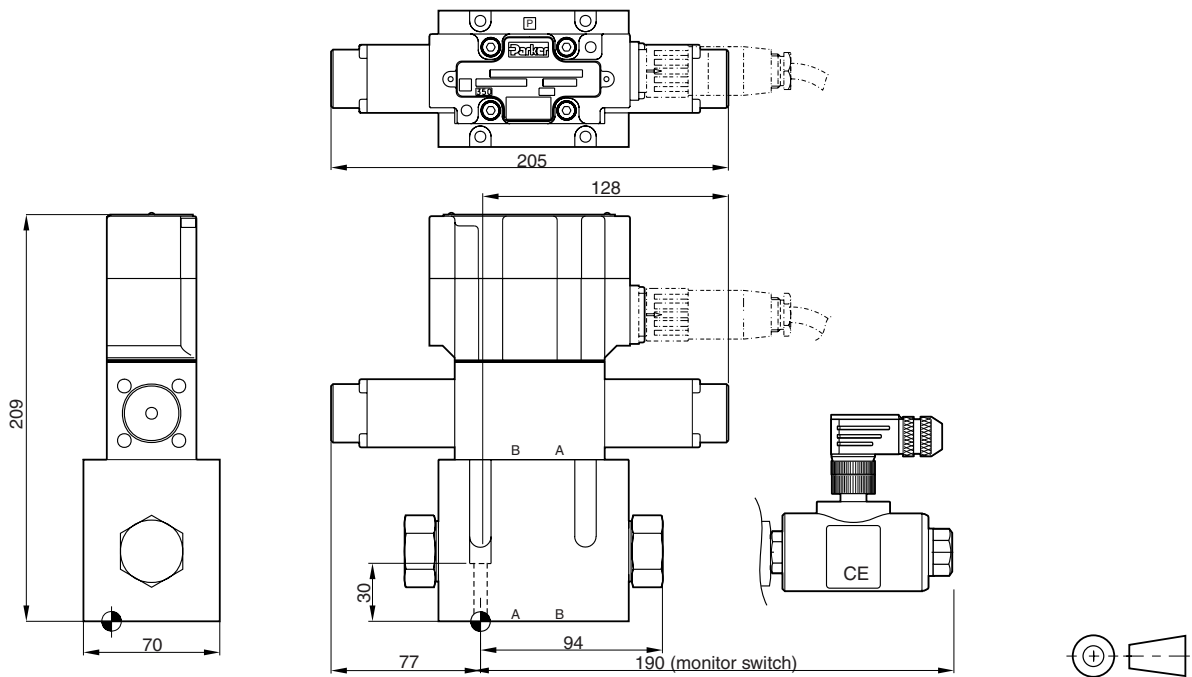


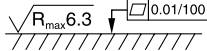
○ open, ● closed

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

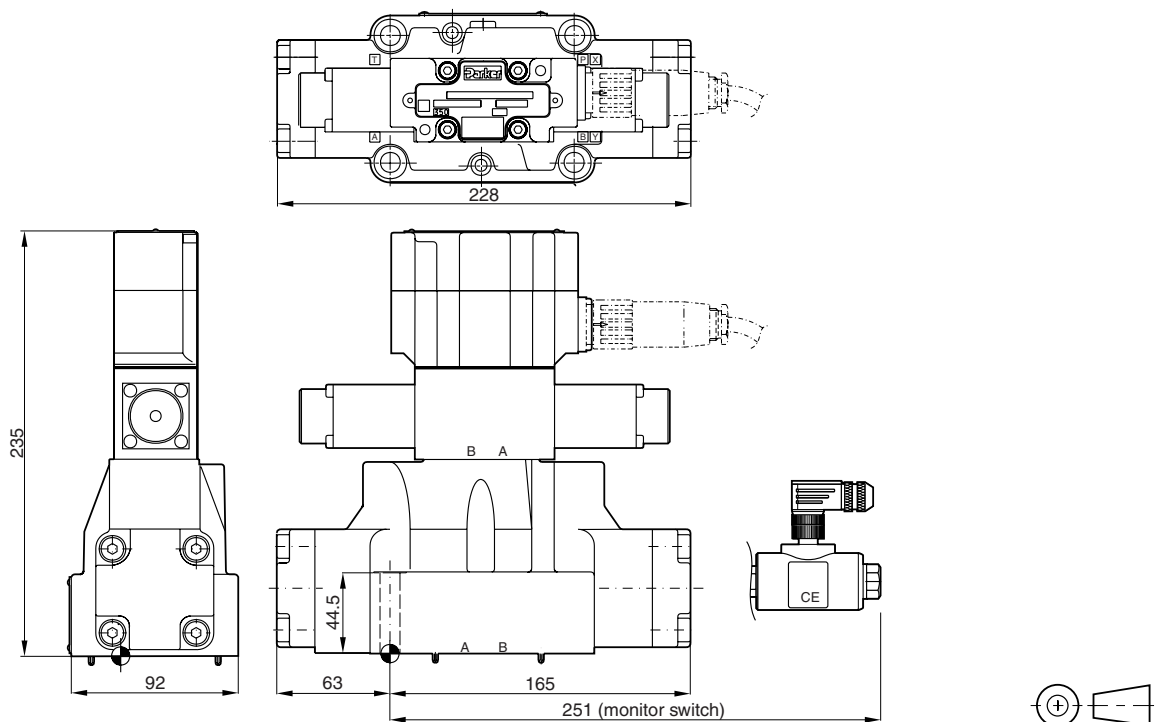


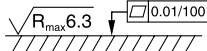
D31FT



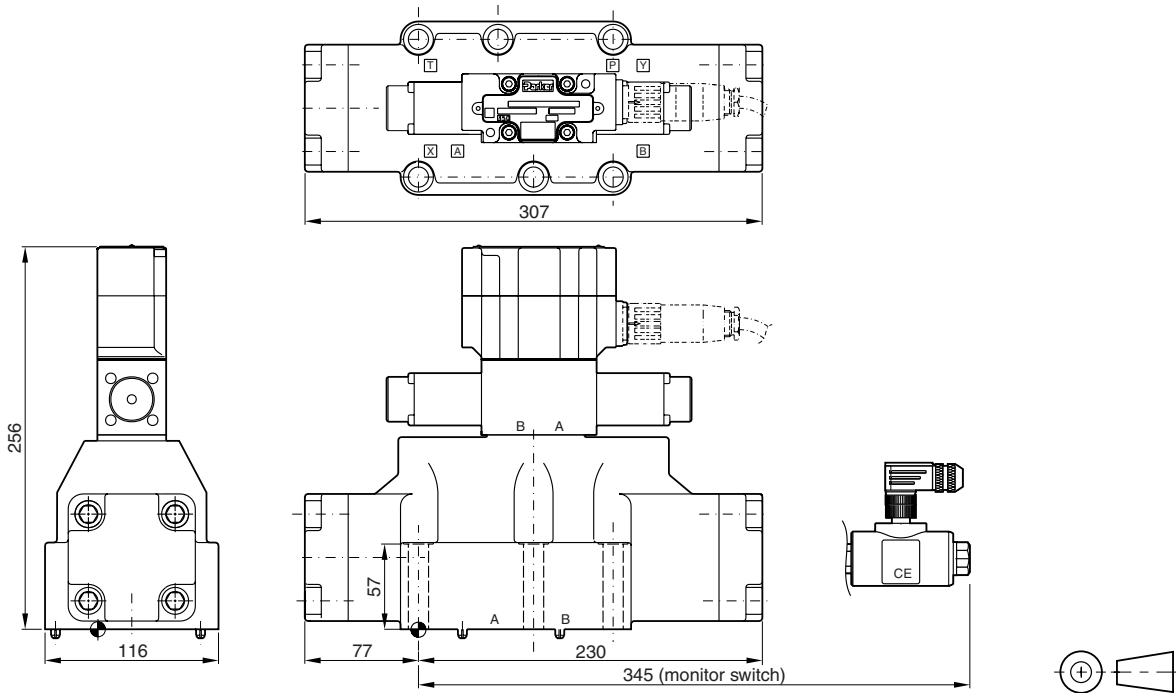
Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	SK-D31FTN

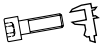
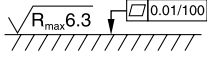
D41FT



Surface finish	 Kit			 Kit NBR
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 Nm ±15%	SK-D41FTN

D91FT



Surface finish	 Kit	 Kit		 Kit NBR
	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	SK-D91FTN

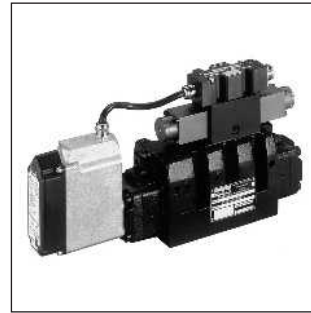
The pilot operated proportional DC valves series of the D*1FH series are high-performance valves with electronic spool position feedback. These valves are available in sizes NG10 to NG32 (CETOP05 to CETOP10).

Typical applications are:

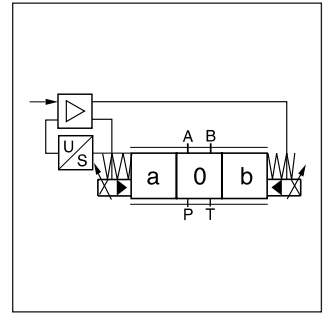
High precision and reproducible adjustment of flow rates, applications in rapid / creep speed with spool position monitoring for presses and dynamic position and p/Q closed loop systems.

Technical features

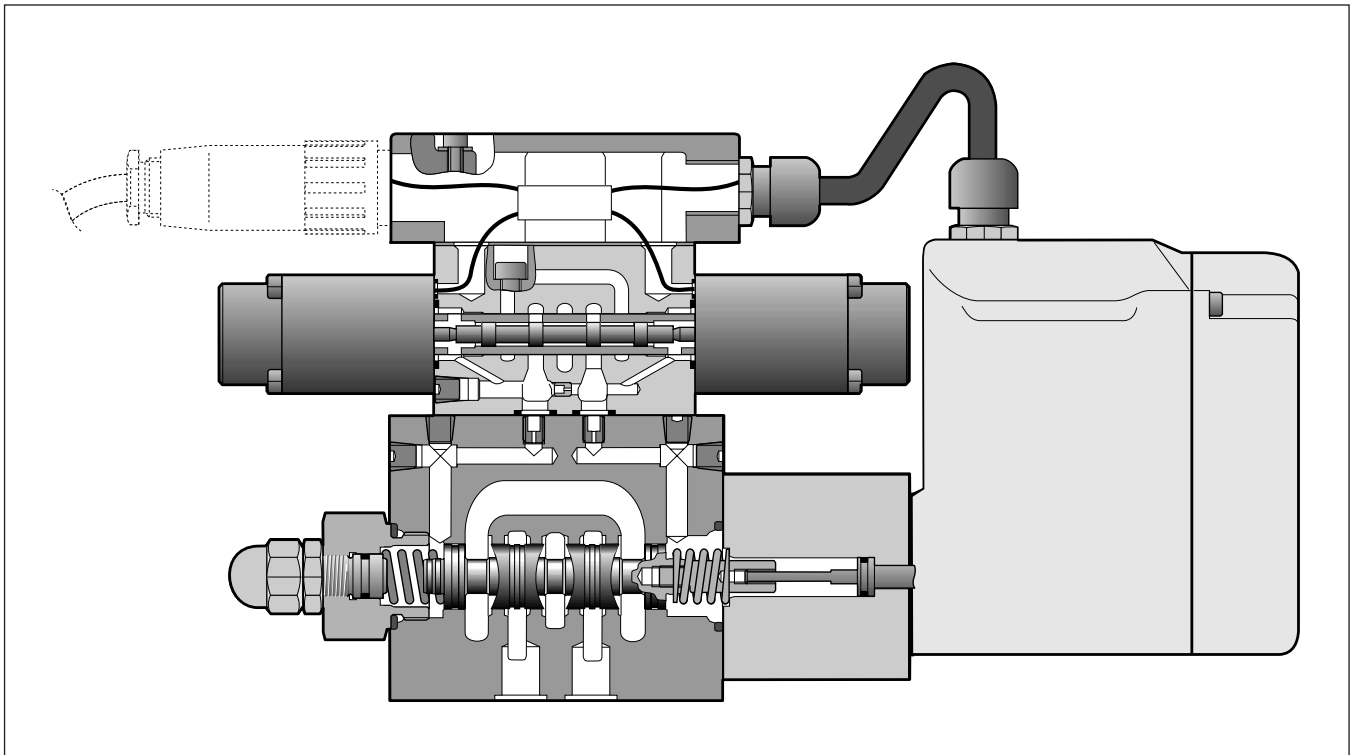
- Very low hysteresis
- Zero lap and overlap spool design available
- High dynamics
- Spool position feedback
- Center position monitoring optional
- D31FH – NG 10 (CETOP05)
- D41FH – NG 16 (CETOP07)
- D81/91FH – NG 25 (CETOP08)
- D111FH – NG 32 (CETOP10)



D91FH

**3**

D*1FH



Ordering Code

Pilot Operated Proportional DC Valve
Series D*1FH

3

D		1	F	H				N		0		
Directional control valve	Size	NG06 pilot	Proportional control	High response	Spool type	Flow	Pilot connection	Seal NBR (other seal compound on request)	Electronic variation	Electronic accessories	Valve accessories	Design series

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

¹⁾ with enlarged connections
Ø 32 mm

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

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

Code	Valve accessories
0	Standard
8 ³⁾	Monitor switch

³⁾ not for spool B11 and B12 at NG10

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

Code	Inlet	Drain
1	Internal	External
2	External	External
4	Internal	Internal
5	External	Internal

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

() flow for spool B11/B12

Bold letters =
Short-term availability

Please order plugs separately.
See chapter 3 accessories.

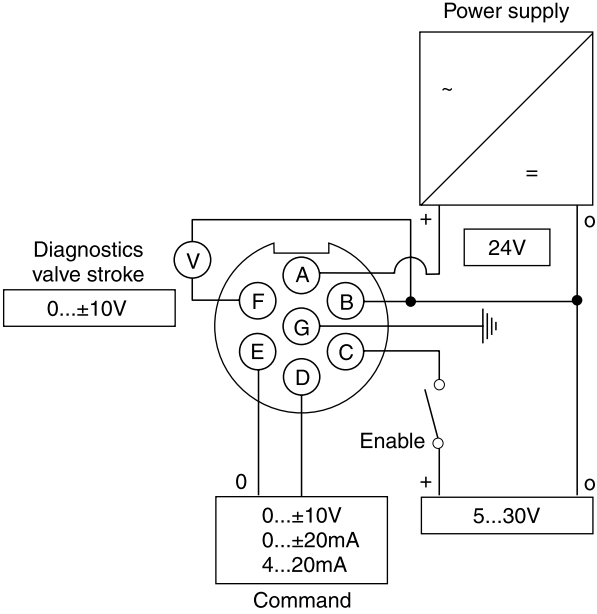
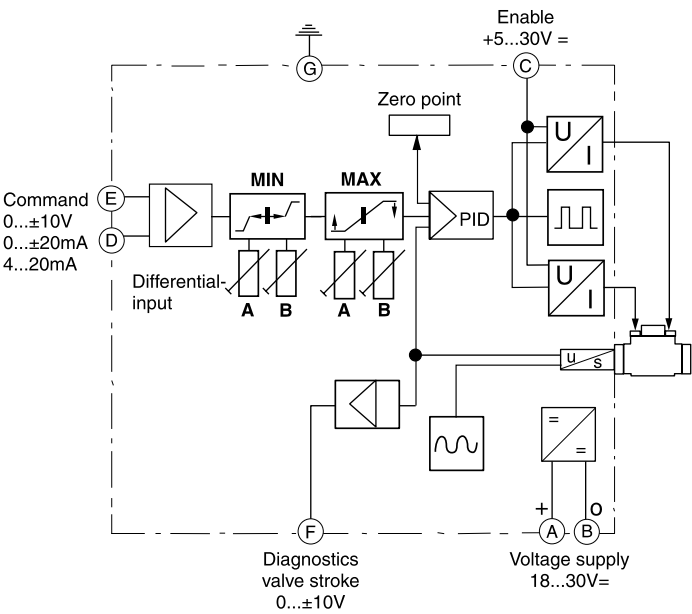
General		Pilot operated DC Valve with onboard electronic Proportional solenoid			
Design		Proportional solenoid			
Actuation					
Size		NG10 (CETOP05)	NG16 (CETOP07)	NG25 (CETOP08)	NG32 (CETOP10)
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA			
Mounting position		unrestricted			
Ambient temperature	[°C]	-20...+60			
Weight	[kg]	8.1	11.6	20.7	62
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6			
Hydraulic					
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 ¹⁾	[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
Static / Dynamic					
Step response at 100% step	[ms]	25	45	65	150
Hysteresis	[%]	<0.1			
Sensitivity	[%]	<0.05			
Electrical characteristics					
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 ²⁾					
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 length max.	[m]	50			
Electrical monitor switch					
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 length max.	[m]	50			

¹⁾ Flow rate for different Δp per control edge:²⁾ Inverse polarity on request

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

Control system flow chart, valve electronics

Wiring



Enable input

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

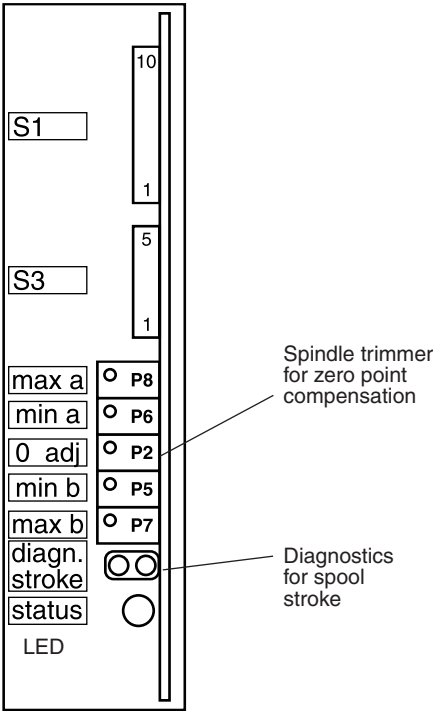
Supply voltage monitoring

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

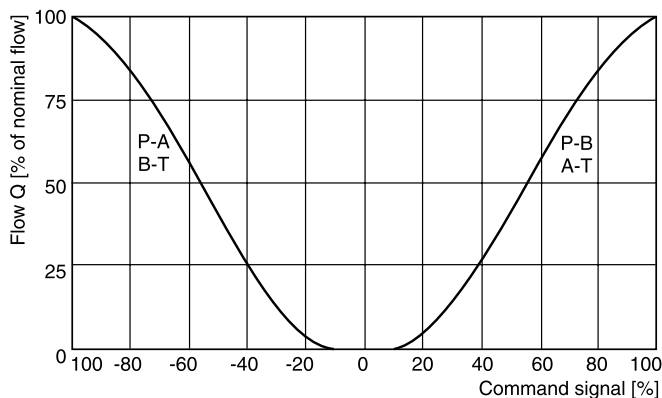
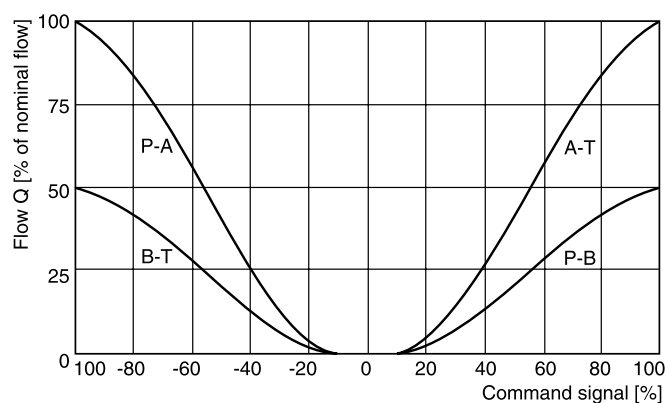
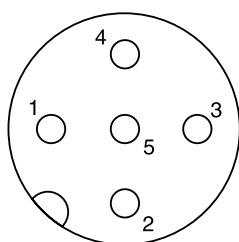
Control monitoring

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

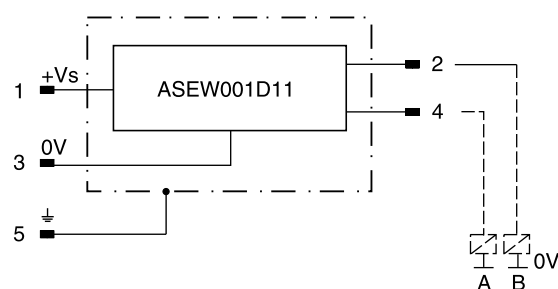
Arrangement of the potentiometers



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

Flow characteristicsat $\Delta p = 5\text{bar}$ per metering edgeSpool types **E01, E02**Spool types **B31, B32****3****Monitor switch M12x1 pin assignment**

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

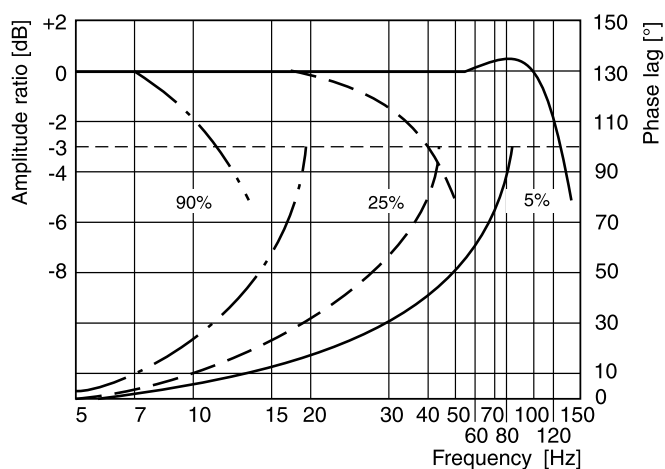


Signal	Output A (pin 4)	Output B (pin 2)
neutral	closed	closed
	open	closed
	closed	open

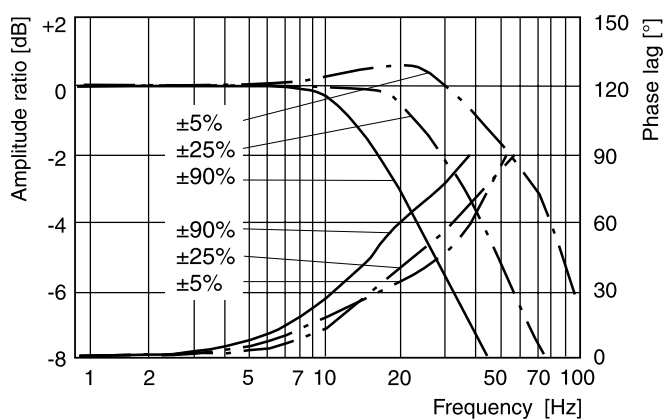
The neutral position is monitored. The signal changes after less than 10% of the spool stroke.

Frequency response

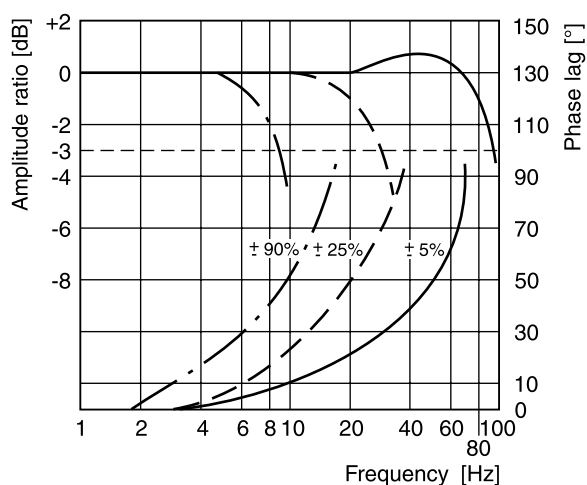
D31FH



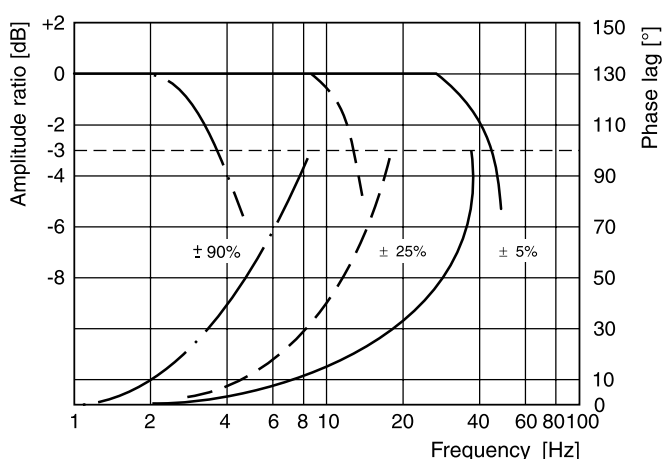
D81/91FH

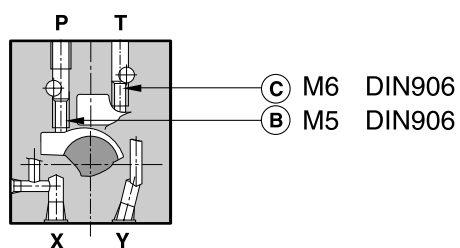


D41FH



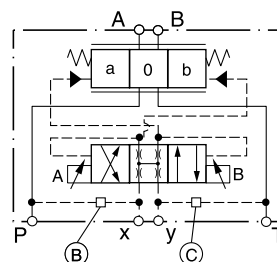
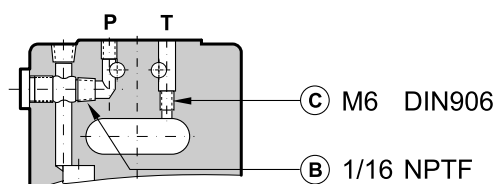
D111FH



Pilot oil inlet (supply) and outlet (drain)**D31FH**

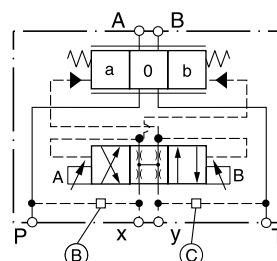
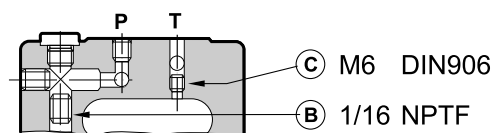
○ open, ● closed

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

**D41FH**

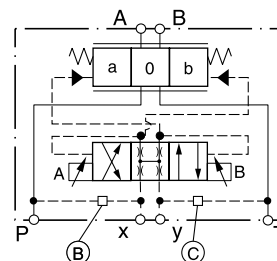
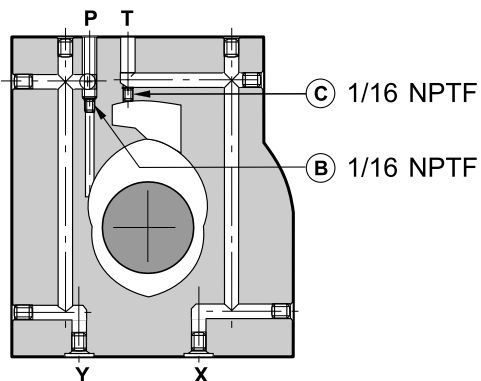
○ open, ● closed

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

**D81/91FH**

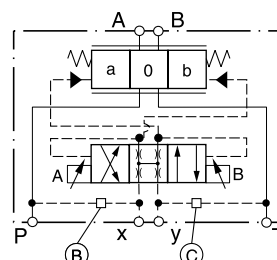
○ open, ● closed

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

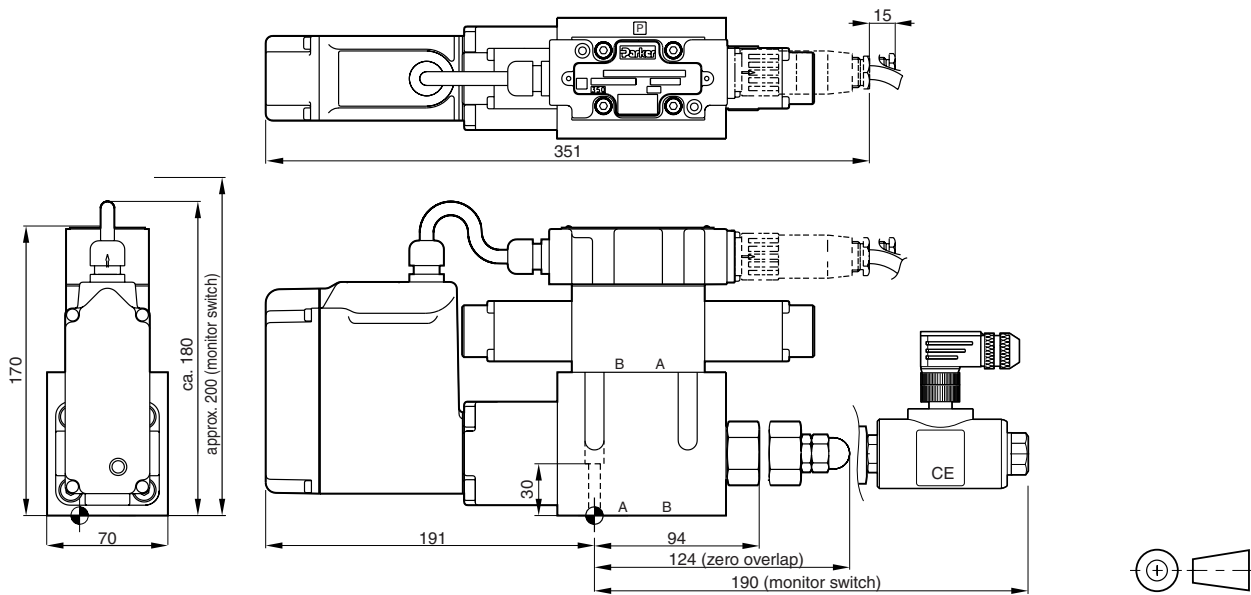
**D111FH**

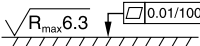
○ open, ● closed

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

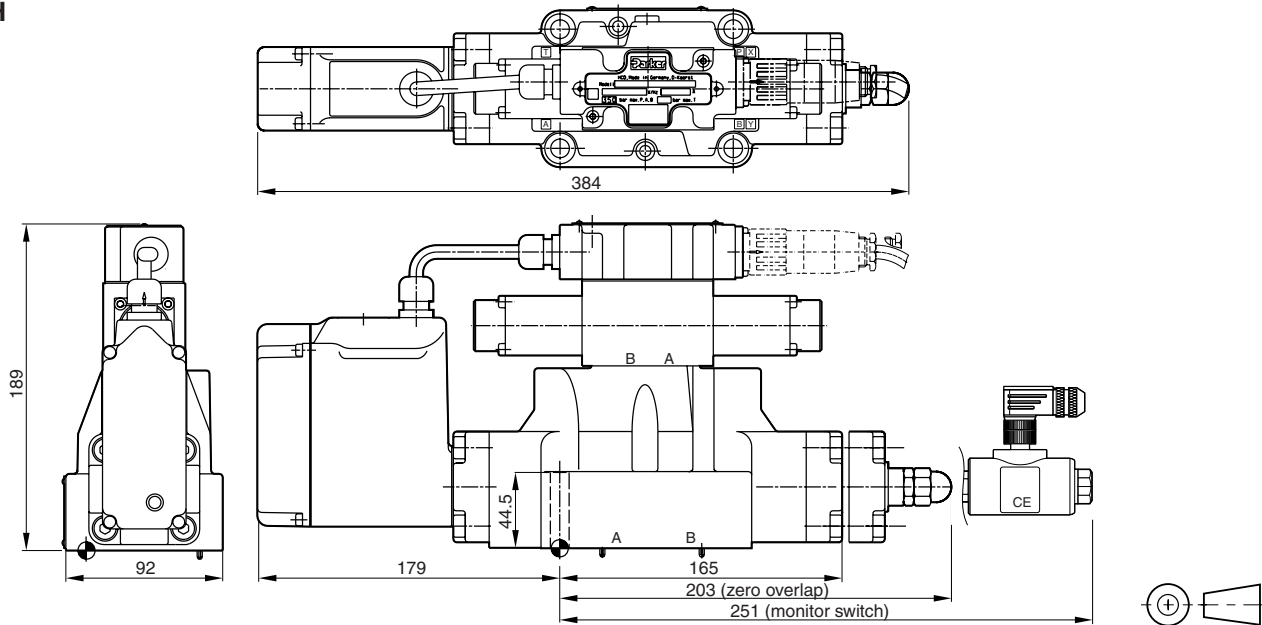


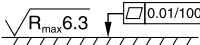
D31FH



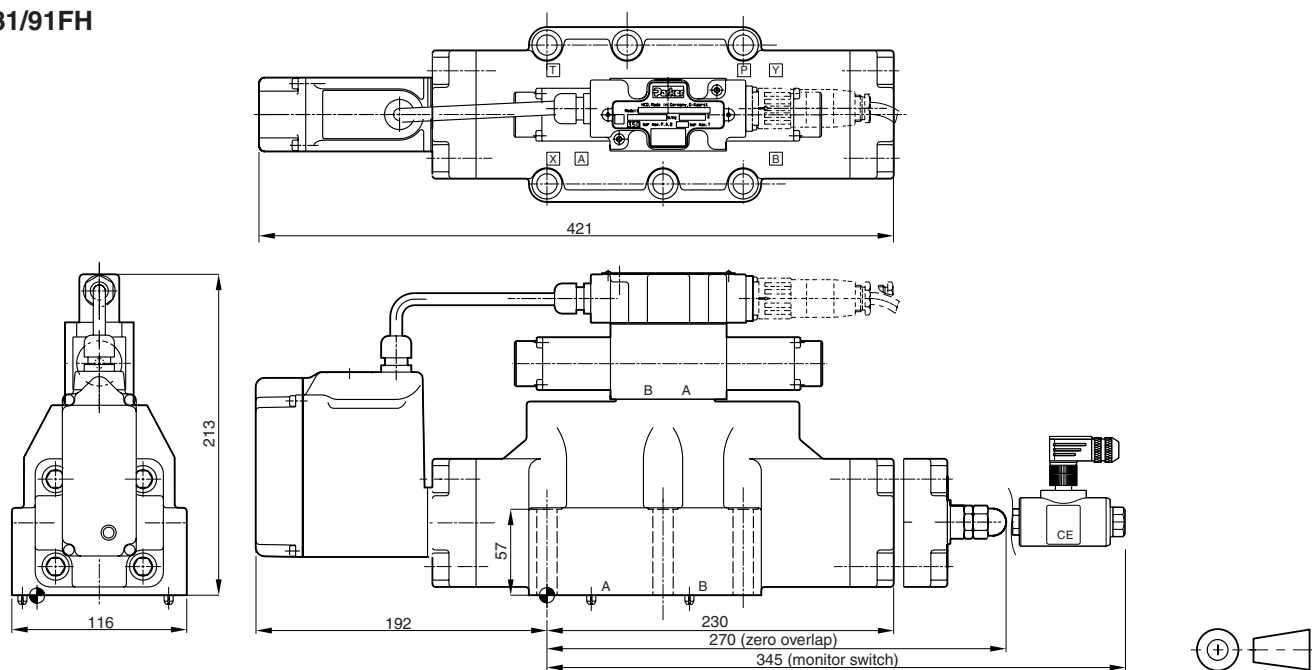
Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	SK-D31FHN

D41FH



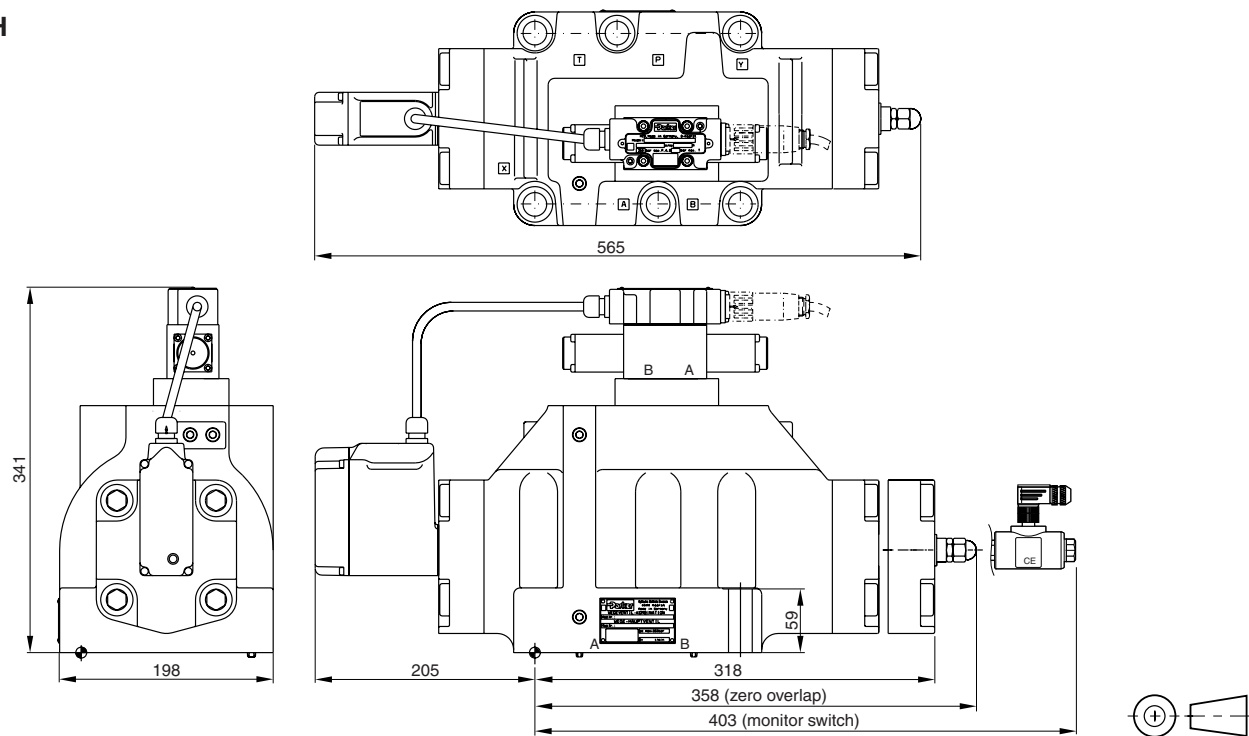
Surface finish	 Kit			 Kit NBR
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 Nm ±15%	SK-D41FHN

D81/91FH



Surface finish	Kit	Kit	Kit	Kit NBR
$\sqrt{R_{max} 6.3}$	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	SK-D91FHN

D111FH



Surface finish	Kit	Kit	Kit	Kit NBR
$\sqrt{R_{max} 6.3}$	BK386	6x M20x90 DIN 912 12.9	517 Nm ±15%	SK-D111FHN

3

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin, dark gray lines. There are 20 columns and 20 rows of squares, creating a total of 400 square units. The background is white, and the grid covers the entire area of the page.

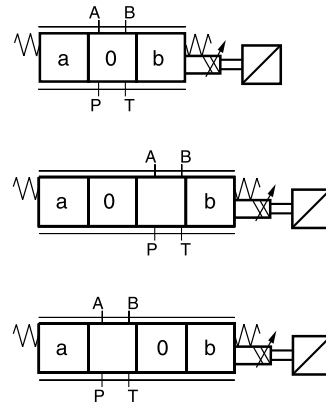
The direct operated control valve D1FP of the nominal size NG06 (CETOP03) shows extremely high dynamics combined with maximum flow. First of all it is used for highest accuracy in positioning of hydraulic axis and controlling of pressure and velocity.

Driven by the new patented VCD® actuator the D1FP reaches the frequency response of real servovalves. Compared with solenoid driven valves the D1FP can also be used in applications with pressure drops up to 350bar across the valve. Because of the high flow capability the D1FP can be a substitute for NG10 valves in some cases.

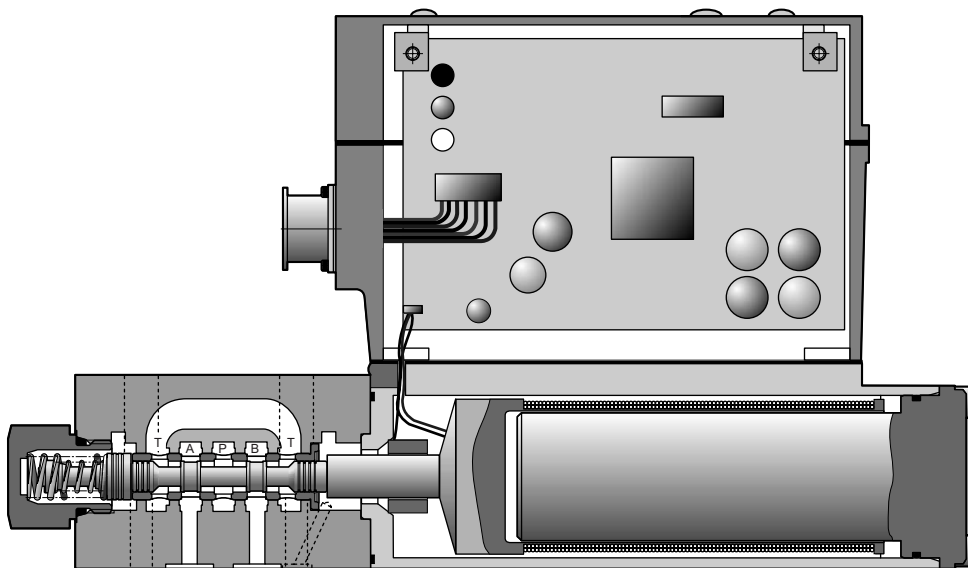
A loss of the power supply lets the spool move in a defined position. All common input signals are available.

Technical features

- Real servovalve dynamics
(-3dB/350Hz at ±5% input signal)
- No flow limit up to 350 bar pressure drop through the valve
- Max. tank pressure 350 bar
(with external drain port y)
- High flow
- Defined spool positioning in case of power supply breakdown
- Onboard electronics

**3**

D1FP



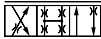
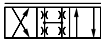
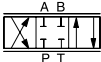
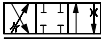
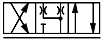
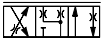
D1FP_UK.INDD CM_28.01.08.1

Ordering Code

Direct Operated Proportional DC Valve
Series D1FP

D	1	F	P			9				0	
Directional control valve	Size DIN NG06 CETOP03 NFA D03	Proportional control	VCD	Spool type	Spool position on power down ¹⁾	Y-port (plugged) ⁴⁾	Seals	Command-signal	Accessories	Spool/sleeve design	Design series

3

Code	Spool type	Flow [l/min] at Δp 35bar per metering edge
Zerolap		
E50M		40
E50H		25
E50F		12
E50C		6
E50B		3
B60M	$Q_B = Q_A/2$ 	40 / 20
Underlap approx. -0.5%		
E55M		40
E55H		25
Overlap 25%		
E01M		40
E01H		25
E01F		12
E01C		6
E01B		3
B31M	$Q_B = Q_A/2$ 	40 / 20
E02M		40
E02H		25
E02F		12
E02C		6
E02B	$Q_B = Q_A/2$ 	3
B32M		40 / 20

Bold letters =
Short-term availability

Code	Connection type
0	6 + PE acc. EN175201-804
5	11 + PE acc. EN175201-804

Code	Signal	Flow direction
B	+/- 10V	0...+10V -> P-A
E	+/- 20mA	0...+20mA -> P-A
S	4...20mA	12...20mA -> P-A

Code	Seals
N	NBR
V	FPM
H	for HFC fluid

Code	Spool pos. on power down
A ²⁾	
B ²⁾	
C ³⁾	

¹⁾ On power down the spool moves in a defined position. This cannot be guaranteed in case of single flow path on the control edge A – T resp. B – T with pressure drops above 120 bar or contamination in the hydraulic fluid.

²⁾ approx. 10% opening, only zero lapped spools and underlap spools

³⁾ only for overlapped spools

⁴⁾ needs to be removed at tank pressure >35 bar

Please order plugs separately.
See chapter 3 accessories.

General		
Design		Direct operated proportional DC valve
Actuation		VCD® actuator
Size		NG06/CETOP03/NFPA D03
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+50
Weight	[kg]	4.5
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350
	[bar]	Port T max. 35, port Y max. 35 ¹⁾
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=35bar		
per control edge ²⁾	[l/min]	3 / 6 / 12 / 25 / 40
Flow maximum	[l/min]	90 (at Δp=350bar over two control edges)
Leakage at 100 bar	[ml/min]	<400 (zero lapped spool); <50 (over lapped spool)
Static / Dynamic		
Step response at 100% step ³⁾	[ms]	<3.5
Frequency response		
(±5% signal) ³⁾	[Hz]	350 (amplitude ratio -3dB), 350 (phase lag -90°)
Hysteresis	[%]	<0.05
Sensitivity	[%]	<0.03
Temperature drift	[%/°K]	<0.025
Electrical characteristics		
Duty ratio	[%]	100
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Supply voltage/ripple	[V]	DC 22 ... 30, ripple <5% eff., surge free
Current consumption max.	[A]	3.5
Switch-on current typical	[A]	22 for 0.2 ms
Input signal		
Voltage	[V]	10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A
Impedance	[kOhm]	100
Current	[mA]	20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P->A
Impedance	[Ohm]	250
Current	[mA]	4...12...20, ripple <0.01% eff., surge free, 12...20mA P->A
Impedance	[Ohm]	<3.6 mA = disable, <3.8 mA = according to NAMUR NE43
Differential input max.		
Code 0	[V]	30 for terminal D and E against PE (terminal G)
Code 5	[V]	30 for terminal 4 and 5 against PE (terminal ⊥)
Enable signal (only code 5)	[V]	5...30, Ri = 9 kOhm
Diagnostic signal	[V]	+10...0...-10 / +Ub, rated max. 5mA
Pre-fusing	[A]	4.0 medium lag
EMC		EN 50081-2 / EN50082-2
Electrical connection	Code 0	6 + PE acc. EN 175201-804
	Code 5	11 + PE acc. EN 175201-804
Wiring min.		
Code 0	[mm²]	7x1.0 (AWG 18) overall braid shield
Code 5	[mm²]	12x1.0 (AWG 18) overall braid shield
Wiring length max.	[m]	50

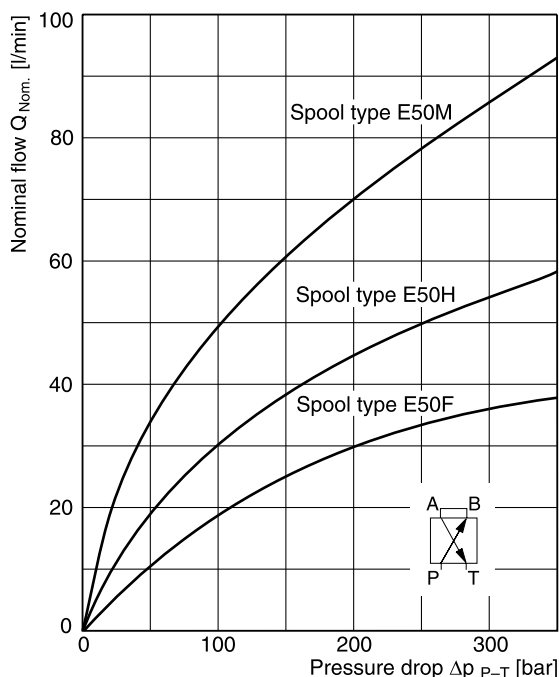
¹⁾ For applications with p_r>35 bar the Y-port has to be connected and the plug in the Y-port has to be removed.

²⁾ Flow rate for different Δp per control edge:

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

³⁾ Measured with load (100 bar pressure drop/two control edges)

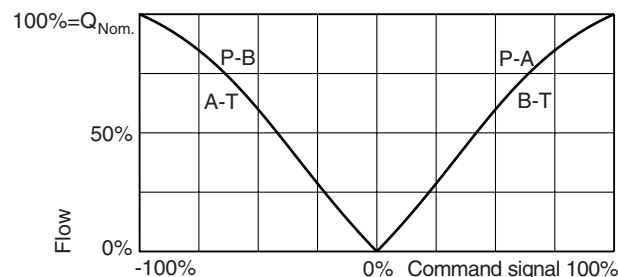
Functional limit (at 100% command signal)



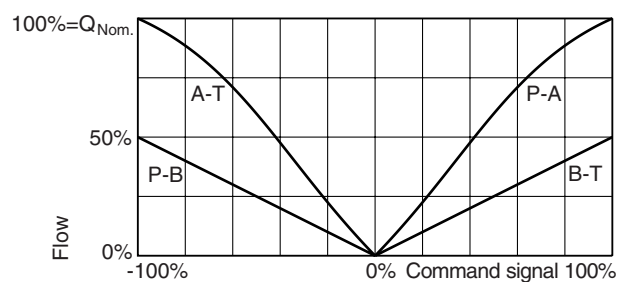
Flow curves

at $\Delta p = 35$ bar per metering edge

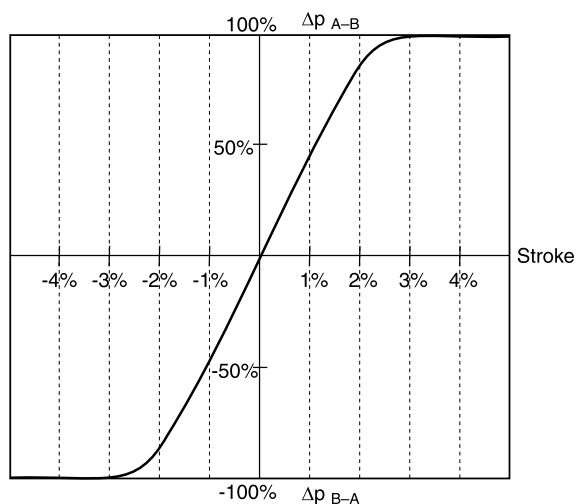
Spool type E50



Spool type B60



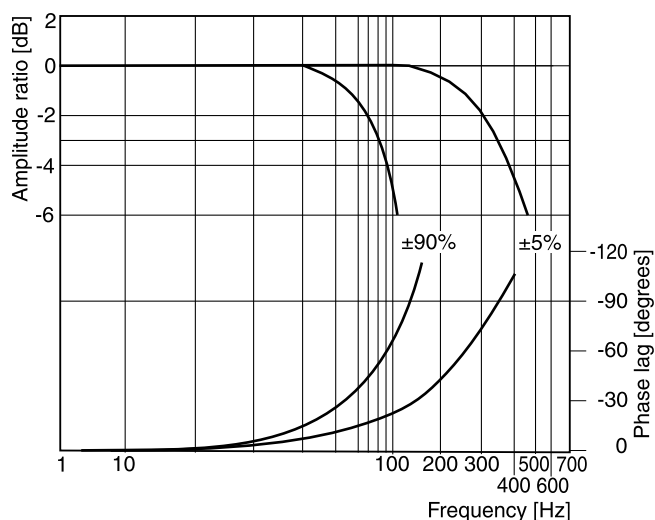
Pressure gain



Frequency response

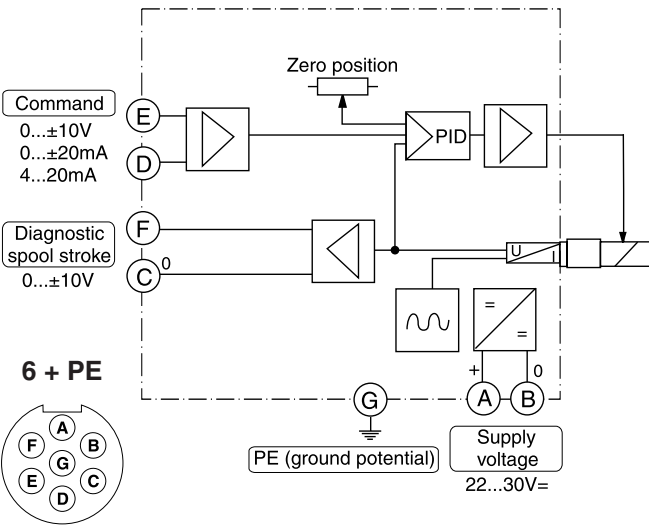
$\pm 5\%$ command signal

$\pm 90\%$ command signal

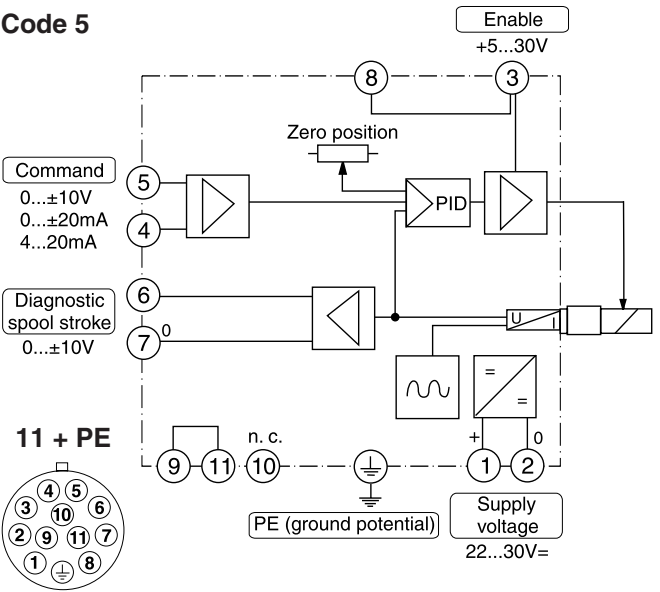


Block diagrams

Code 0

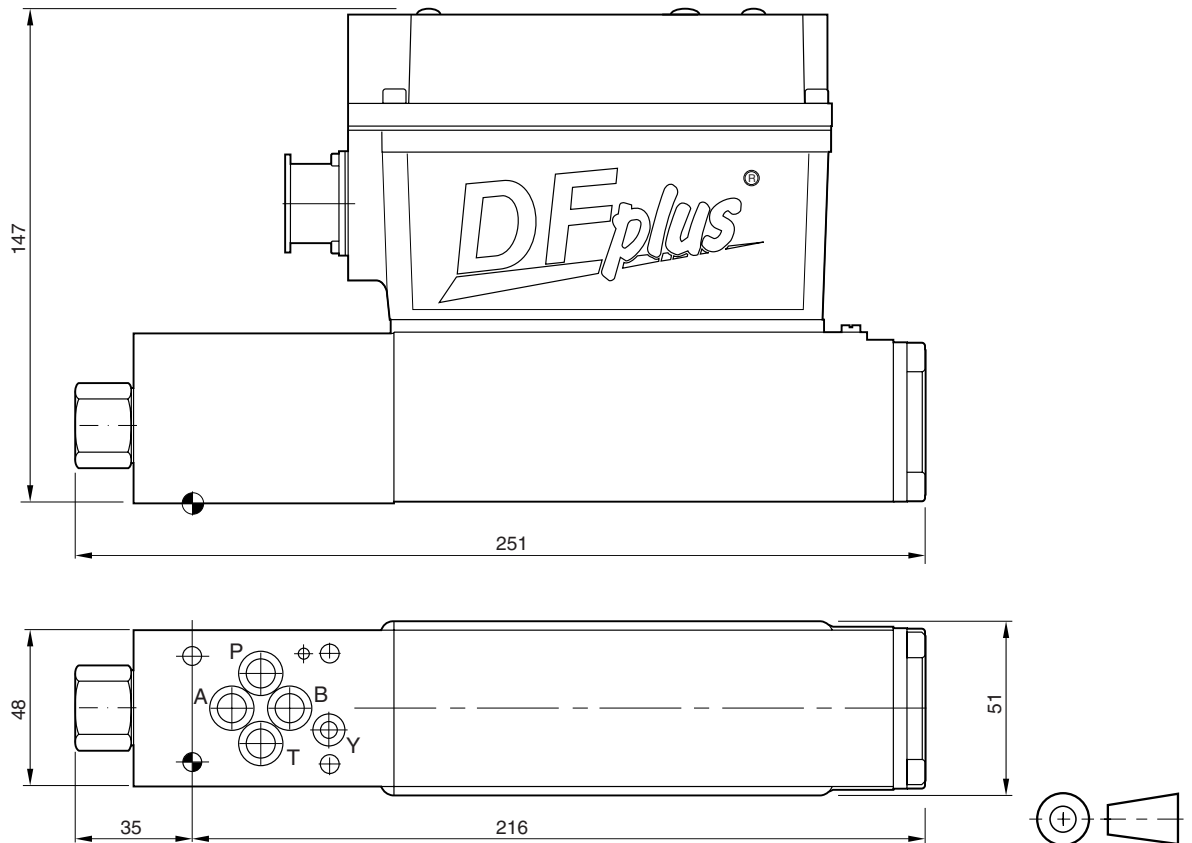


Code 5



3

Dimensions



Surface finish	Kit		
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK375	4x M5x30 DIN 912 12.9	7.6 Nm $\pm 15\%$

D1FP_UK.INDD CM_28.01.08.1

3

A full-page view of a blank sheet of white graph paper. The page is covered by a continuous, uniform grid of thin gray lines. The grid consists of small squares, approximately 10 units wide and 15 units high, forming a rectangular area suitable for drawing or calculation. There are no margins, text, or other markings on the paper.

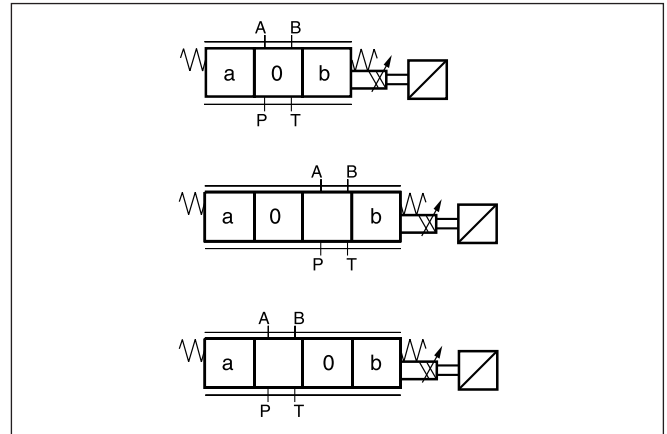
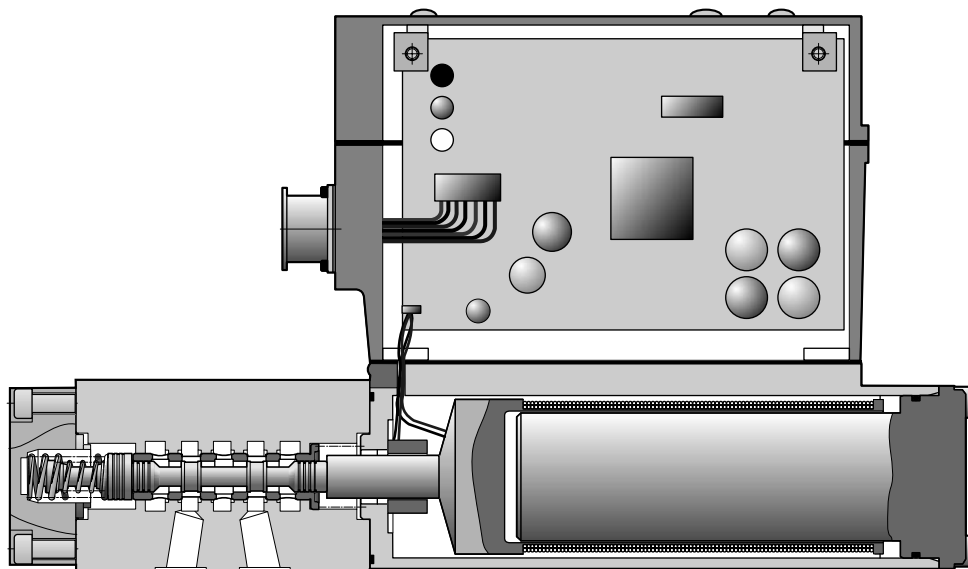
The direct operated control valve D1FP*S of the nominal size 04 (ISO 10372) shows extremely high dynamics combined with maximum flow. The valve mounting pattern is designed to replace servovalves of size 04 (ISO 10372) with the D1FP*S.

Driven by the new patented VCD® technology the D1FP*S shows all advantages of the DFplus® series as robustness, high dynamics and no flow limit up to 350 bar. Additional features are low leakage and a defined spool position in case of power supply breakdown.

Maintenance and contamination restrictions correspond to common solenoid driven valves and pilot supply is not required. All common input signals are available.

Technical features

- Servovalve size 04 (ISO 10372) mounting pattern
- Real servovalve dynamics
(-3db/350Hz with $\pm 5\%$ input signal)
- Low leakage
- No flow limit up to 350 bar pressure drop through the valve
- Max. tank pressure 350 bar
(with external drain port y)
- High flow
- Defined spool positioning in case of power supply breakdown
- Onboard electronics

**3****D1FP*S**

D1FPS_UK.INDD CM_28.01.08.1

Ordering Code

Direct Operated Proportional DC Valve
Series D1FP*S

D	1	F	P			9				S	
Directional control valve	ISO 10372 size 04	Proportional control	VCD	Spool type	Spool position on power down ¹⁾	Y-port (plugged) ⁴⁾	Seals	Command-signal	Accessories	Mounting interface ISO 10372	Design series

3

Code	Spool type	Flow [l/min] at Δp 35bar per metering edge
Zerolap		
E50M		40
E50H		25
E50F		12
E50C		6
E50B		3
B60M	$Q_B = Q_A/2$ 	40 / 20
Underlap approx. -0.5%		
E55M		40
E55H		25
Overlap 25%		
E01M		40
E01H		25
E01F		12
E01C		6
E01B		3
B31M	$Q_B = Q_A/2$ 	40 / 20
E02M		40
E02H		25
E02F		12
E02C		6
E02B		3
B32M	$Q_B = Q_A/2$ 	40 / 20

Bold letters =
Short-term availability

Code	Connection type
0	6 + PE acc. EN175201-804
5	11 + PE acc. EN175201-804

Code	Signal	Flow direction
B	+/- 10V	0...+10V -> P-A
E	+/- 20mA	0...+20mA -> P-A
S	4...20mA	12...20mA -> P-A

Code	Seals
N	NBR
V	FPM
H	for HFC fluid

Code	Spool pos. on power down
A ²⁾	
B ²⁾	
C ³⁾	

¹⁾ On power down the spool moves in a defined position. This cannot be guaranteed in case of single flow path on the control edge A – T resp. B – T with pressure drops above 120 bar or contamination in the hydraulic fluid.

²⁾ approx. 10% opening, only zero lapped spools and underlap spools

³⁾ only for overlapped spools

⁴⁾ needs to be removed at tank pressure >35 bar

Please order plugs separately.
See chapter 3 accessories.

General		
Design		Direct operated proportional DC valve
Actuation		VCD® actuator
Size		ISO 10372 size 04
Mounting interface ¹⁾		Acc. ISO 10372-04-04-0-92 (x port used as y unpressurized tank)
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+50
Weight	[kg]	4.5
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350 Port T 35, port Y max. 35 ¹⁾
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=35bar per control edge ²⁾	[l/min]	3 / 6 / 12 / 25 / 40
Flow maximum	[l/min]	90 (at Δp=350bar over two control edges)
Leakage at 100 bar	[ml/min]	<400 (zero lapped spool); <50 (over lapped spool)
Static / Dynamic		
Step response at 100% step ³⁾	[ms]	<3.5
Frequency response (±5% signal) ³⁾	[Hz]	350 (amplitude ratio -3dB), 350 (phase lag -90°)
Hysteresis	[%]	<0.05
Sensitivity	[%]	<0.03
Temperature drift	[%/°K]	<0.025
Electrical characteristics		
Duty ratio	[%]	100
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Supply voltage/ripple	[V]	22 ... 30, ripple <5% eff.
Current consumption max.	[A]	3.5
Switch-on current typical	[A]	22 for 0.2 ms
Input signal	[V]	10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A
Voltage	[kOhm]	100
Impedance	[mA]	20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P->A
Current	[Ohm]	250
Impedance	[mA]	4...12...20, ripple <0.01% eff., surge free, 12...20mA P->A
Current		<3.6 mA = disable, <3.8 mA = according to NAMUR NE43
Impedance	[Ohm]	250
Differential input max.		
Code 0	[V]	30 for terminal D and E against PE (terminal G)
Code 5	[V]	30 for terminal 4 and 5 against PE (terminal ⊥)
Enable signal (only code 5)	[V]	5...30, Ri = 9 kOhm
Diagnostic signal	[V]	+10...0...-10 / +Ub, rated max. 5mA
Pre-fusing	[A]	4.0 medium lag
EMC		EN 50081-2 / EN50082-2
Electrical connection	Code 0	6 + PE acc. EN 175201-804
	Code 5	11 + PE acc. EN 175201-804
Wiring min.		
Code 0	[mm²]	7x1.0 (AWG 18) overall braid shield
Code 5	[mm²]	12x1.0 (AWG 18) overall braid shield
Wiring length max.	[m]	50

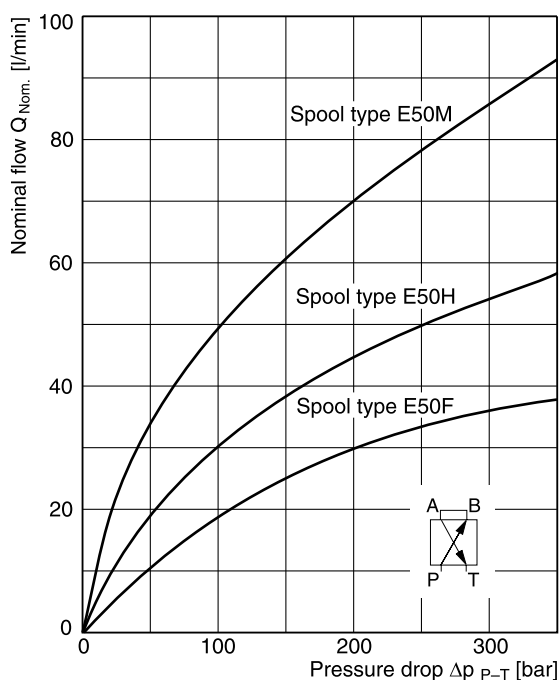
¹⁾ For applications with p_r>35 bar the Y-port has to be connected and the plug in the Y-port has to be removed.

²⁾ Flow rate for different Δp per control edge:

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

³⁾ Measured with load (100 bar pressure drop/two control edges)

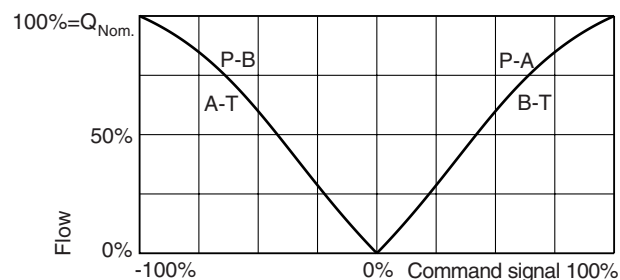
Functional limit (at 100% command signal)



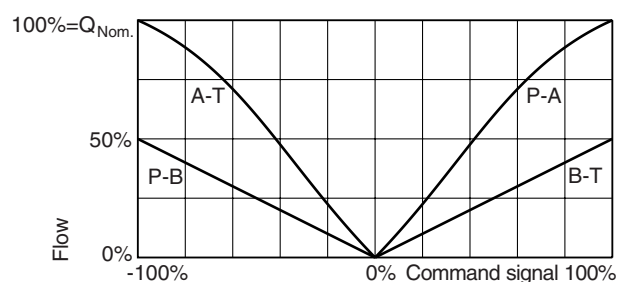
Flow curves

at $\Delta p = 35$ bar per metering edge

Spool type E50



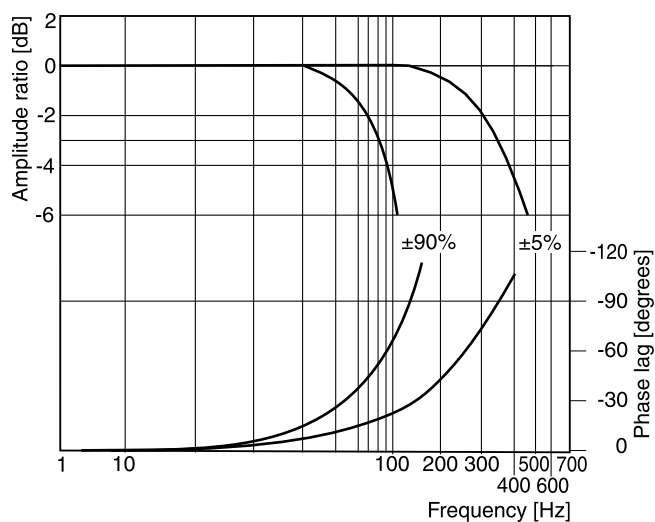
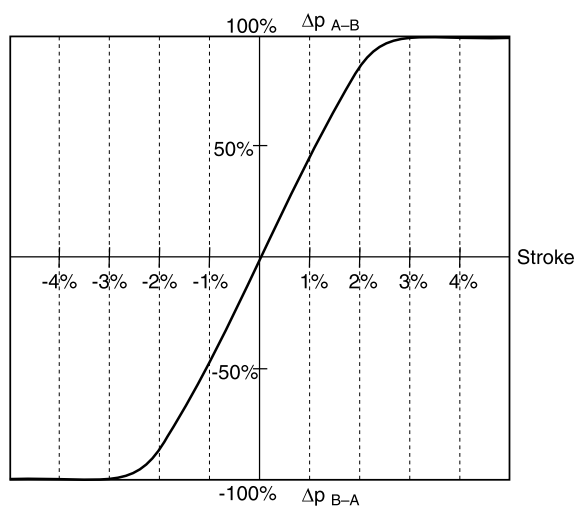
Spool type B60



Frequency response

$\pm 5\%$ command signal

$\pm 90\%$ command signal

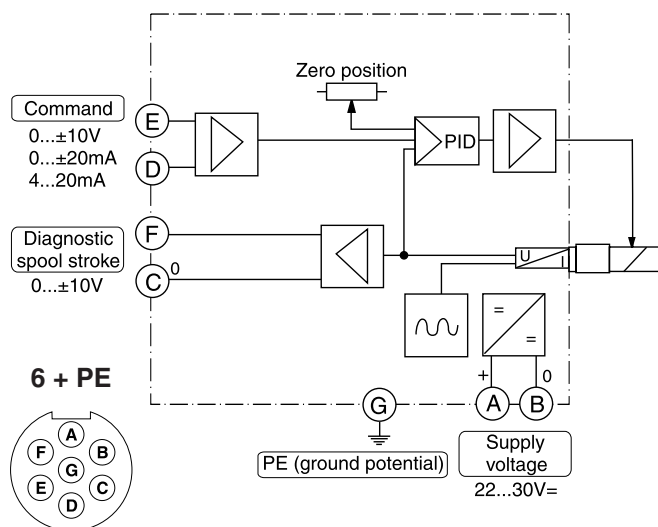


Dimensions

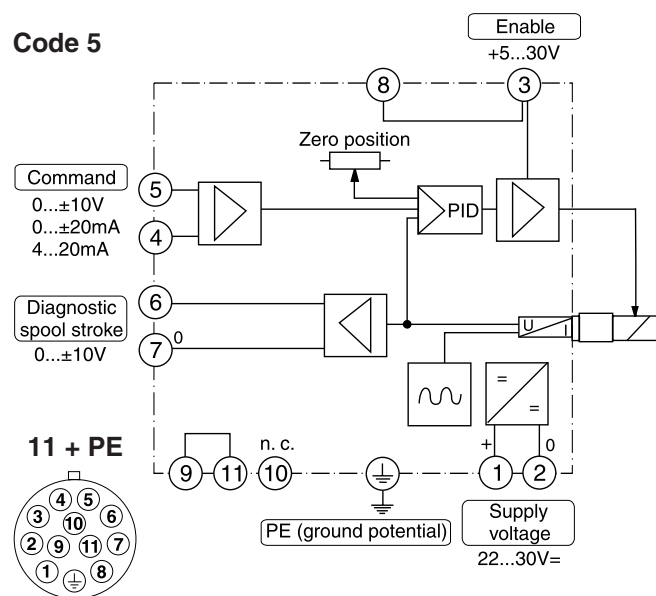
Direct Operated Proportional DC Valve Series D1FP*S

Block diagrams

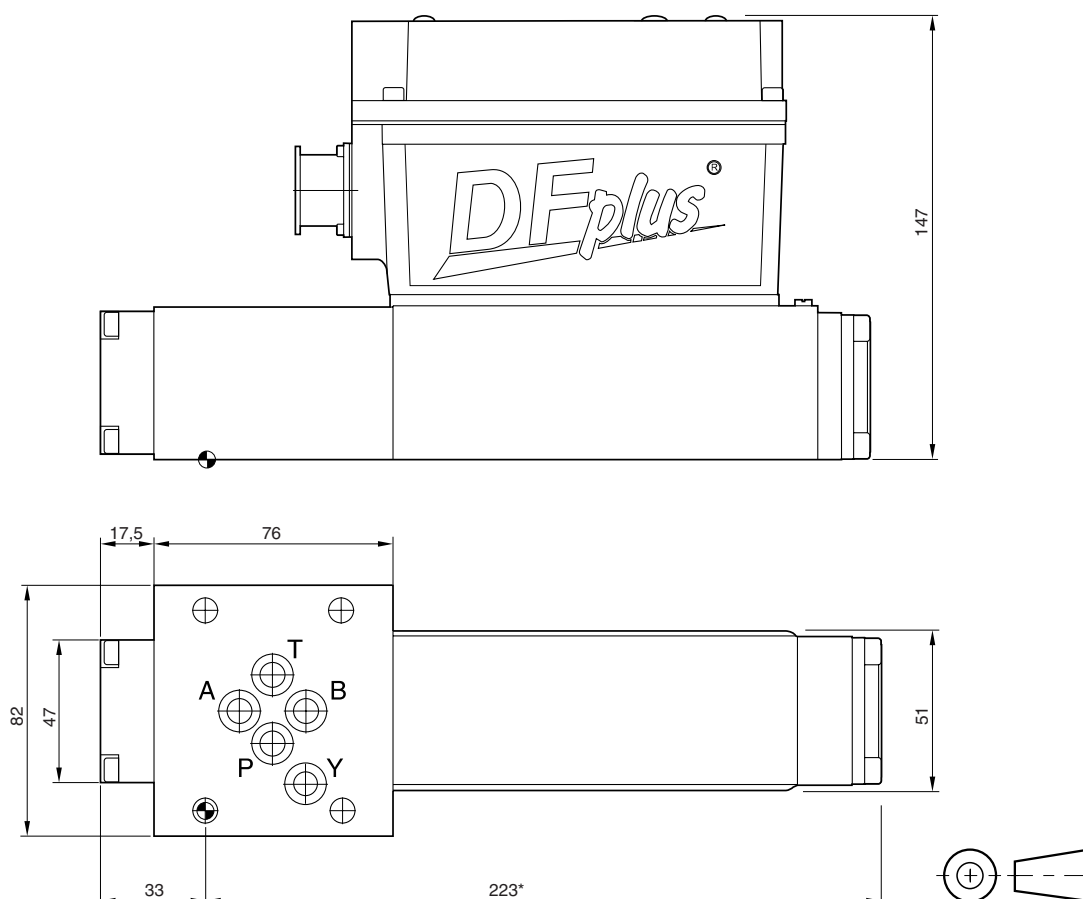
Code 0



Code 5



Dimensions



* valve drive on opposite side on request

Surface finish	Kit		
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK414	4x M8x40 DIN 912 12.9	31.8 Nm ±15%

D1FPS_UK.INDD CM_28.01.08.1

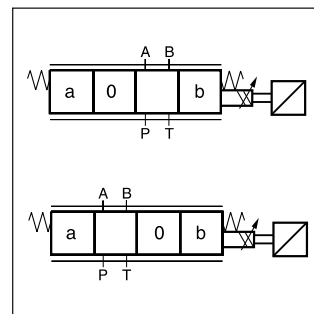
3

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.

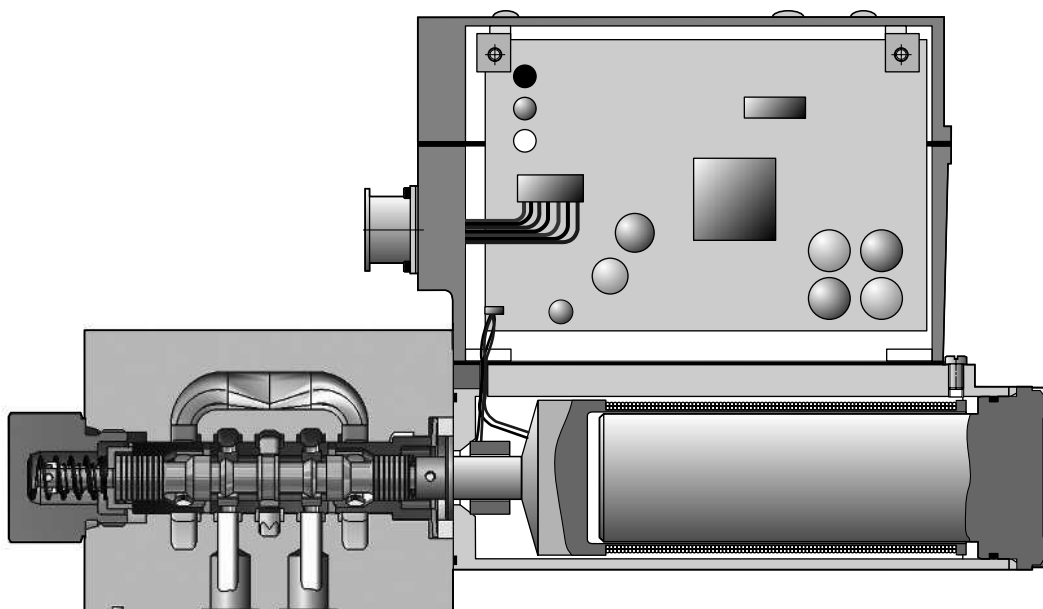
The direct operated control valve D3FP of the nominal size NG10 (CETOP05) shows extremely high dynamics combined with high flow. First of all it is used for highest accuracy in positioning of hydraulic axis and controlling of pressure and velocity.

Driven by the new patented VCD® actuator the D3FP reaches the frequency response of real servovalves.

A loss of power supply lets the spool move in a defined position. All common input signals are available.

**Technical features**

- Extremely high dynamics
- Max. tank pressure 350 bar (with external drain port Y)
- Defined spool positioning in case of power supply breakdown
- Onboard electronics
- Spool / sleeve design

**D3FP**

D3FP0_UK.INDD CM_28.01.08.1

Ordering Code

Direct Operated Proportional DC Valve
Series D3FP*0

D	3	F	P			9				0	
Direct control valve	Size DIN NG10 CETOP05 NFA D05	Proportional control	VCD	Spool type	Spool position on power down ¹⁾	Y-port (plugged) ⁴⁾	Seals	Command-signal	Accessories	Spool/sleeve design	Design series

3

Code	Spool type	Flow [l/min] at Δp 35bar per metering edge
Zerolap		
E50Y		100
E50P		50
B60Y	$Q_B = Q_A / 2$ 	100
B60P	$Q_B = Q_A / 2$ 	50
Underlap approx. -0.5%		
E55Y		100
E55P		50
Overlap 18%		
E01Y		100
E02Y		100

Code	Spool pos. on power down
A ²⁾	
B ²⁾	
C ³⁾	

Bold letters =
Short-term availability

Code	Connection type
0	6 + PE acc. EN175201-804
5	11 + PE acc. EN175201-804

Code	Signal	Flow direction
B	+/- 10V	0...+10V -> P-A
E	+/- 20mA	0...+20mA -> P-A
S	4...20mA	12...20mA -> P-A

Code	Seals
N	NBR
V	FPM
H	for HFC fluid

¹⁾ On power down the spool moves in the middle position. This cannot be guaranteed in case of contamination in the hydraulic fluid.

²⁾ approx. 10% opening

³⁾ only for overlapped spools

⁴⁾ needs to be removed at tank pressure >35 bar

Please order plugs separately.
See chapter 3 accessories.

General		
Design		Direct operated proportional DC valve
Actuation		VCD® actuator
Size		NG10/CETOP05/NFPA D05
Mounting interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position		unrestricted
Ambient temperature	[°C]	-20...+50
Weight	[kg]	6.5
Vibration resistance	[g]	25 acc. DIN IEC68, part 2-6
Hydraulic		
Max. operating pressure	[bar]	Ports P, A, B 350
	[bar]	Port T max. 35, port Y max. 35 ¹⁾
Fluid		Hydraulic oil as per DIN 51524...535, other on request
Fluid temperature	[°C]	-20...+60
Viscosity permitted	[cSt] / [mm²/s]	20...380
Viscosity recommended	[cSt] / [mm²/s]	30...80
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)
Flow nominal at Δp=35bar per control edge ²⁾	[l/min]	50 / 100
Flow maximum	[l/min]	150
Leakage at 100 bar	[ml/min]	<400
Static / Dynamic		
Step response at 100% step ³⁾	[ms]	<6
Frequency response (±5% signal) ³⁾	[Hz]	200 (amplitude ratio -3dB), 200 (phase lag -90°)
Hysteresis	[%]	<0.05
Sensitivity	[%]	<0.03
Temperature drift	[%/°K]	<0.025
Electrical characteristics		
Duty ratio	[%]	100
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)
Supply voltage/ripple	[V]	22 ... 30, ripple <5% eff.
Current consumption max.	[A]	3.5
Switch-on current typical	[A]	22 for 0.2 ms
Input signal		
Voltage	[V]	10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A
Impedance	[kOhm]	100
Current	[mA]	20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P->A
Impedance	[Ohm]	250
Current	[mA]	4...12...20, ripple <0.01% eff., surge free, 12...20mA P->A
Impedance	[Ohm]	<3.6 mA = disable, <3.8 mA = according to NAMUR NE43
Differential input max.	[V]	30 for terminal D and E against PE (terminal G)
		30 for terminal 4 and 5 against PE (terminal 1)
Enable signal (only code 5)	[V]	5...30, Ri = 9 kOhm
Diagnostic signal	[V]	+10...0...-10 / +Ub, rated max. 5mA
Pre-fusing	[A]	4.0 medium lag
EMC		EN 50081-2 / EN50082-2
Electrical connection	Code 0	6 + PE acc. EN 175201-804
	Code 5	11 + PE acc. EN 175201-804
Wiring min.		
Code 0	[mm²]	7 x 1.0 (AWG 18) overall braid shield
Code 5	[mm²]	12 x 1.0 (AWG 18) overall braid shield
Wiring length max.	[m]	50

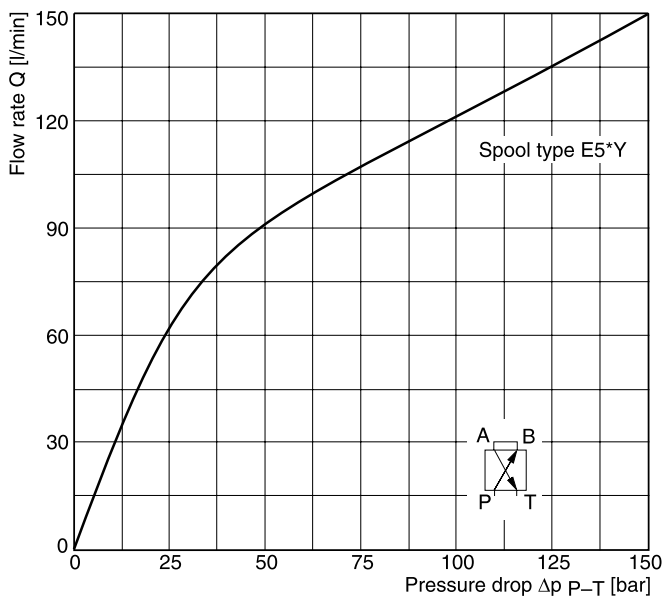
¹⁾ For applications with p_T>35 bar the Y-port has to be connected and the plug in the Y-port has to be removed.

²⁾ Flow rate for different Δp per control edge:

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

³⁾ Measured with load (100 bar pressure drop/two control edges)

Functional limit* (at 100% command signal)

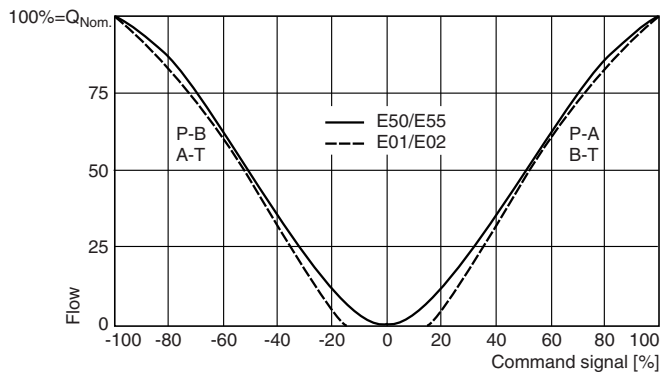


* When exceeding the functional limits, for a period of time the valve will go into fail safe and power supply needs to be switched off/on to re-enable the valve.

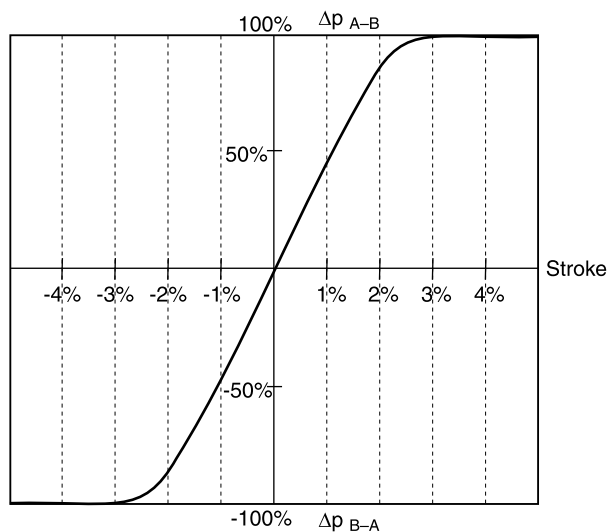
Flow curves

at $\Delta p = 35$ bar per metering edge

Spool type **E50/E55, E01/E02**



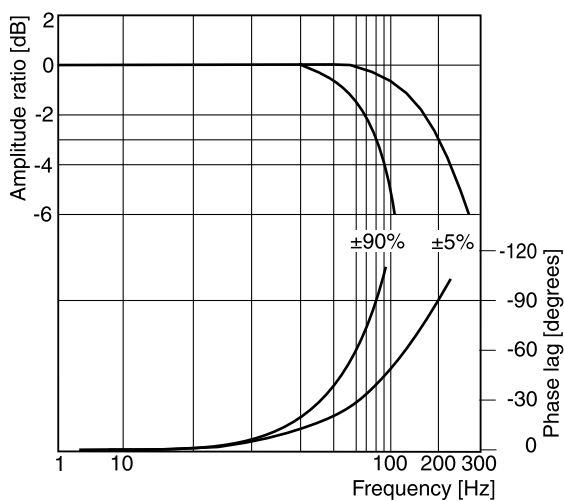
Pressure gain



Frequency response

$\pm 5\%$ command signal

$\pm 90\%$ command signal

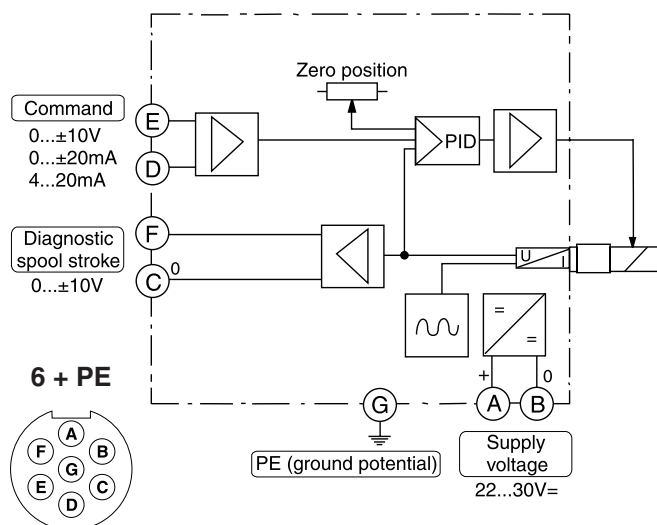


Dimensions

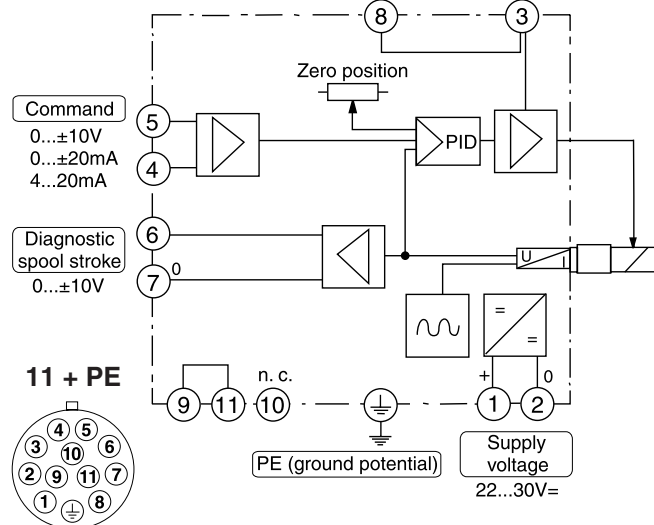
Direct Operated Proportional DC Valve Series D3FP*0

Block diagrams

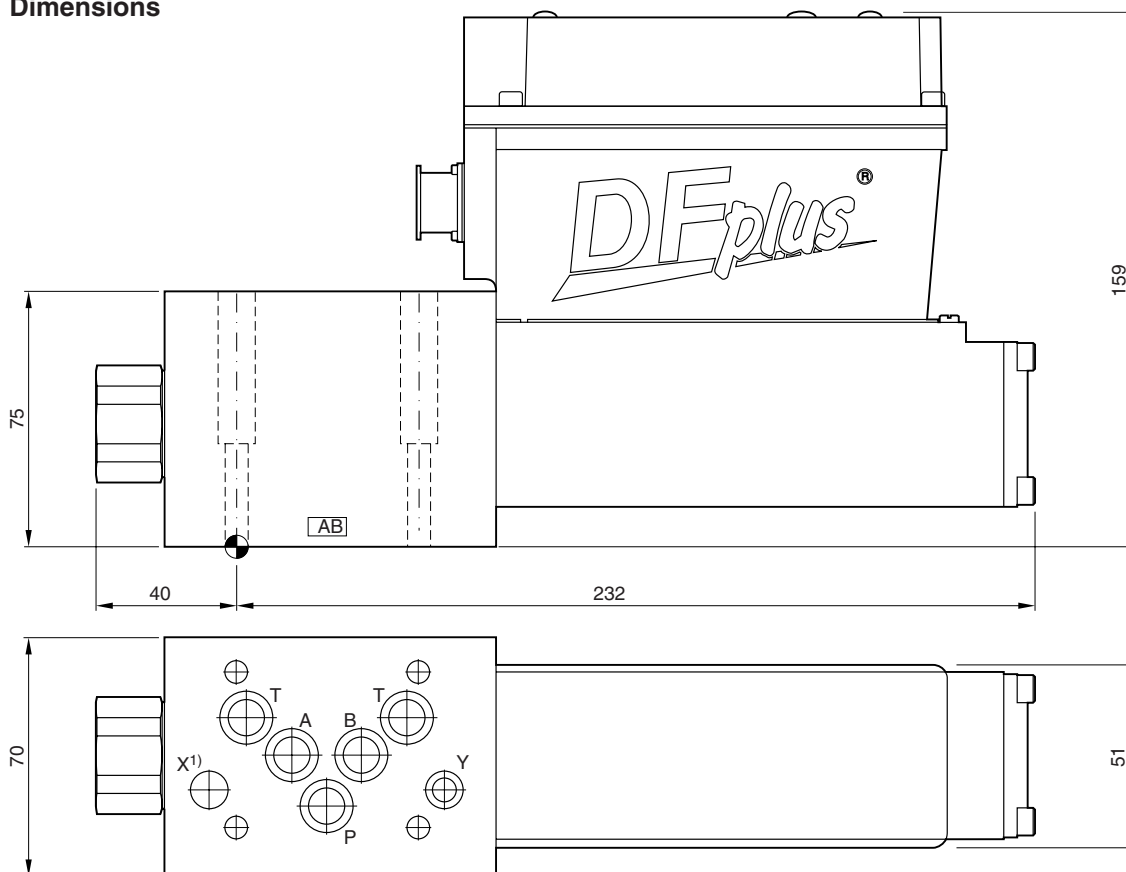
Code 0



Code 5



Dimensions



¹⁾ O-ring recess diameter on valve body.

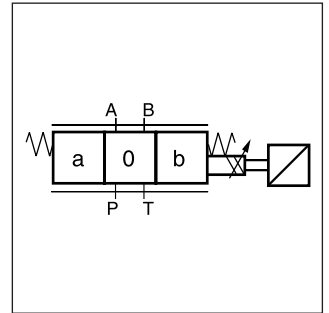
Surface finish	Kit		
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK385	4xM6x40 DIN 912 12.9	13.2 Nm ±15%

D3FP0_UK.INDD CM_28.01.08.1

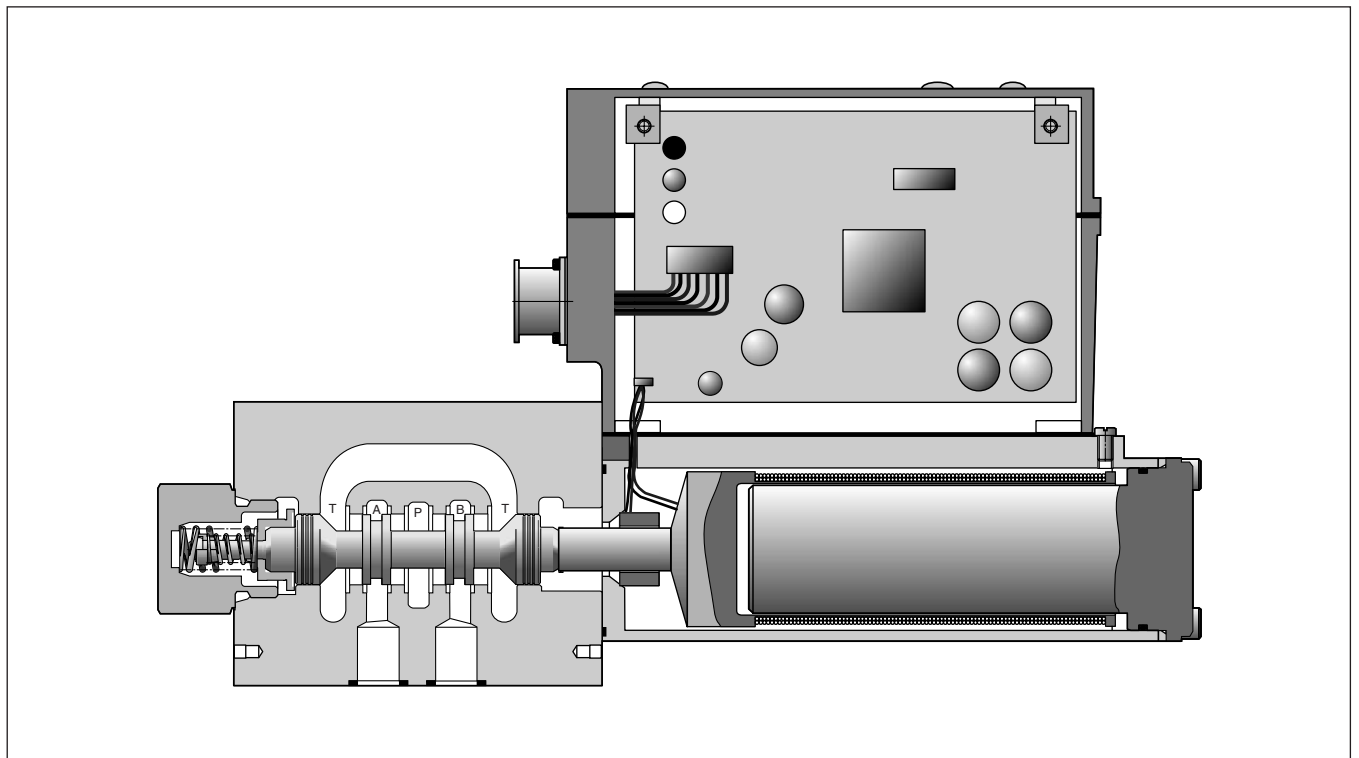
A full-page sheet of white graph paper featuring a light gray grid. The grid consists of small, equal-sized squares covering the entire area. There are no margins, text, or other markings on the page.

The direct operated control valve D3FP of the nominal size NG10 (CETOP05) shows extremely high dynamics combined with high flow. First of all it is used for highest accuracy in positioning of hydraulic axis and controlling of pressure and velocity. Driven by the new patented VCD® actuator the D3FP reaches the frequency response of real servovalves.

A loss of power supply lets the spool move in a defined position. All common input signals are available.

**Technical features**

- Extremely high dynamics
- Max. tank pressure 350 bar (with external drain port Y)
- Defined spool positioning
- Onboard electronics
- Spool / body design

**D3FP**

D

3

F

P

C

9

3

Directional control valve

Size
DIN NG06
CETOP03
NFA D03

Proportional control

VCD

Spool type

Spool position on power down ¹⁾

Y-port (plugged) ²⁾

Seals

Command signal

Accessories

Spool in body design

Design series

Code

Spool type

Flow [l/min]
at Δp 35bar
per metering edge

Overlap 20%

E01Y
E01P

100
50

E02Y
E02P

100
50

B31Y
B31P

100 / 50
50 / 25

B32Y
B32P

100 / 50
50 / 25

Code

Connection type

0

6 + PE acc. EN175201-804

5

11 + PE acc. EN175201-804

Code

Signal

Flow direction

B

+/- 10V

0...+10V -> P-A

E

+/- 20mA

0...+20mA -> P-A

S

4...20mA

12...+20mA -> P-A

Code

Seals

N

NBR

V

FPM

H

for HFC fluid

Bold letters =
Short-term availability

¹⁾ On power down the spool moves in the middle position. This cannot be guaranteed in case of contamination in the hydraulic fluid.
²⁾ needs to be removed at tank pressure >35 bar

Please order plugs separately.
See chapter 3 accessories.

General			
Design			Direct operated proportional DC valve
Actuation			VCD® actuator
Size			NG10/CETOP05/NFPA D05
Mounting interface			DIN 24340 / ISO 4401 / CETOP RP121 / NFPA
Mounting position			unrestricted
Ambient temperature	[°C]		-20...+50
Weight	[kg]		6.5
Vibration resistance	[g]		25 acc. DIN IEC68, part 2-6
Hydraulic			
Max. operating pressure	[bar]		Ports P, A, B 350
	[bar]		Port T max. 35, port Y max. 35 ¹⁾
Fluid			Hydraulic oil as per DIN 51524...535, other on request
Fluid temperature	[°C]		-20...+60
Viscosity permitted	[cSt] / [mm²/s]		20...380
Viscosity recommended	[cSt] / [mm²/s]		30...80
Filtration			ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)
Flow nominal at Δp=35bar per control edge ²⁾	[l/min]		50 / 100
Flow maximum	[l/min]		150
Leakage at 100 bar	[ml/min]		<150
Static / Dynamic			
Step response at 100% step ³⁾	[ms]		<6
Frequency response (±5% signal) ³⁾	[Hz]		200 at -3dB, 200 at -90°
Hysteresis	[%]		<0.05
Sensitivity	[%]		<0.03
Temperature drift	[%/°K]		<0.025
Electrical characteristics			
Duty ratio	[%]		100
Protection class			IP65 in accordance with EN 60529 (plugged and mounted)
Supply voltage/ripple	[V]		22 ... 30, ripple <5% eff.
Current consumption max.	[A]		3.5
Switch-on current typical	[A]		22 for 0.2 ms
Input signal			
Voltage	[V]		10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A
Impedance	[kOhm]		100
Current	[mA]		20...0...-20, ripple <0.01% eff., surge free, 0...+20mA P->A
Impedance	[Ohm]		250
Current	[mA]		4...12...20, ripple <0.01% eff., surge free, 12...20mA P->A
Impedance	[Ohm]		<3.6 mA = disable, <3.8 mA = according to NAMUR NE43
Differential input max.	[V]		30 for terminal D and E against PE (terminal G)
Enable signal (only code 5)	[V]		5...30, Ri = 9 kOhm
Diagnostic signal	[V]		+10...0...-10 / +Ub, rated max. 5mA
Pre-fusing	[A]		4.0 medium lag
EMC			EN 50081-2 / EN50082-2
Electrical connection	Code 0		6 + PE acc. EN 175201-804
	Code 5		11 + PE acc. EN 175201-804
Wiring min.			
Code 0	[mm²]		7 x 1.0 (AWG 18) overall braid shield
Code 5	[mm²]		12 x 1.0 (AWG 18) overall braid shield
Wiring length max.	[m]		50

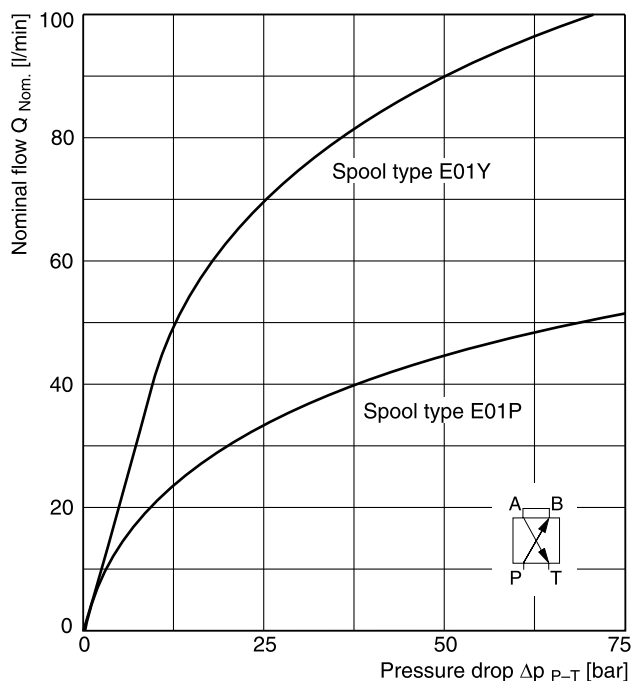
¹⁾ For applications with p_T>35 bar the Y-port has to be connected and the plug in the Y-port has to be removed.

²⁾ Flow rate for different Δp per control edge:

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

³⁾ Measured with load (100 bar pressure drop/two control edges)

Functional limit* (at 100% command signal)

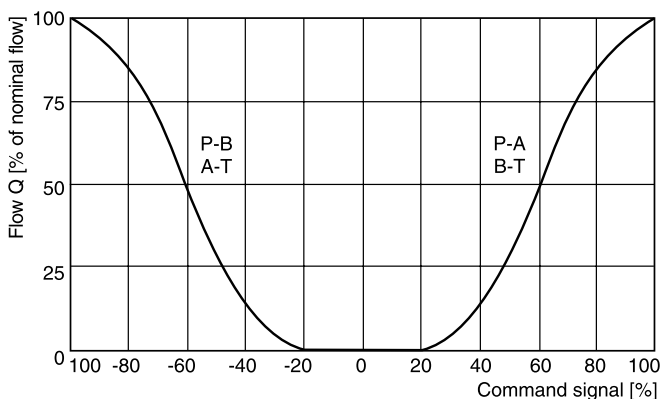


* When exceeding the functional limits, for a period of time the valve will go into fail safe and power supply needs to be switched off/on to re-enable the valve.

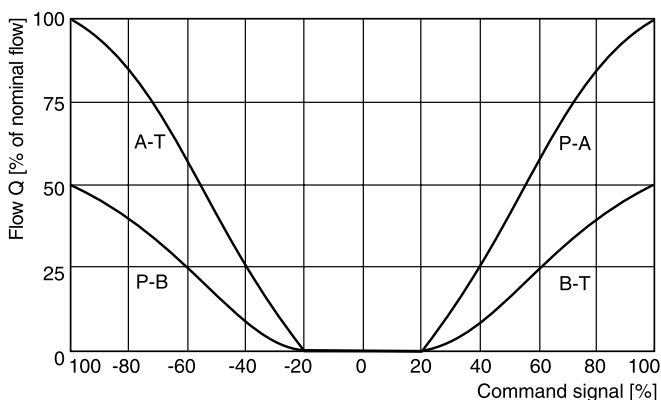
Flow curves

at $\Delta p = 35$ bar per metering edge

Spool type E01



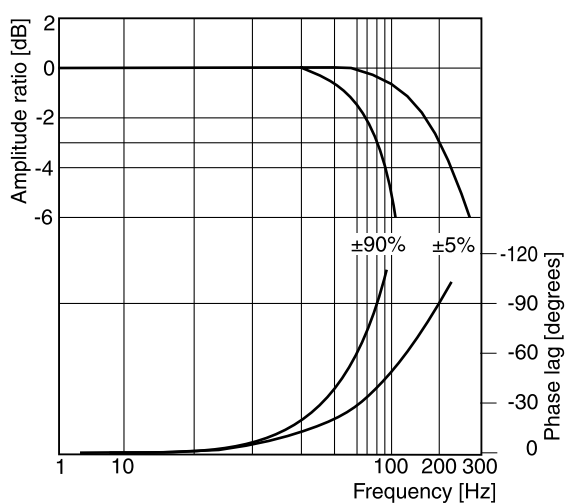
Spool type B31



Frequency response

$\pm 5\%$ command signal

$\pm 90\%$ command signal

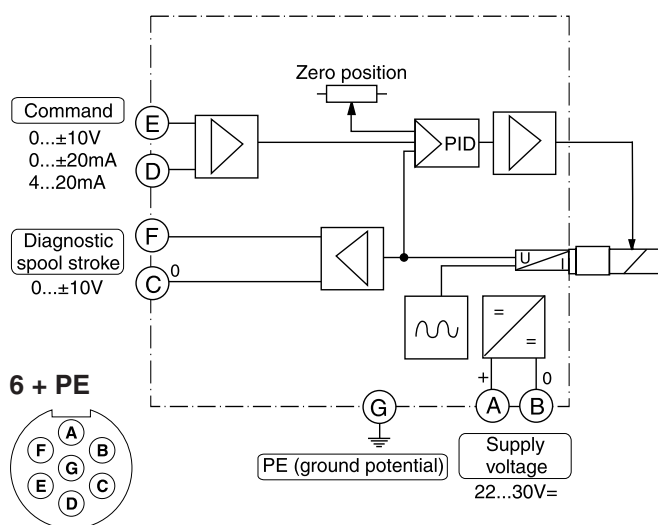


Dimensions

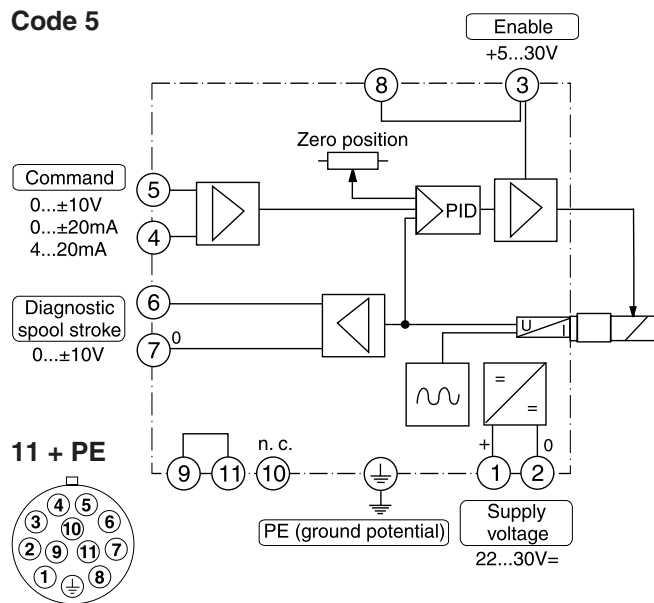
Direct Operated Proportional DC Valve Series D3FP*3

Block diagrams

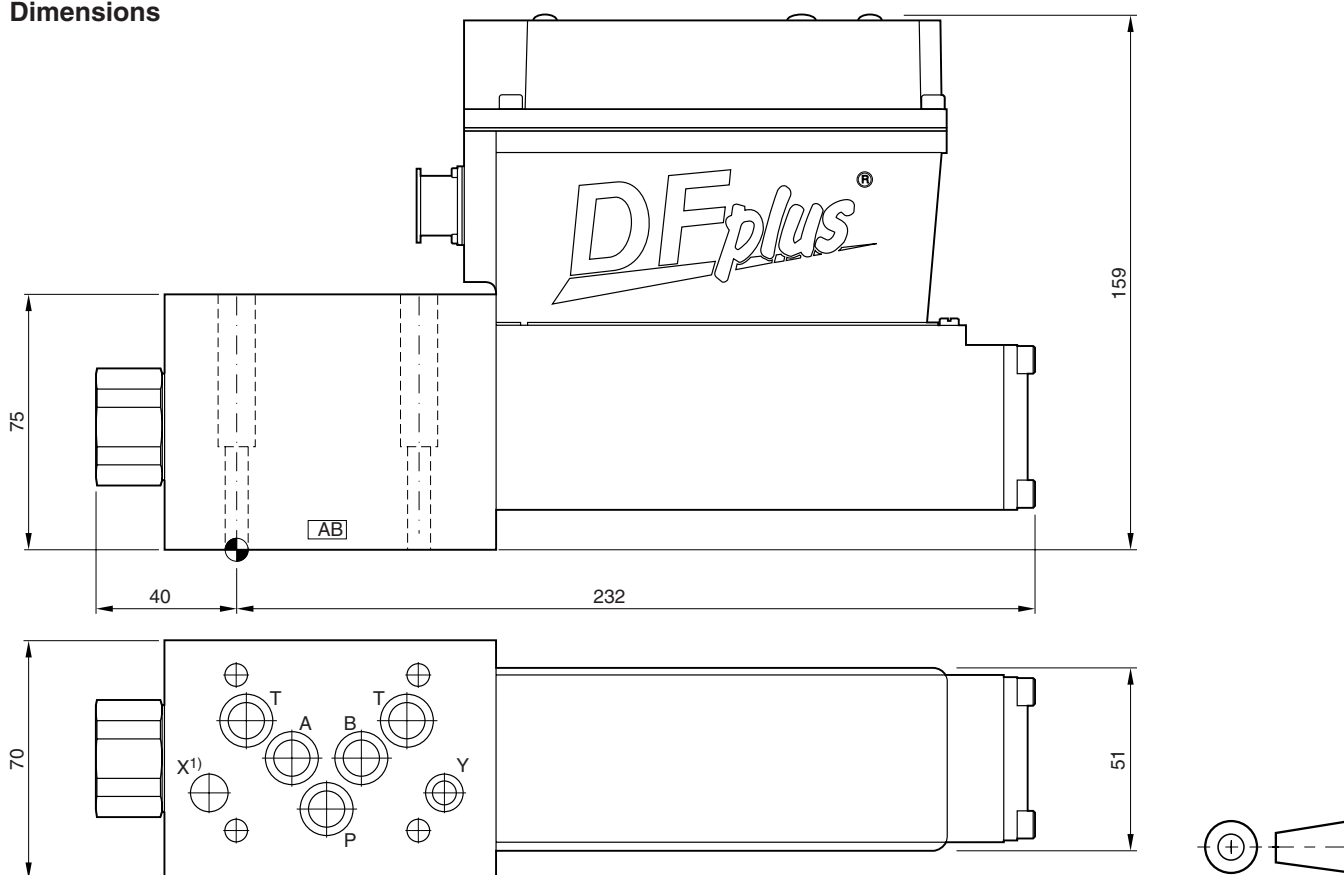
Code 0



Code 5



Dimensions



¹⁾ O-ring recess diameter on valve body.

Surface finish	Kit		
$\sqrt{R_{max} 6.3}$ $\square 0.01/100$	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%

D3FP3_UK.INDD CM_28.01.08.1

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.

The new series of pilot operated servo proportional valves D*1FP transfers the advantages of the Parker patented Voice Coil Drive (VCD®) to larger frame sizes and thus high flow rates. The high dynamic / high precision drive of the pilot valve allows the optimum control of the main spool and results in servo class performance of the complete valves.

The D*1FP series is available in 5 sizes:

D31FP NG10 (CETOP05)

D41FP NG16 (CETOP07)

D81FP NG25 (CETOP08) for port diam. up to 26 mm

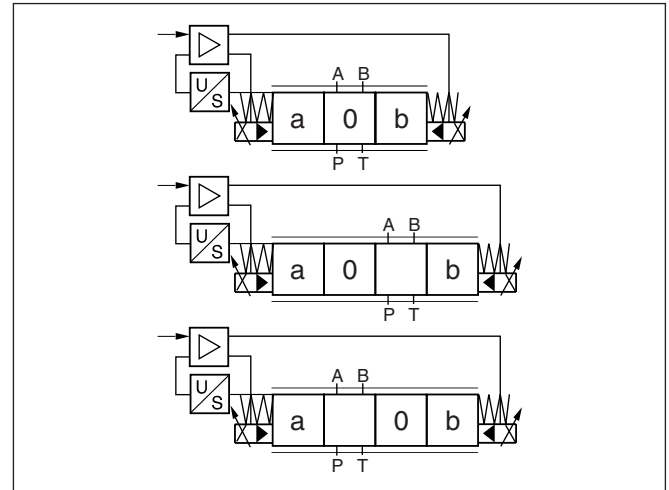
D91FP NG25 (CETOP08) for port diam. up to 32 mm

D111FP NG32 (CETOP10)

The new safety concept works with a safe 4th position of the D1FP pilot valve. This ensures that the main stage is hydraulically balanced at power down and allows to have the main spool spring centred (for overlapped spools) or approximately 10% spring offset to spool position A or B (for zerolap spools).

Technical features

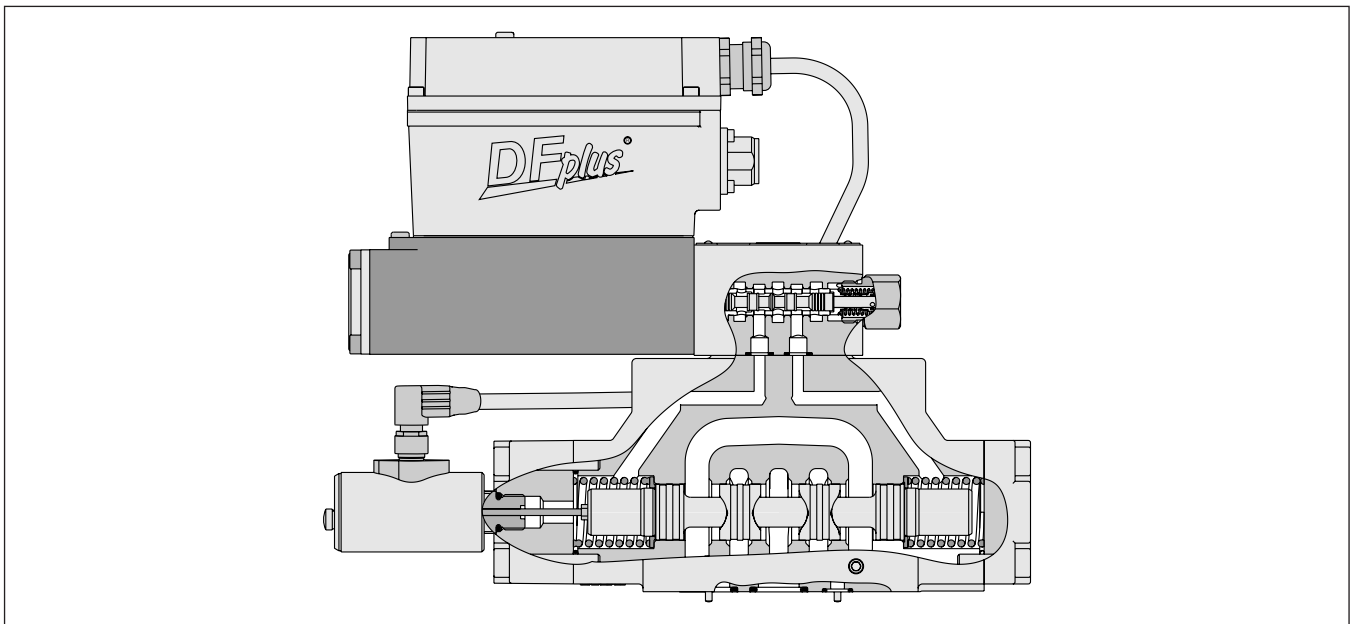
- High dynamics
- High flow
- Defined spool positioning in case of power supply breakdown
- Onboard electronics
- Closed loop position – controlled pilot valve and main stage



D41FP



D41FP



Ordering Code

Pilot Operated Servo Proportional DC Valve
Series D*1FP

D

Directional control valve

Size

1

NG06 pilot

F

Proportional control

P

High response

Spool type

Flow

Spool position on power down ¹⁾

Pilot connections

Seals

Electronic options

Valve options

0

Design series

Code	Size
3	NG10 / CETOP05
4	NG16 / CETOP07
8	NG25 / CETOP08
9 ²⁾	NG25 / CETOP08
11	NG32 / CETOP10

²⁾ for enlarged connections
Ø 32 mm

Code	Valve options
0	6+PE acc. EN175201-804
5	11+PE acc. EN175201-804
7	6+PE + Enable

Code	Spool type
overlap	
E01	
E02	
B31	$Q_B = Q_A / 2$
B32	$Q_B = Q_A / 2$
zerolap	
E52 ³⁾	
B61 ³⁾	$Q_B = Q_A / 2$

Code	Flow [l/min] at $\Delta p = 5\text{bar}$ per metering edge			
	D31	D41	D81/91	D111
E	120	—	—	—
F	—	200	—	—
H	—	—	400	—
L	—	—	—	1000

Code	Spool pos. on power down
A ⁴⁾	
B ⁴⁾	
C ⁵⁾	

Code	Electronic options
K	Voltage input 0...±10V
S	Current input 4...20mA

Code	Seals
N	NBR
V	FPM
H	for HFC fluid

Code	Inlet	Drain
1	internal	external
2	external	external
4	internal	internal
5	external	internal

¹⁾ On power down the spool moves into a defined position.³⁾ not for D111FP⁴⁾ approx. 10% opening, only zero lapped spools⁵⁾ only for overlapped spoolsPlease order plugs separately.
See chapter 3 accessories.

General		Servo Proportional directional control valve, pilot operated			
Design		VCD®-actuator			
Actuation					
Size		NG10 (CETOP 05)	NG16 (CETOP 07)	NG25 (CETOP 08)	NG32 (CETOP 10)
Mounting Interface		DIN 24340 / ISO 4401 / CETOP RP121 / NFPA			
Mounting position		unrestricted			
Ambient temperature		[°C] -20...+50			
Weight		[kg] 11.3 14.2 23.5 64.5			
Hydraulic					
Max. operating pressure		[bar] Internal Pilot Drain P, A, B, X 350; T, Y 35 External Pilot Drain P, A, B, T, X 350; Y 35 Hydraulic oil acc. DIN 51524...535, other on request			
Fluid					
Fluid temperature		[°C] -20...+60			
Viscosity	permitted	[cSt] / [mm ² /s] 20...380			
	recommended	[cSt] / [mm ² /s] 30...80			
Filtration		ISO 4406 (1999) 18/16/13 (acc. NAS 1638: 7)			
Nominal flow at Δp = 5 bar per control edge ¹⁾		[l/min] 120	200	400	1000
Max. recommended Flow		[l/min] 250	600	1000	3000
Leakage at 100 bar					
Overlapped spool		[ml/min] 200	200	600	1000
Zero-lapped spool		[ml/min] 900	900	1000	-
Pilot		[ml/min] < 1000			
Pilot supply pressure		[bar] 20...350			
Pilot flow, step response at 210 bar		[l/min] 10	12	24	40
Static / Dynamic					
Step response at 100% stroke ²⁾		[ms] 10	13	19	45
Frequency response					
Amplitude ±5 % at 210 bar		[Hz] 128	95	95	40
Phase ±5 % at 210 bar		[Hz] 118	95	90	75
Hysteresis		[%] < 0.1			
Sensitivity		[%] < 0.05			
Temperature drift of Center Position		[%/°K] < 0.025			
Electrical					
Duty ratio		[%] 100			
Protection class		IP65 in accordance with EN 60529 (plugged and mounted)			
Supply voltage / ripple		[V] 22...30, ripple < 5% eff., surge free			
Current consumption max.		[A] 3.5			
Switch-on current typical		[A] 22 for 0.2 ms			
Input signal	voltage	[V] +10...0...-10, ripple < 0.01 % eff., surge free, 0...+10 V P→A			
	Impedance	[kOhm] 100			
	current	[mA] 4...12...20, ripple < 0.01 % eff., surge free, 12...20 mA P→A < 3.6 mA = enable off, > 3.8 mA = enable on acc. NAMUR NE43			
	Impedance	[Ohm] 250			
Input Capacitance typ.		[nF] 1			
Differential input max.	Code 0	[V] 30 for terminal D and E against PE (terminal G) 11 for terminal D and E against 0V (terminal B)			
	Code 5	[V] 30 for terminal 4 and 5 against PE (terminal ⊥) 11 for terminal 4 and 5 against 0V (terminal 2)			
	Code 7	[V] 30 for terminal D and E against PE (terminal G)			
	Code 5/7	[V] 5...30, Ri = 9 kOhm			
Diagnostic signal		[V] +10...0...-10 / +Ub, rated max. 5 mA			
Pre-fusing		[A] 4.0 A medium lag			
EMC		EN 61000-6-2, EN 61000-6-4			
Electrical connection	Code 0/7	6 + PE acc. EN 175201-804			
	Code 5	11 + PE acc. EN 175201-804			
Wiring min.	Code 0/7	7 x AWG16 overall braid shield			
	Code 5	8 x AWG16 overall braid shield			
Wiring length max.		[m] 50			

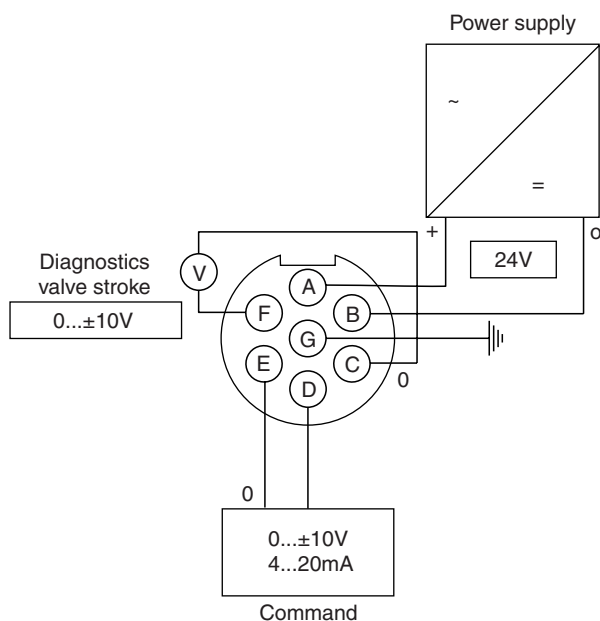
¹⁾ Flow rate for different Δp per control edge:²⁾ Measured with load (210 bar pressure drop/two control edges)

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

Wiring

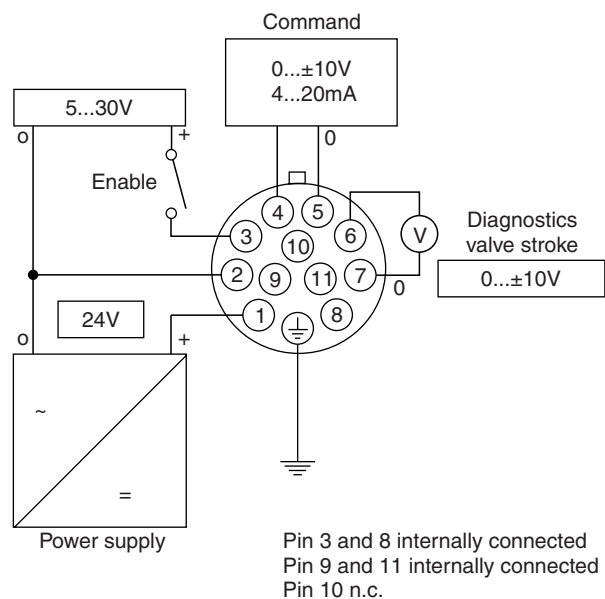
Code 0

6 + PE acc. EN 175201-804



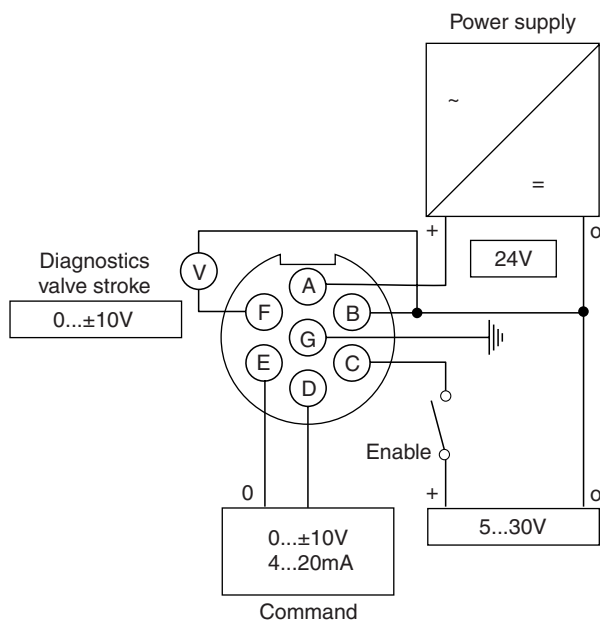
Code 5

11 + PE acc. EN 175201-804



Code 7

6 + PE acc. EN 175201-804 + enable

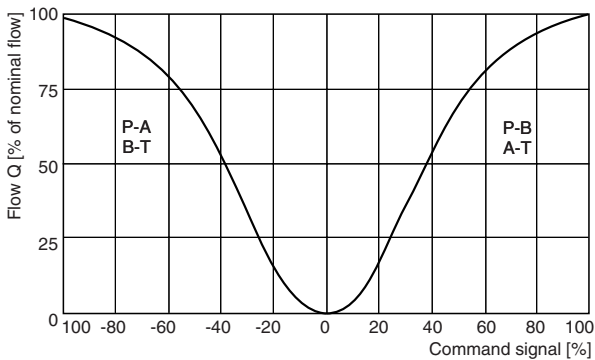


Flow curves

at $\Delta p = 5$ bar per metering edge

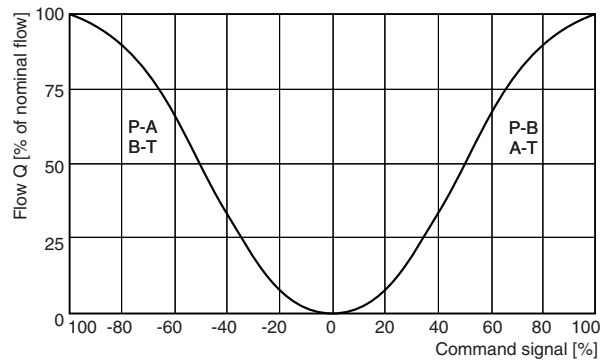
D31FP

Spool type E52



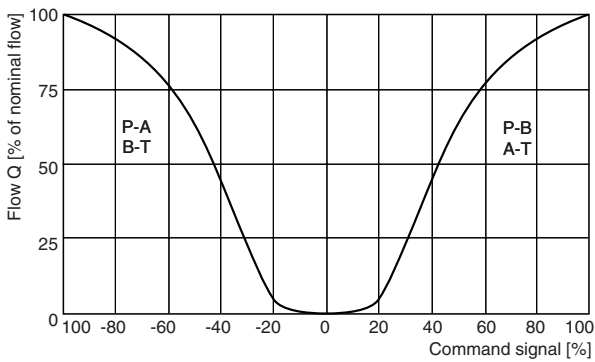
D41FP

Spool type E52



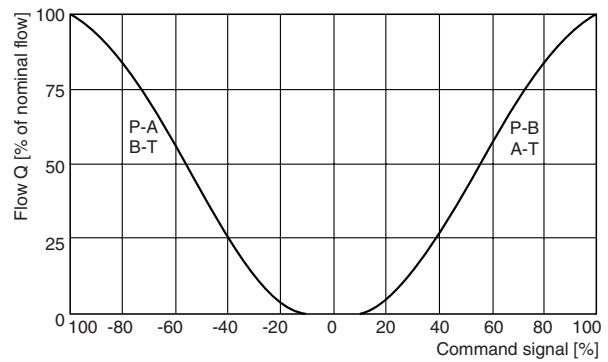
D81FP/D91FP

Spool type E52



D111FP

Spool type E01

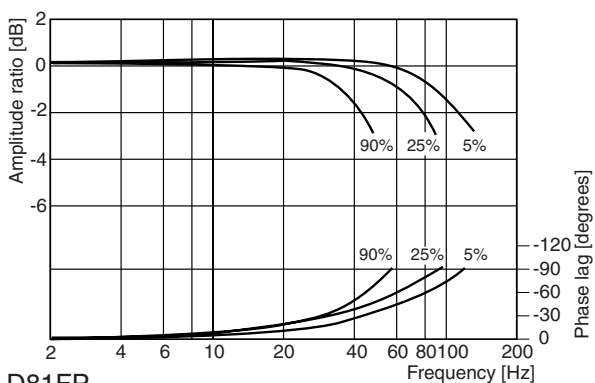


Frequency response

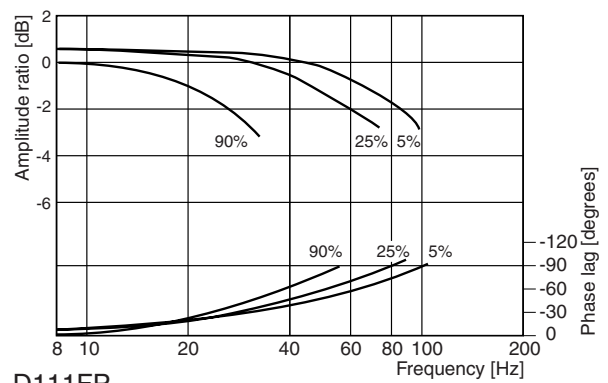
$\pm 5\%$ / $\pm 25\%$ / $\pm 90\%$ command signal

Dynamics at 210 bar pilot supply pressure

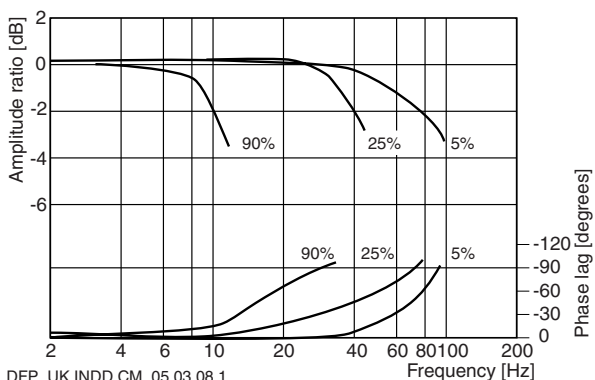
D31FP



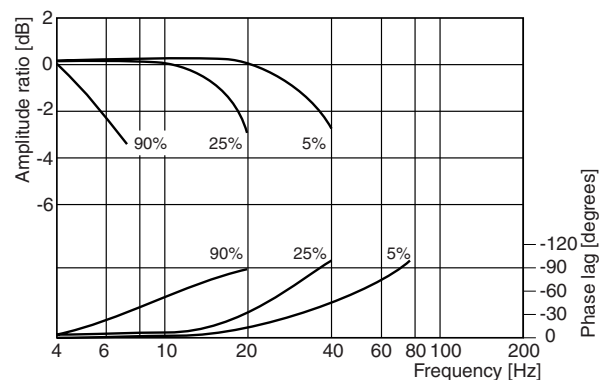
D41FP



D81FP



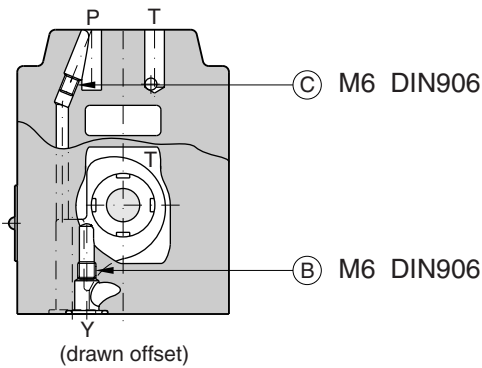
D111FP



D31FP, D41FP, D81FP, D91FP, D111FP

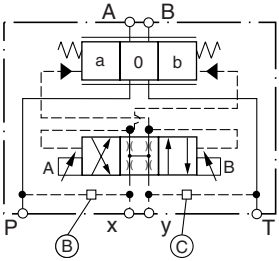
Pilot oil inlet (supply) and outlet (drain)

D31FP

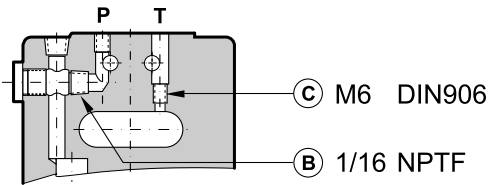


○ open, ● closed

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

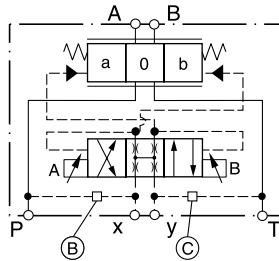


D41FP

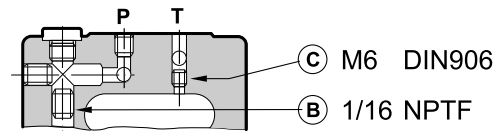


○ open, ● closed

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

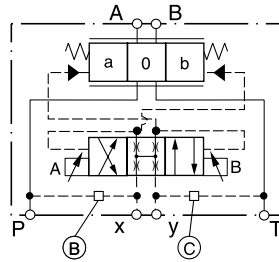


D81/91FP

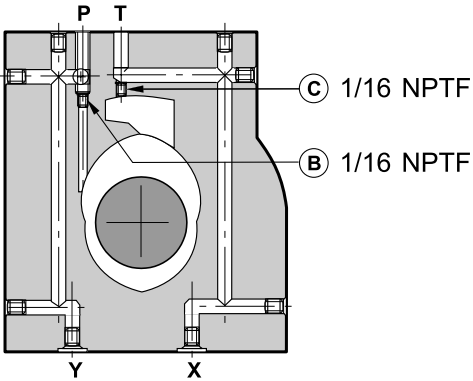


○ open, ● closed

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

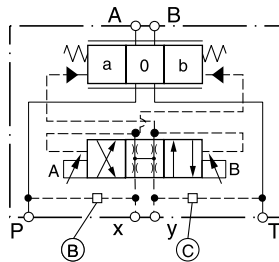


D111FP

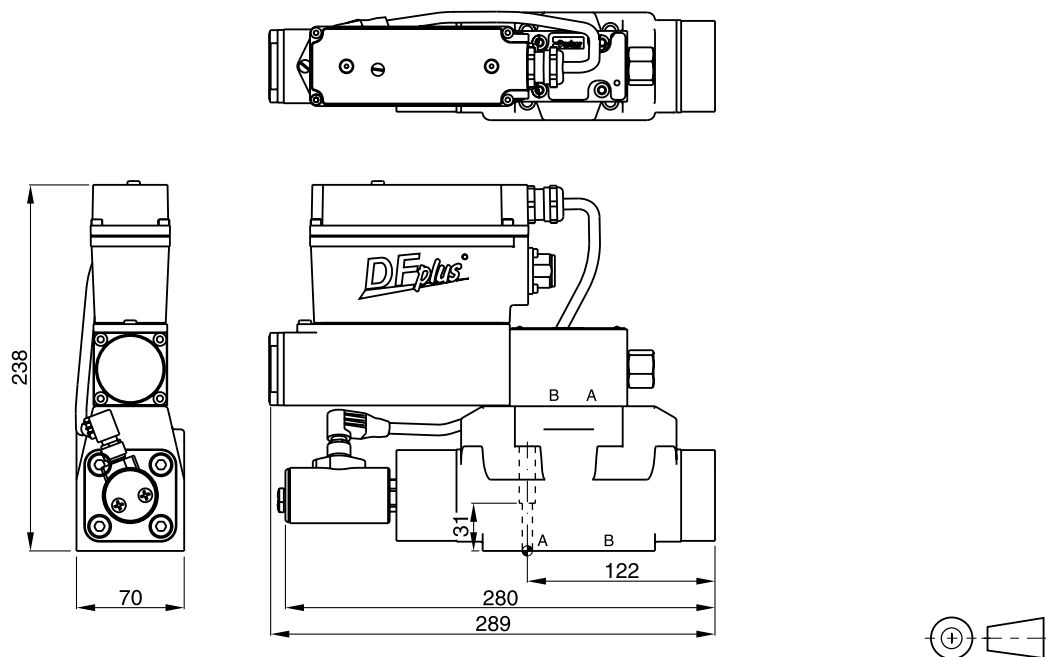


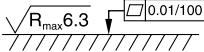
○ open, ● closed

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

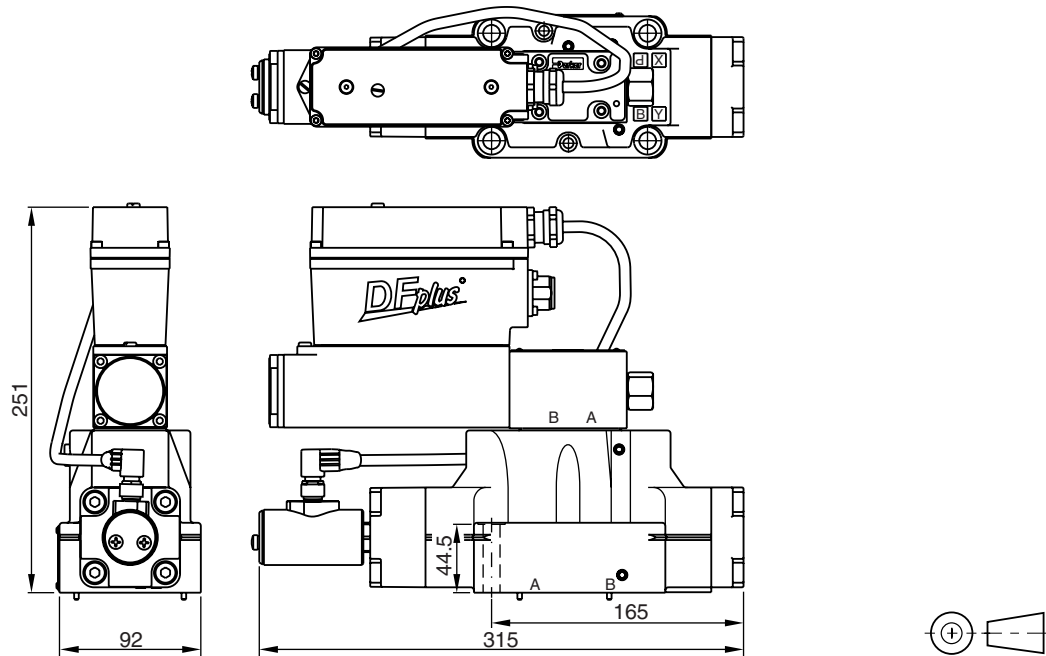


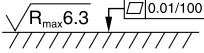
D31FP



Surface finish	 Kit			 Kit NBR
	BK385	4x M6x40 DIN 912 12.9	13.2 Nm ±15%	SK-D31FP

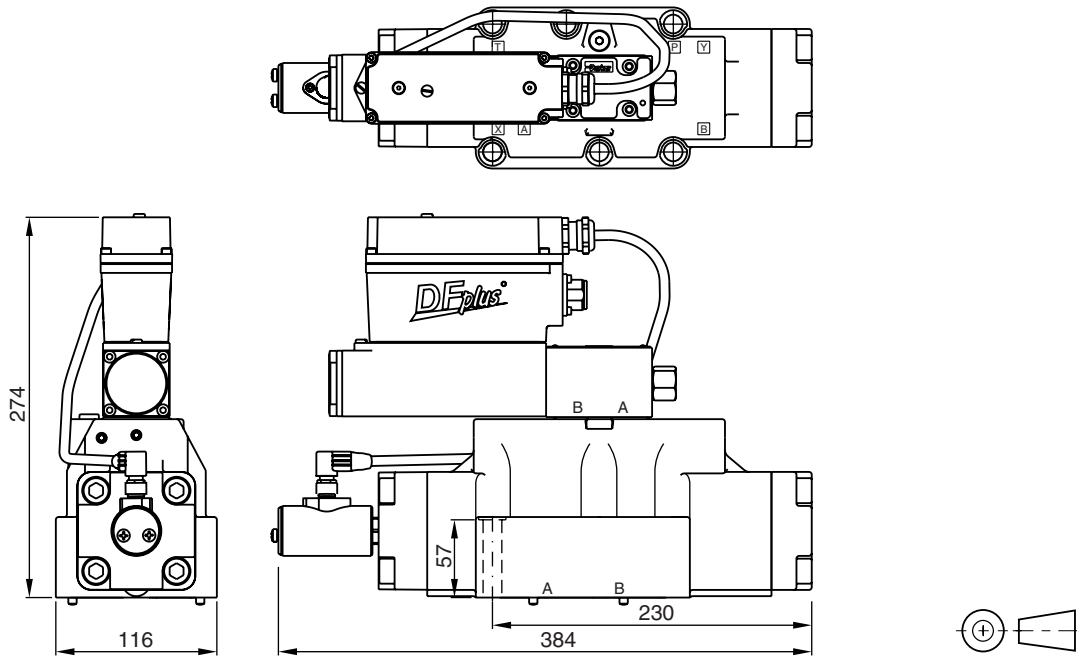
D41FP

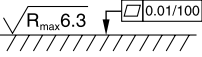


Surface finish	 Kit			 Kit NBR
	BK320	2x M6x55 4x M10x60 DIN 912 12.9	13.2 Nm ±15% 63 NM ±15%	SK-D41FP

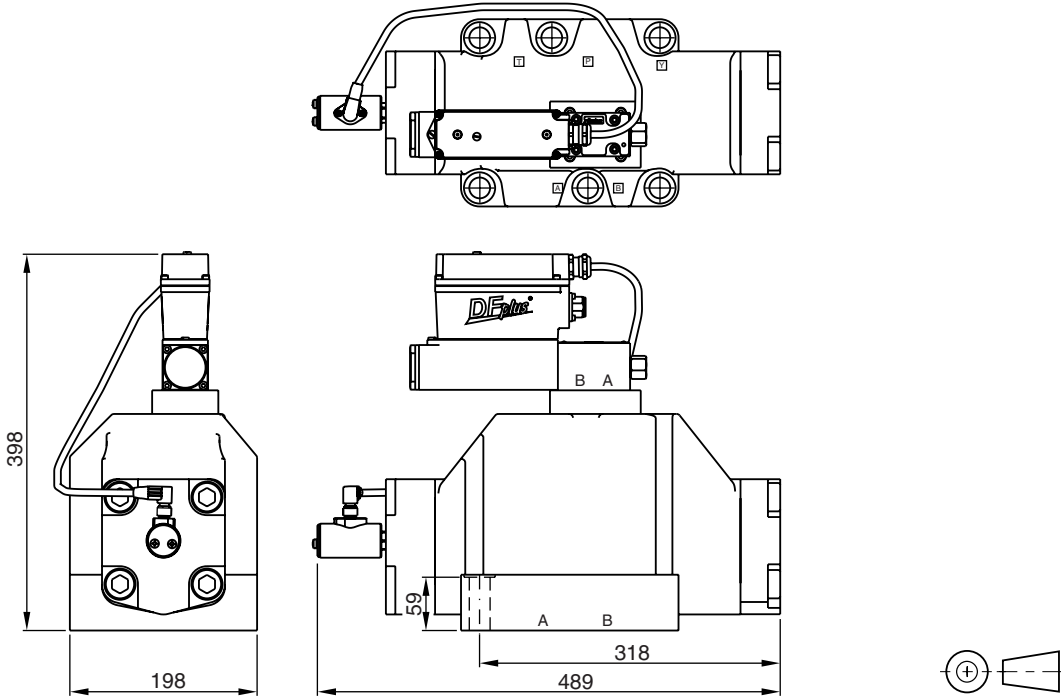
D81/91FP

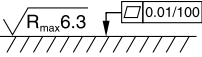
3



Surface finish	 Kit			 Kit NBR
	BK360	6x M12x75 DIN 912 12.9	108 Nm ±15%	SK-D81FP SK-D91FP

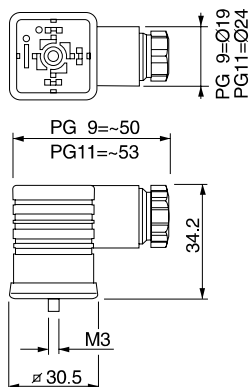
D111FP



Surface finish	 Kit			 Kit NBR
	BK386	6x M20x90 DIN 912 12.9	517 Nm ±15%	SK-D111FP

Solenoid connector

D*FB, D*1FW

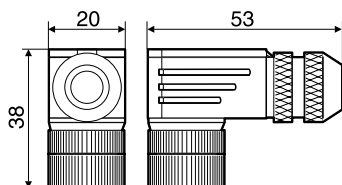


Description	Variation	Order No.
EN 175301-803 2+PE	PG 9 black B	5001710
EN 175301-803 2+PE	PG 9 grey A	5001711
EN 175301-803 2+PE	PG 11 black B	5001716
EN 175301-803 2+PE	PG 11 grey A	5001717

3

Monitor switch connector

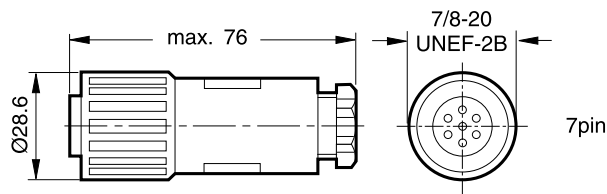
D*1FW / D*1FT / D*1FH



Description	Order No.
IEC 61076-2-101 M12 / 4 + PE	5004109

Central connector

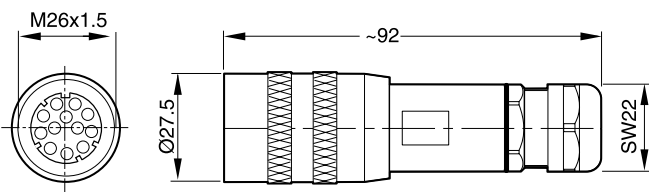
D1FT / D*1FT / D*1FH / D*FP*0 / D*1FP*0 / D*1FP*7



Description	Order No.
EN 175201-804 6 + PE	5004072

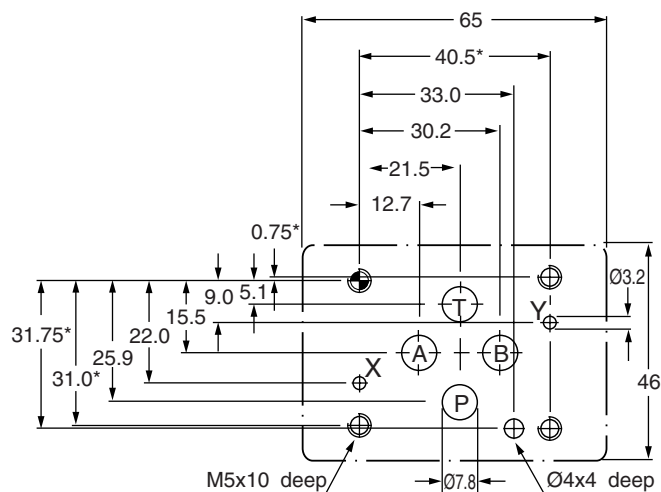
Central connector

D*FP*5 / D*1FP*5

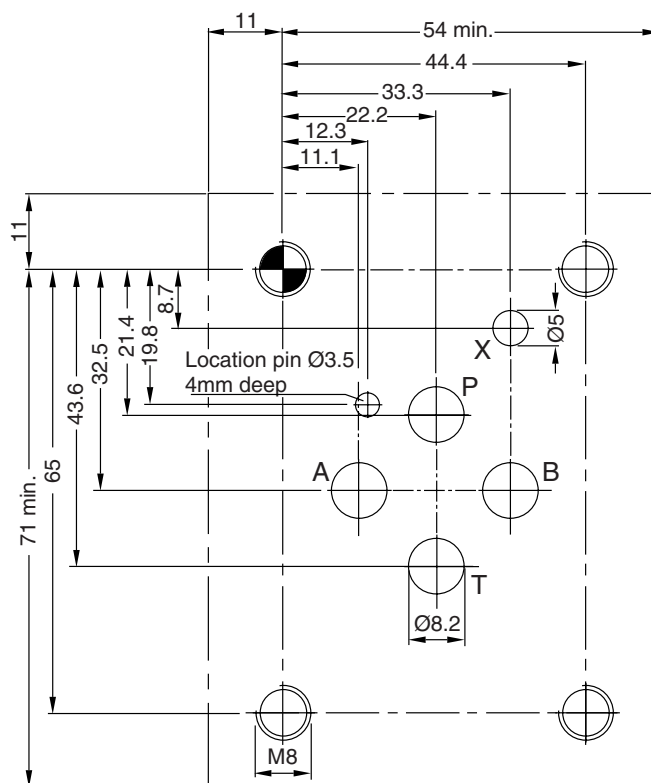


Description	Order No.
EN 175201-804 11 + PE	5004711

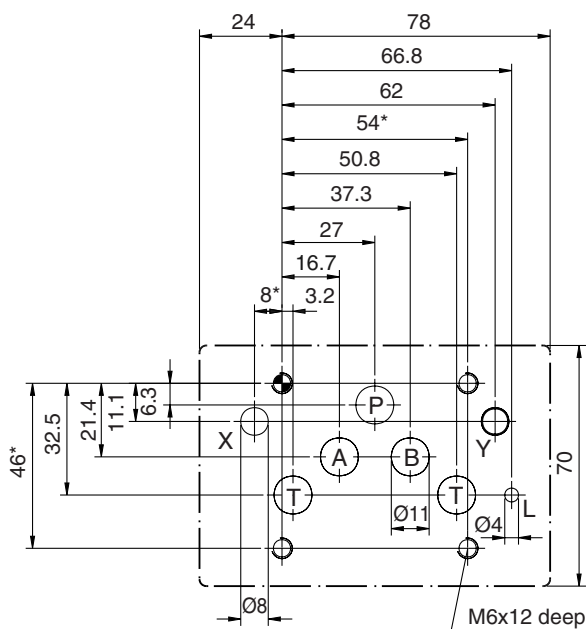
to DIN 24340-A6, size NG06/CETOP03



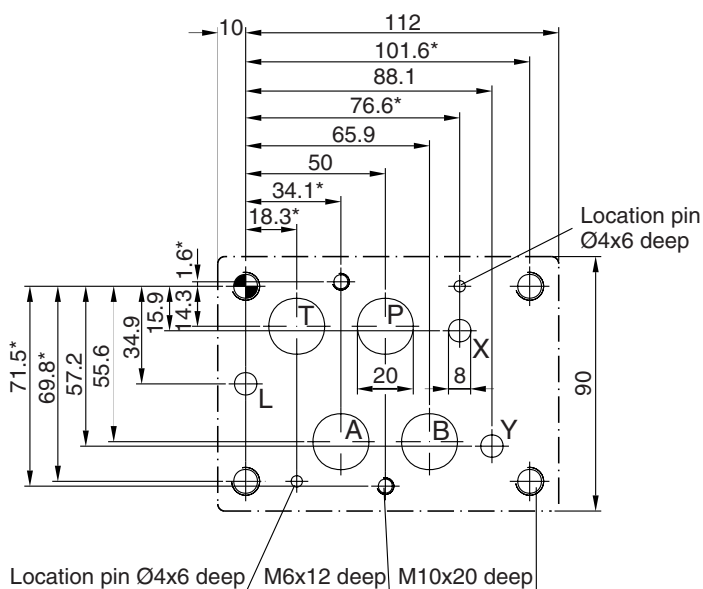
to ISO 10372-04-04-0-92, size 04



to DIN 24340-A10, size NG10/CETOP05



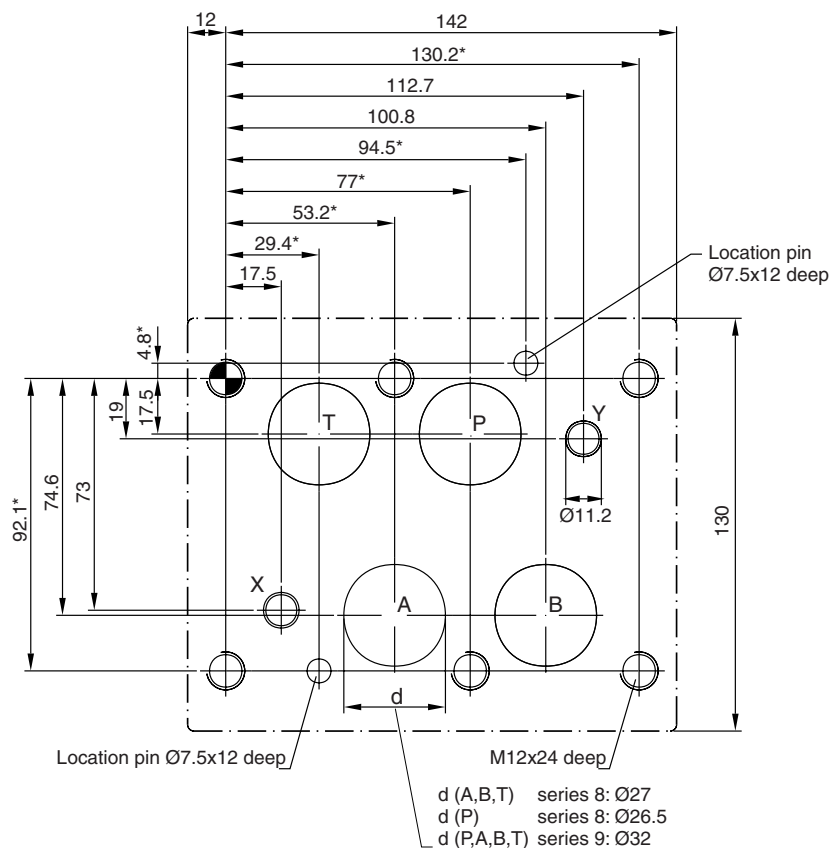
to DIN 24340-A16, size NG16/CETOP07

With * marked dimensions ± 0.1 mm.All other dimensions ± 0.2 mm.

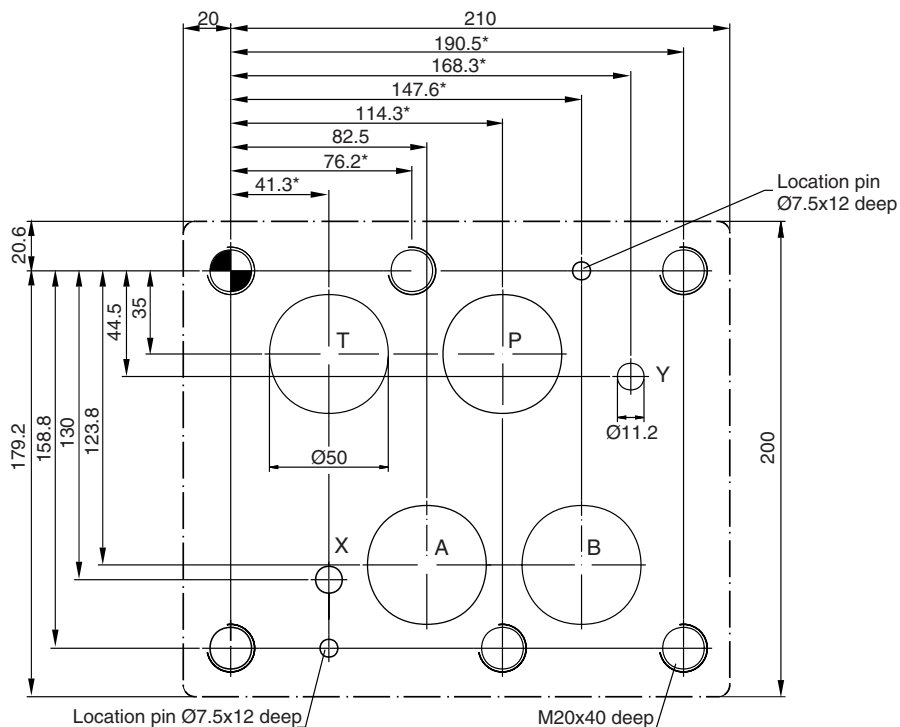
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Subplates and manifolds see chapter 12.

to DIN 24340-A25, size NG25/CETOP08



to DIN 24340-A32, size NG32/CETOP10



With * marked dimensions ± 0.1 mm.
All other dimensions ± 0.2 mm.

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Subplates and manifolds see chapter 12.

3

[illegible]