

General Description

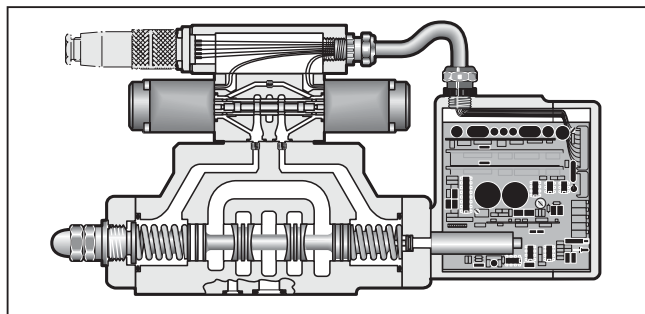
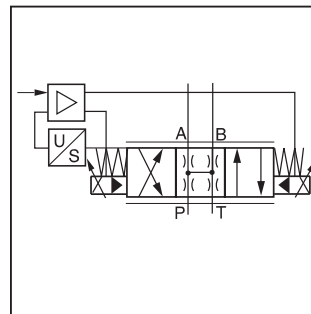
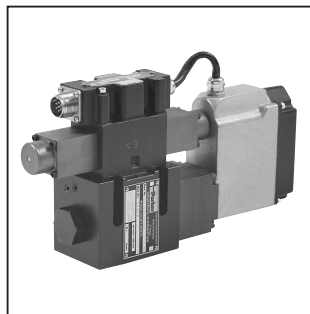
A

Series D*1FH proportional directional control valves are high performance, two stage pilot operated solenoid valves with electronic spool position feedback, and on-board integrated control electronics. Valves are available in sizes NG10 (CETOP 5), NG16 (CETOP 7), NG25 (CETOP 8) and NG32 (CETOP 10).

D*1FH valve performance is characterized by high resolution flow control, repeatability and high dynamic performance. Typical applications include precise and reproducible control of actuator speed in rapid/slow speed profiling, and smooth acceleration and deceleration performance. Zero lap spools are available for closed loop applications.

Features

- Standard DIN/ISO/CETOP/NFPA interfaces.
- Integrated valve electronics.
- Spool position feedback.
- High frequency response.
- Spring centered main stage spool.
- LED functional diagnostic indicator.



- Wide selection of spool options, and flow capacity.
- 2:1 ratio spool options.



Specifications

Use D*1FC for new applications

Interface DIN		NG10 (CETOP 5)	NG16 (CETOP 7)	NG25 (CETOP 8)	NG32 (CETOP 10)
Flow Rating @ 10 Bar (150 PSI) Δp (P→A, B→T) (spool options up to) ¹⁾ LPM (GPM)		80 (21)	240 (63)	400 (106)	1000 (264)
Pressure Gain (Zero Lap Spool) %		3.5	3.0	2.5	—
Maximum Flow (spool options up to) ¹⁾ LPM (GPM)		170 (45)	420 (111)	900 (238)	2000 (528)
Pilot Flow					
Continuous	LPM (GPM)	<1.2 (0.3)	<1.2 (0.3)	<1.2 (0.3)	<1.2 (0.3)
Step Input	LPM (GPM)	2 (0.5)	4 (1.1)	9 (2.4)	18 (4.8)
Step Response (time to reach 90% of a 100% step command) ms		25	45	65	150
Hysteresis	% <0.5	Mating Connector (order separately)		Part #5004072 (7-pin CE)	
Repeatability	% <0.5				
Operating Pressure Port P, A, B Bar (PSI) Port P, internal pilot Port T, internal drain Port T, external drain Port Y, pilot drain Port X, external pilot		Fluid Cleanliness Level		ISO Class 16/13	
		Fluid Viscosity, Recommended		80 – 1000 SSU	
		Fluid Temperature, Recommended		0°C to +60°C (+32°F to +140°F)	
		Environmental Protection Class		NEMA 4 (IP65)	
		Electrical Power Requirements		Ambient Operating Temperature	
Command Signal (impedance) (select by ordering code)		Temperature Drift		0.005%/°C (0.009%/°F)	
Command Polarity		Pin 'D' more positive than 'E' produces flow P to B			

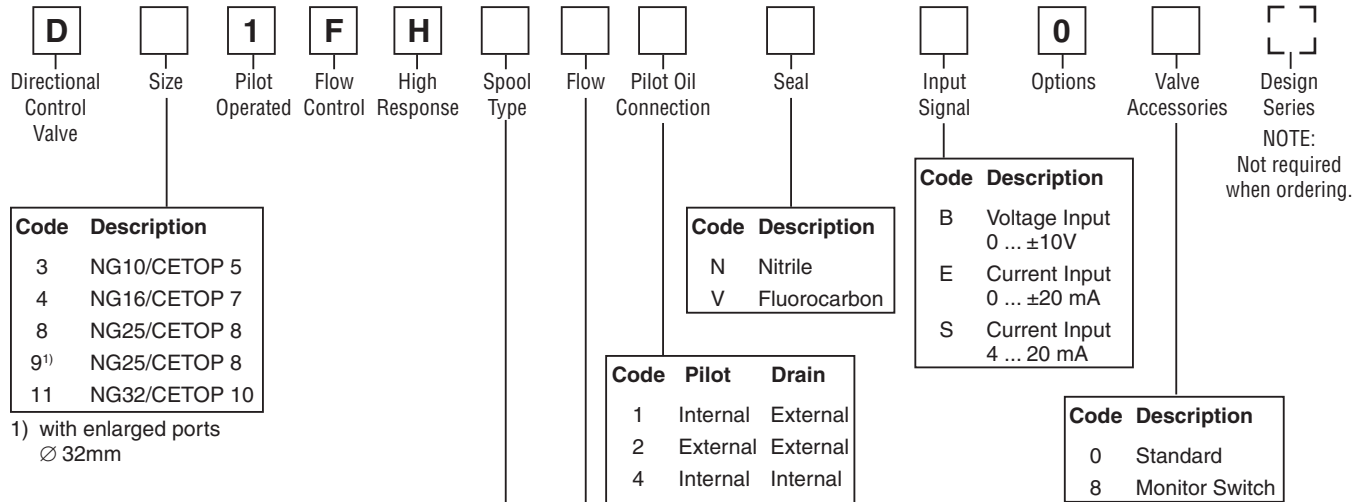
1) Actual pressure drop required for each metering land, up to the specified maximum flow rate is:

$$\Delta P_{\text{Actual}} = (5) \left(\frac{Q_{\text{Actual}}}{Q_{\text{Rated}}} \right)^2 \text{ Bar; (Q in LPM) [or] } = (75) \left(\frac{Q_{\text{Actual}}}{Q_{\text{Rated}}} \right)^2 \text{ PSI; (Q in GPM)}$$

Flow rate for different Δp per control edge: $Q_x = Q_{\text{Nom.}} \cdot \sqrt{\frac{\Delta p_x}{\Delta p_{\text{Nom.}}}}$

D_1FH.indd, ddp





Code			Spool Type
$Q_A=Q_B$	$Q_A>Q_B$ ²⁾	$Q_B>Q_A$ ³⁾	
E01	B31	A31	Overlap Sine
E02	B32	A32	Overlap Sine

2) 2:1 Ratio: Reduced Flow Rate; Port B, Rated Flow Rate; Port A
 3) 2:1 Ratio: Reduced Flow Rate; Port A, Rated Flow Rate; Port B

Flow at Δp 5 Bar (72.5 PSI) per Metering Edge				
Code	Sine Notch Spools			
	D31 LPM (GPM)	D41 LPM (GPM)	D81/91 LPM (GPM)	D111 LPM (GPM)
A	55 (14.6)	—	—	—
B	—	105 (27.8)	—	—
C	80 (21)	140 (37)	—	—
E	—	190 (50)	250 (66)	—
F	—	240 (63)	310 (82)	—
H	—	—	400 (106)	500 (32)
L	—	—	—	1000 (264)

V-Notch Spool Options - Spool Type and Flow Codes				
Code		V-Notch	Spool Type	Flow at Δp 5 Bar (72.5 PSI) per metering edge
$Q_A=Q_B$	$Q_A>Q_B$ ⁴⁾			
E21	B41			
E22	B42			

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge		
	D31 LPM (GPM)	D41 LPM (GPM)	D81/D91 LPM (GPM)
B	—	—	—
D	—	120 (32)	—
F	—	—	300 (79)

4) 2:1 Ratio: Reduced Flow Rate on Port B, Rated Flow Rate on Port A
 Code A* for spool $Q_B>Q_A$ optional

Bolt Kit:		Weight:	
D31FH	BK98	D31FH	8.1 kg (17.9 lbs.)
D41FH	BK160	D41FH	11.6 kg (25.6 lbs.)
D81/91FH	BK228	D81/91FH	20.7 kg (45.6 lbs.)
D111FH	BK150	D111FH	62.0 kg (137.0 lbs.)

Mating Connector: Part # 5004072 (7-Pin CE) Order Separately

Use D*1FC for new applications

Mounting Interface

Refer to the Mounting Interface Dimensions in the Proportional Directional Valve section of this catalog.

Accessories

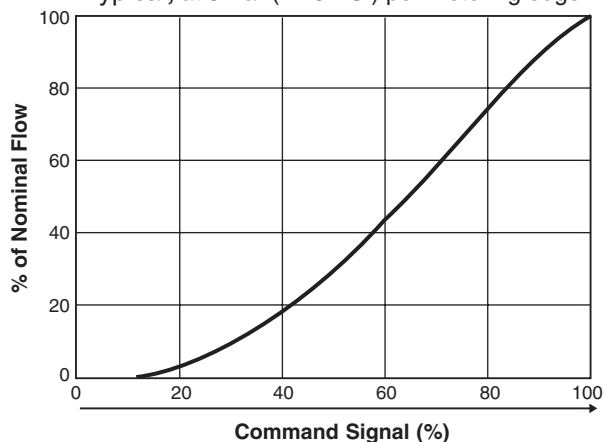
Refer to the Accessories section for bolt kits, subplates, connectors and pre-assembled cable assemblies.

Note: Depending on the spool type selected, the actual flow characteristic may deviate from the typical flow curves as shown.

A

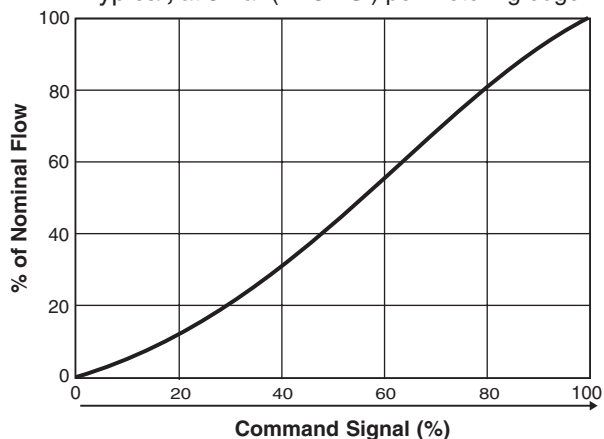
Flow Characteristics – Overlap Spools

Typical, at 5 Bar (72.5 PSI) per metering edge

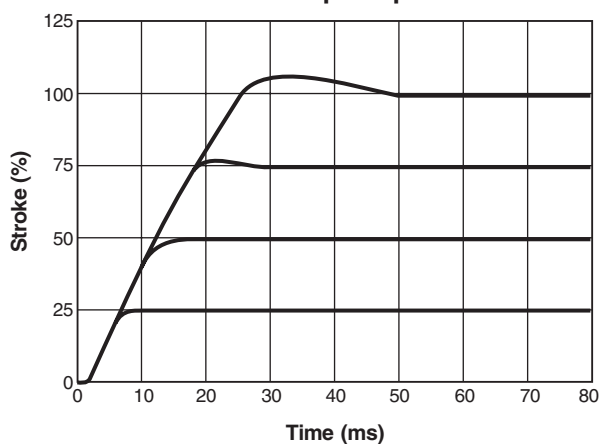


Flow Characteristics – Zero Lap Spools

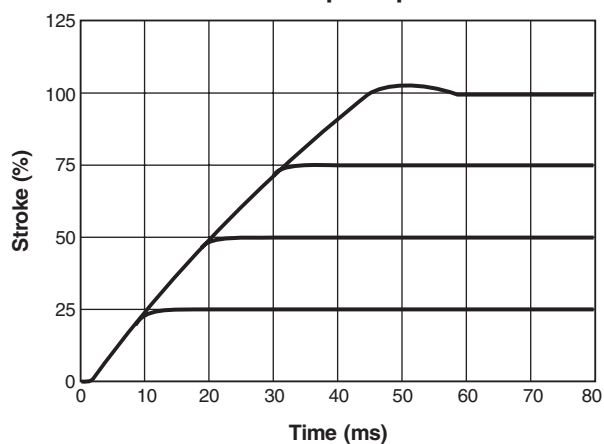
Typical, at 5 Bar (72.5 PSI) per metering edge



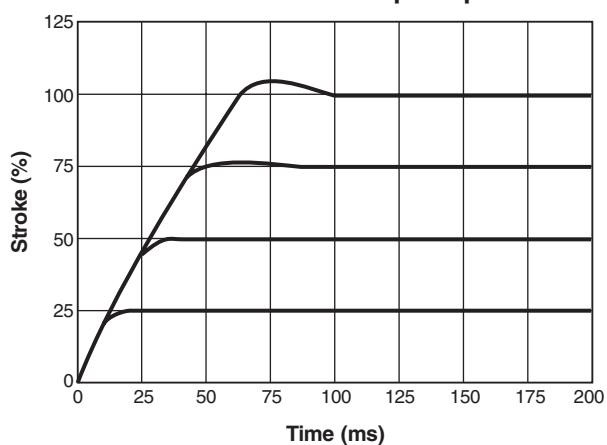
D31FH Step Response



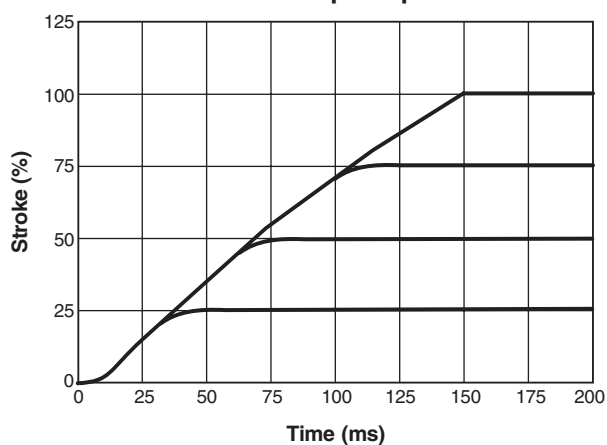
D41FH Step Response



D81FH and D91FH Step Response



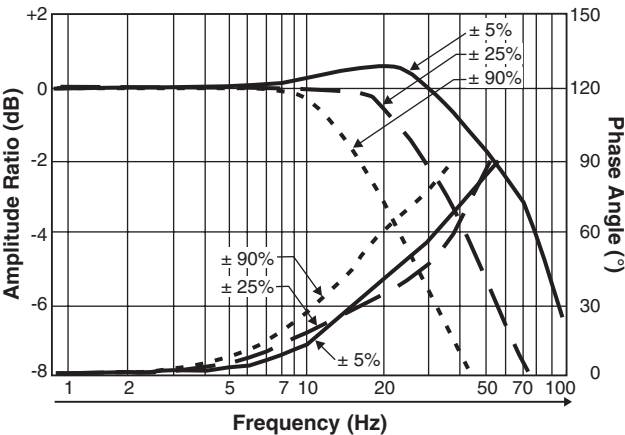
D111FH Step Response



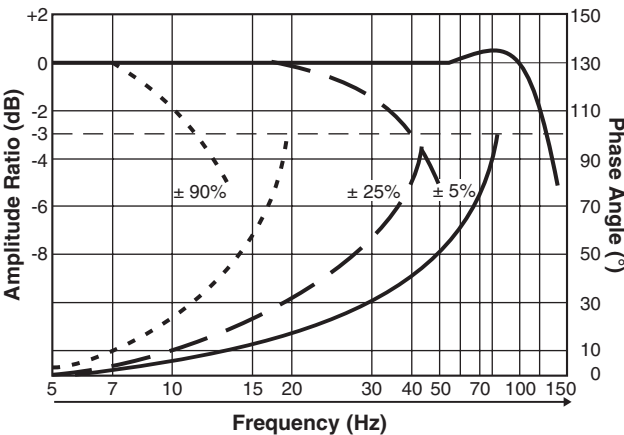
Use D*1FC for new applications

A

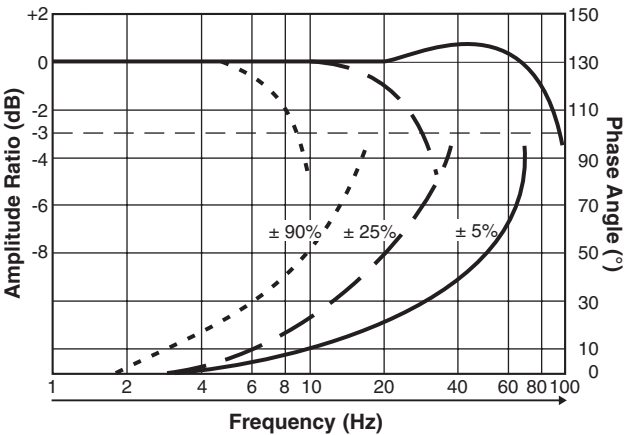
D31FH Frequency Response



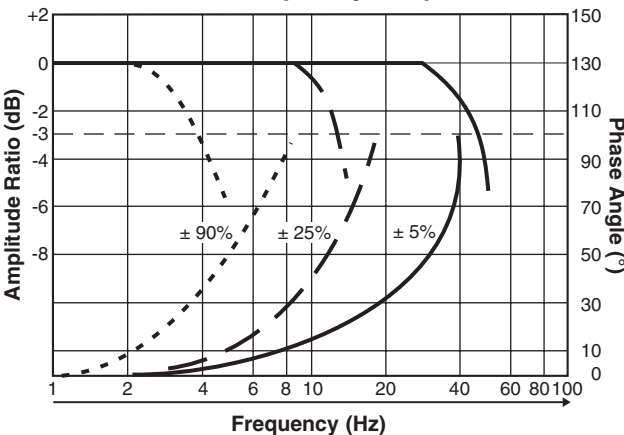
D41FH Frequency Response



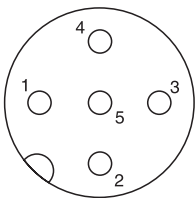
D81FH and D91FH Frequency Response



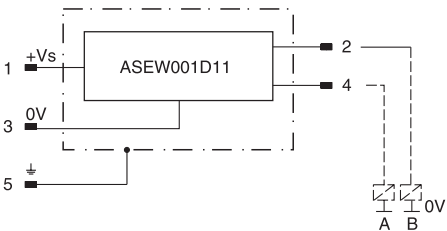
D111FH Frequency Response



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.

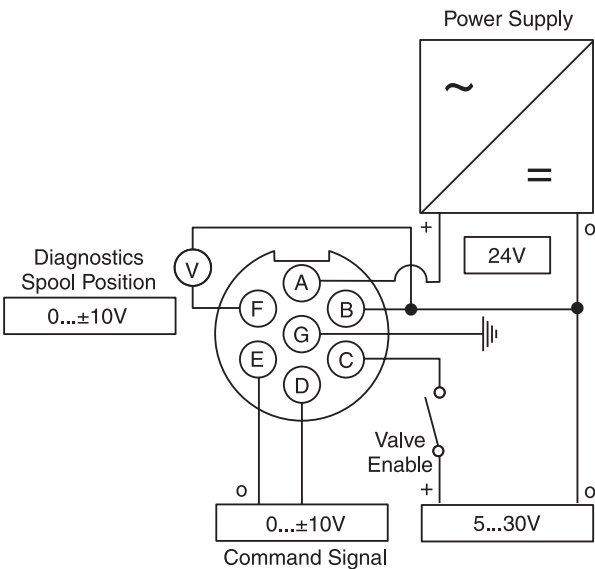
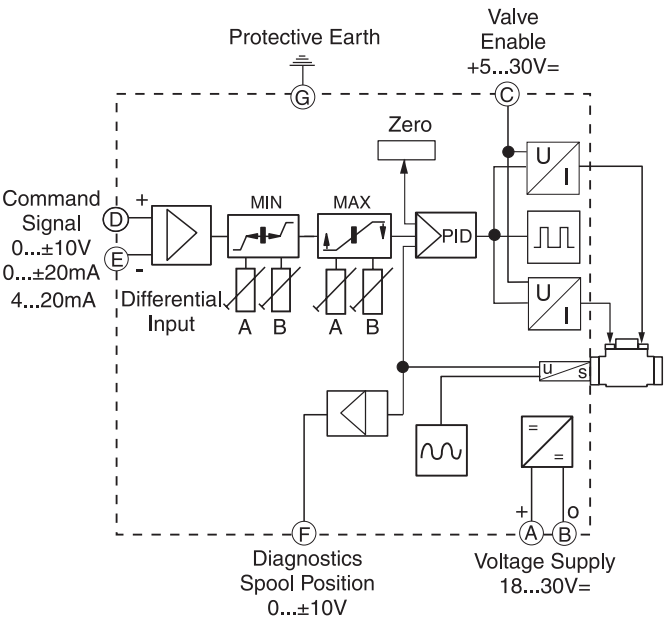
Protection Class	IP65 in accordance with EN 60529 (plugged and mounted)
Ambient Temperature	[°C] 0...70; (32°F...158°F)
Supply Voltage/Ripple	[V] 18...42, ripple < 10% eff.
Current Consumption without Load	[mA] < 30
Maximum Output Current per Channel, Ohmic	[mA] 400
Minimum Output Load per Channel, Ohmic	[kOhm] 100
Maximum Output Drop at 0.2A	[V] < 1.1
Maximum Output Drop at 0.4A	[V] < 1.6
EMC	EN 61000-6-2, EN61000-6-4
Maximum tol. Ambient Field Strength	[A/m] 1200
Minimum Distance to Next AC solenoid	[m] 0.1
Interface	4+PE acc. IEC 61076-2-101 (M12)
Wiring Minimum	[mm²] 5 x 0.5 (AWG 20) overall braid shield
Wiring Length Maximum	[m] 50 (164 ft.)

Use D*1FC for new applications

Function Diagram, Valve Electronics

Wiring Connection

A



Valve Enable Input

The valve power stage electronics is enabled by applying a positive voltage to pin 'C' with respect to power supply 0V pin 'B'. A voltage between 5 and 30 volts is a logical enable, less than 5 volts disables the valve.

Electronics Adjustment

Electronic valve adjustments are located inside the electronics enclosure. Refer to installation manual: DFH- (Series 30) 2573 / GB.

Diagnostics — Valve Spool Position

Spool position can be monitored by measuring the voltage on pin 'F' with respect to power supply 0V pin 'B' of the valve input connector. The same signal is available inside the enclosure as a calibration aid as shown.

Integrated Control Electronics

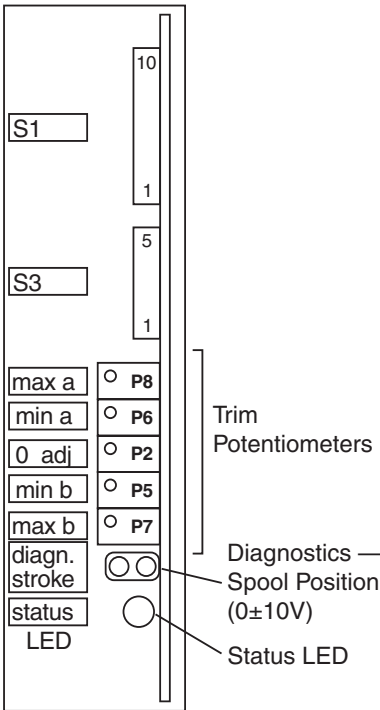
Arrangement of potentiometers, status LED, and internal valve spool monitor point.

Status LED

A status lamp (LED) is located inside the electronics enclosure and visible through a transparent lens. Refer to the table below.

Display Color	Indicates
Green	Normal operation
Off	Supply voltage outside permissible range of 18 to 30 VDC
Red	Spool position error / Low pilot pressure

Use D*1FC for new applications

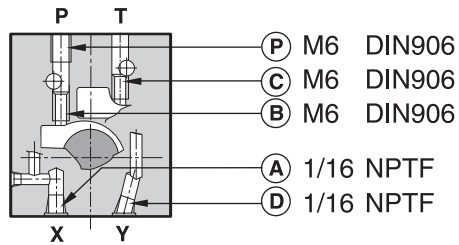


Pilot Flow
Oil Inlet (Supply) and Outlet (Drain)

Use D*1FC for new applications

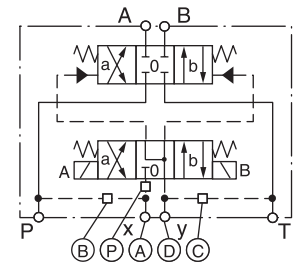
A

D31FH

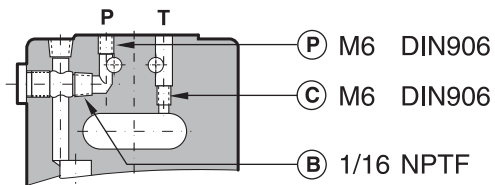


○ open, ● closed

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

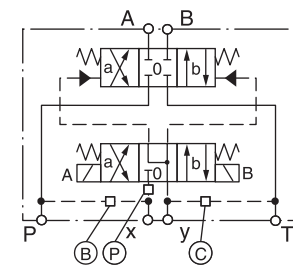


D41FH

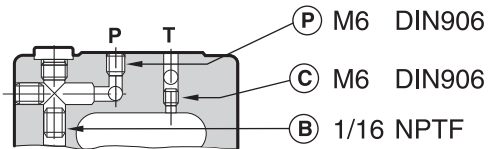


○ open, ● closed

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

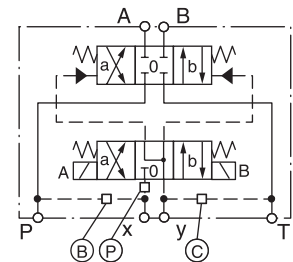


D81FH and D91FH

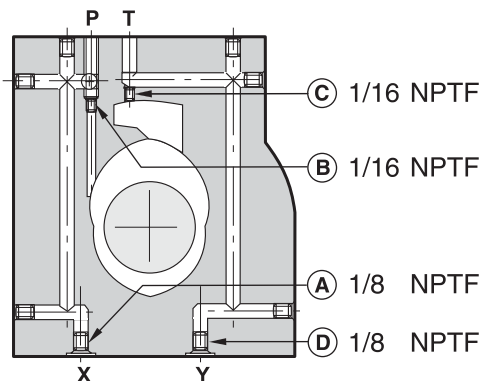


○ open, ● closed

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

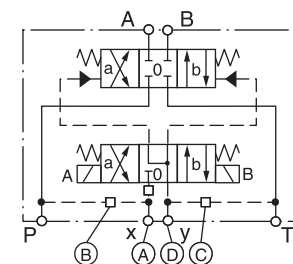


D111FH



○ open, ● closed

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

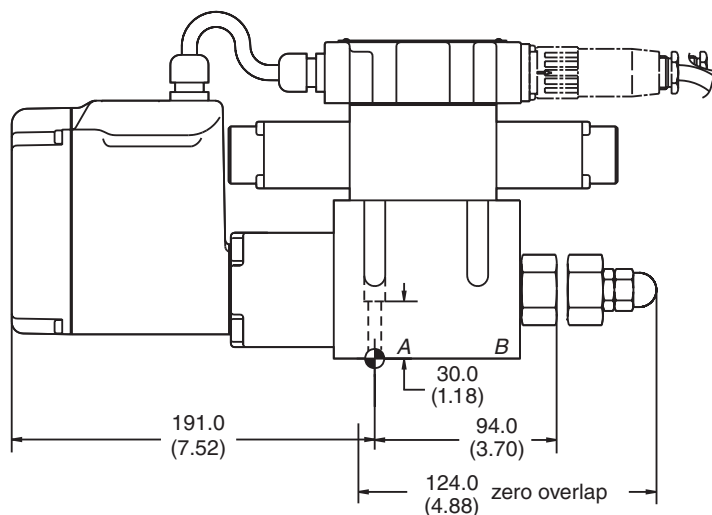
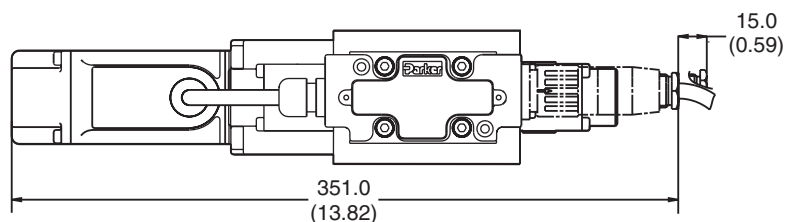
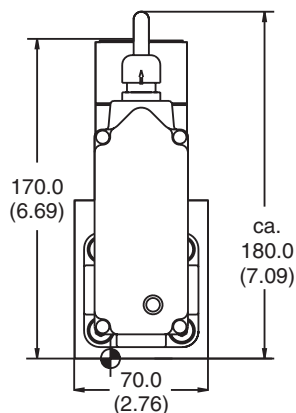


D31FH

Inch equivalents for millimeter dimensions are shown in (**)

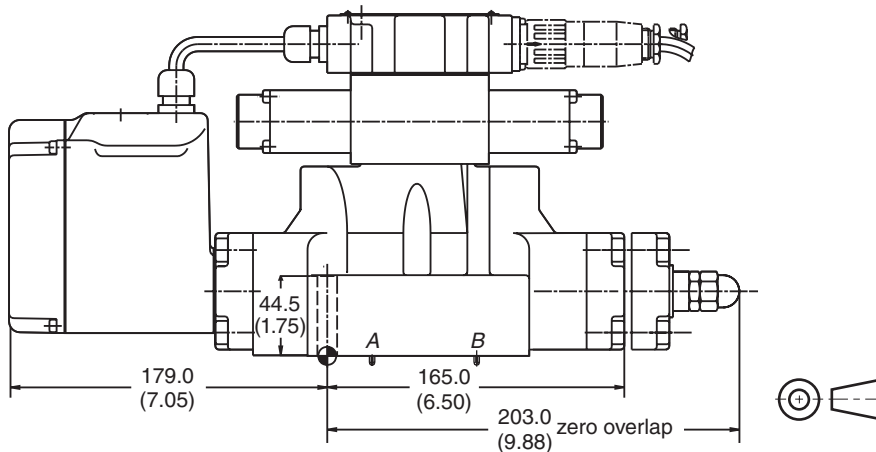
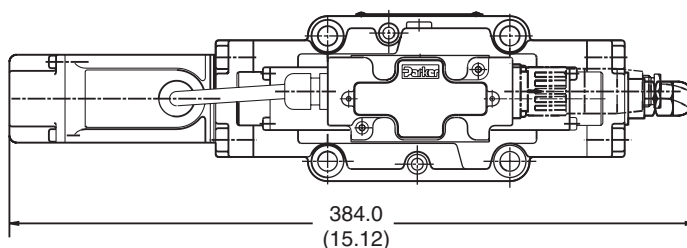
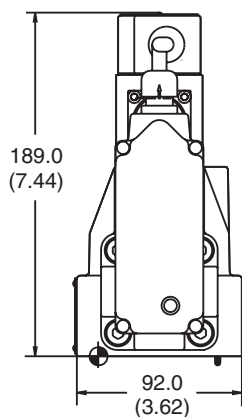
A

**Use D31FC
for new applications**

**D41FH**

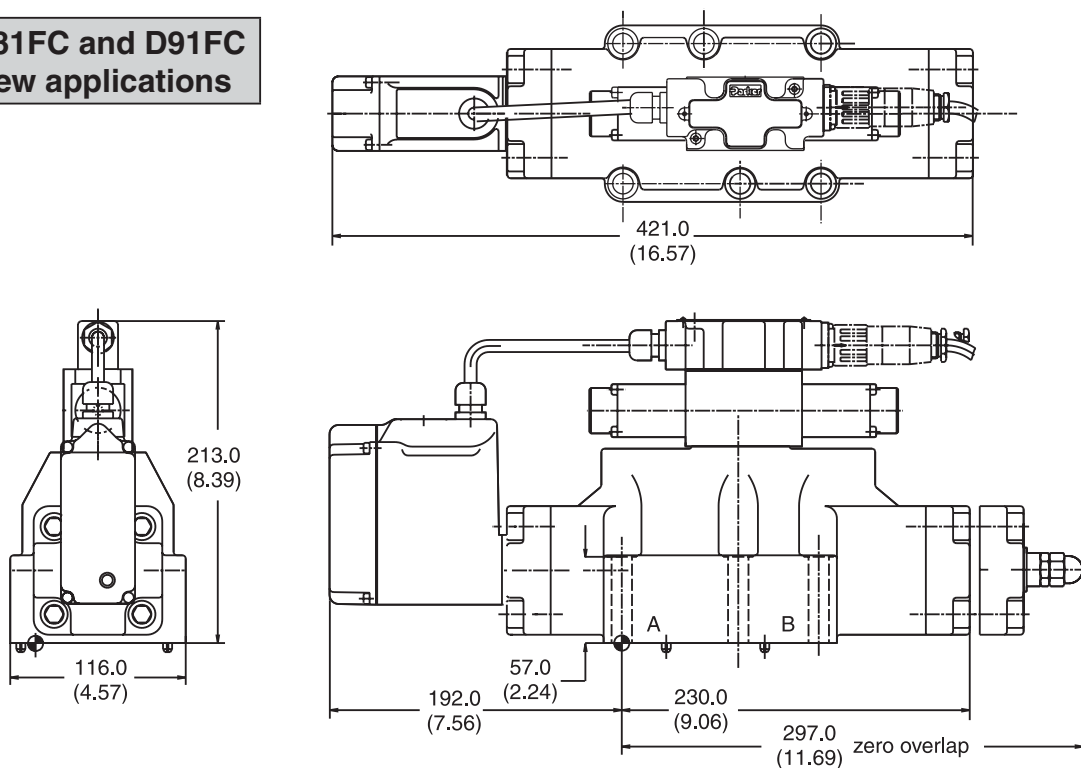
Inch equivalents for millimeter dimensions are shown in (**)

**Use D41FC
for new applications**



D81FH and D91FH

Inch equivalents for millimeter dimensions are shown in (**)

A**Use D81FC and D91FC
for new applications****D111FH**

Inch equivalents for millimeter dimensions are shown in (**)

**Use D111FC
for new applications**