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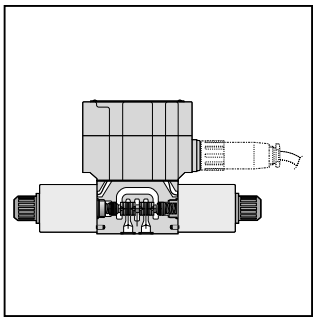
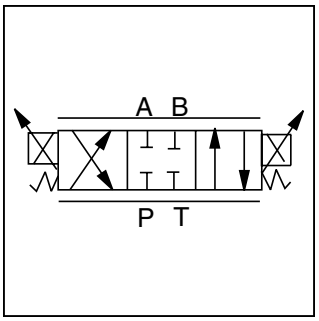
A

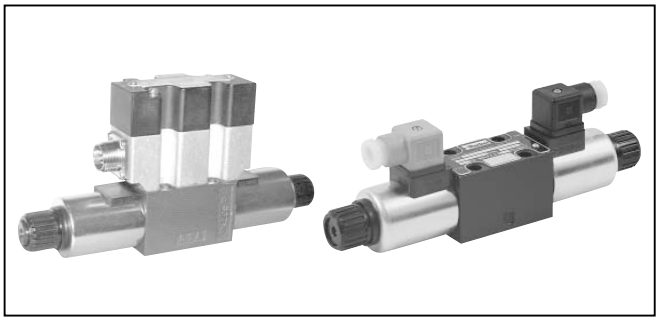
General Description

Series D*FW and D*FT direct operated proportional directional control solenoid valves are available with or without integrated control electronics. Valves are available in sizes NG6 (CETOP 3) and NG10 (CETOP 5).

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





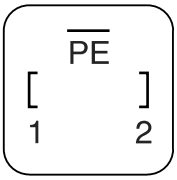


Features

- Standard DIN/ISO/CETOP/NFPA interfaces.
- Optional integrated control electronics with ramp adjustment.
- Progressive flow characteristics for improved low flow resolution.
- Spring centered spool.
- Wide selection of spool options and flow capacity.

Wiring D*FW — Solenoid Coil

(without integrated electronics)



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

Specifications

Interface DIN (NFPA/ISO/CETOP)	NG6 (3)	NG10 (5)
Flow Rating @10 Bar (150 PSI) Δp (P→A, B→T) (spool options up to) LPM (GPM)	20 (5.3)	60 (15.9)
Maximum Flow (refer to operating limit curves) LPM (GPM)	48 (12.5)	170 (45)
Step Response (time to reach 90% of a 100% step command) ms	100	165

Hysteresis	%	<8	**Fluid Viscosity, Recommended**	80 – 1000 SSU
Repeatability	%	<2	**Fluid Temperature, Recommended**	0°C to +60°C (+32°F to +140°F)
Max. Operating Pressure Port P, A, B Port T	Bar (PSI)	315 (4500) 35 (500)	**Environmental Protection Class**	NEMA 1 (IP54)
			Ambient Operating Temperature	-20°C to +60°C (-4°F to +140°F)
Fluid Cleanliness Level		ISO Class 16/13		

D		F	T									
Directional Control Valve	Size and Interface	Flow Control	Integrated Electronics	Spool Type	Flow	Style	Seal	Electronic Variation	Electronic Accessories	Valve Accessories	Design Series	

NOTE: Not required when ordering.

Code	Description
1	NG6/CETOP 3
3	NG10/CETOP 5

See Note 1.

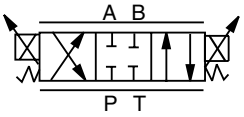
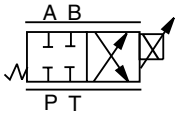
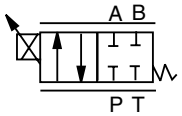
Code		
Spool Overlap		
10%	20%	Spool Type
E01	E81*	
E02	E82*	
E09	–	

Refer to factory for ratio spool options.

* Use E01 or E02 for new applications.

Code	Description
F	Voltage Input 0 ... ±10V (with reference outputs)
G	Current Input 0 ... ±20 mA

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Style
C	
E	
K	

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge	
	D1FT LPM (GPM)	D3FT LPM (GPM)
C	7.5 (2.0)*†	–
F	15 (4.0)	–
H	20 (5.3)†#	20 (5.3)*†
K**	–	30 (7.8)
M	–	40 (10.6)
S	–	60 (15.9)†#

Refer to factory for ratio spool options.

* E09 spools only available where indicated.

** E01 spool only.

† Type E spool only.

Not available with E81, E82.

Weight:

NG6 2.5 kg (5.5 lbs.)
NG10 6.8 kg (15.0 lbs.)

Note 1: NG10 (CETOP 5) valves are supplied with bolt kit BK98 (1/4-20 x 1.625). For metric bolt kit BK385 (M6 x 40 mm), add "-X6181" to ordering code.

Mating Connectors are not included in the delivery.

Mounting Interface

Refer to 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.

D		F	W							0	
Directional Control Valve	Size and Interface	Flow Control	Open Loop	Spool Type	Flow	Style	Seal	Solenoid Voltage	Solenoid Accessories	Valve Accessories	Design Series

NOTE: Not required when ordering.

Code	Description
1	NG6/CETOP 3
3	NG10/CETOP 5

Code		
Spool Overlap		
10%	20%	Spool Type
E01	E81*	
E02	E82*	
E09	–	

Refer to factory for ratio spool options.

* Use E01 or E02 for new applications.

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge	
	D1FT LPM (GPM)	D3FT LPM (GPM)
C	7.5 (2.0)*†	–
F	15 (4.0)	–
H	20 (5.3)†#	20 (5.3)*†
K**	–	30 (7.8)
M	–	40 (10.6)
S	–	60 (15.9)†#

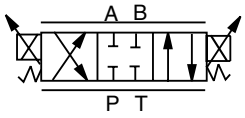
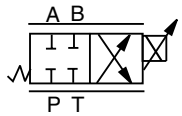
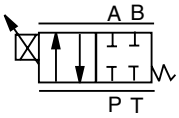
Refer to factory for ratio spool options.

* E09 spools only available where indicated.

** E01 spool only.

† Type E spool only.

Not available with E81, E82.

Code	Style
C	
E	
K	

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
J[2]	24 VDC
K	12 VDC
M[2]	9 VDC

(2) Not for D3FW

Code	Description
C[2]	Coil Lead Wires in Conduit Box
F[3]	Free Coil Lead Wires
W[5]	Socket Connector DIN 43650 without Plug

(2) Only for D1FW.
(3) D1FW, 9V overmolded coil only.
(4) Contact factory for custom lead wire and connector options in OEM quantities.
(5) Not available 9V coil.

Code	Description
0	Standard[1]

(1) Metal can coils

Weight:

NG6	2.5 kg (5.5 lbs.)
NG10	6.8 kg (15.0 lbs.)

Driver Cards

Refer to the Electronics section for driver cards and support electronics.

Mounting Interface

Refer to 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.

A

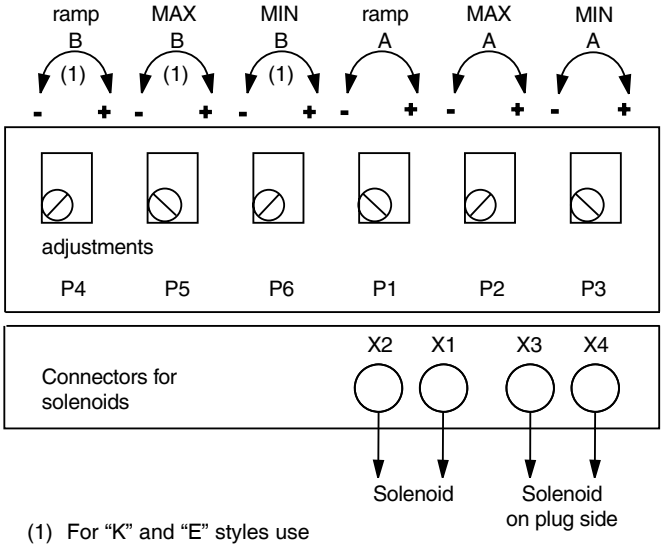
Series D*FW
without integrated electronics

Interface DIN (NFPA/ISO/CETOP)		NG06 (03)			NG10 (05)
Solenoid Order Code		**J**	**K**	**M**	**K**
Nominal Resistance	ohms	24	6	3.3	4
Nominal Current	amps	0.9	1.8	2.5	2.5
Nominal Voltage	voltage	24	12	9	12
Environmental Protection Class		NEMA 1 (IP54)			
Mating Connectors — Solenoid (DIN 43650)		Part #692914 (Black) Part #692915 (Gray)			

Series D*FT
with integrated electronics

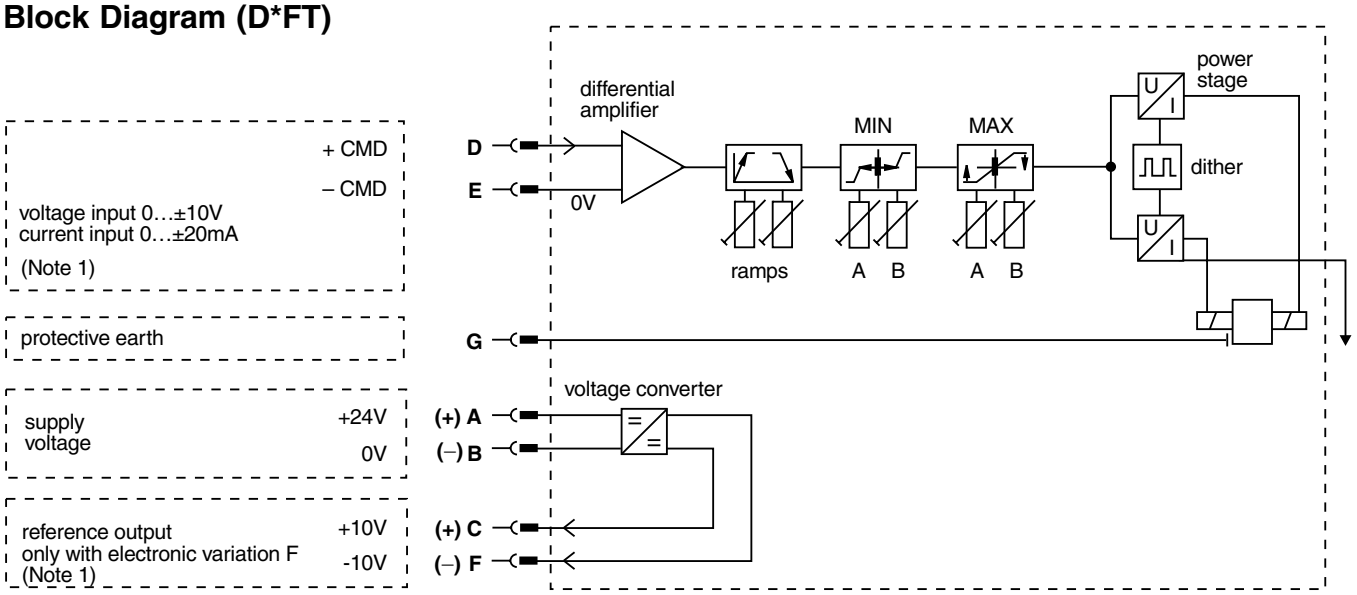
Supply Voltage	14.5 to 30 VDC
Current D1FT D3FT	 3 amps 4 amps
Command Signal (impedance) [select by ordering code]	 0 ± 10 VDC (100K) 0 ± 20 mA (500 ohms)
Command Polarity Pin 'D' more positive than 'E'; flow =	 D1FT: P→A D3FT: P→B
Ramp Time Adjustment	0 to 3 seconds
Reference Outputs VDC (10 mA maximum)	+10 (pin C), -10 (pin F)
Environmental Protection Class	NEMA 1 (IP54)
Mating Connector (order separately) (7-pin CE)	 Part #5004072

Integrated Control Electronics (D*FT)
Arrangement of Potentiometers



(1) For "K" and "E" styles use these adjustments only

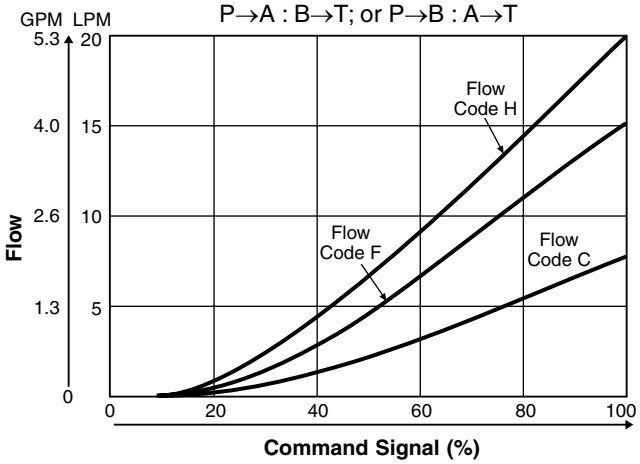
Block Diagram (D*FT)



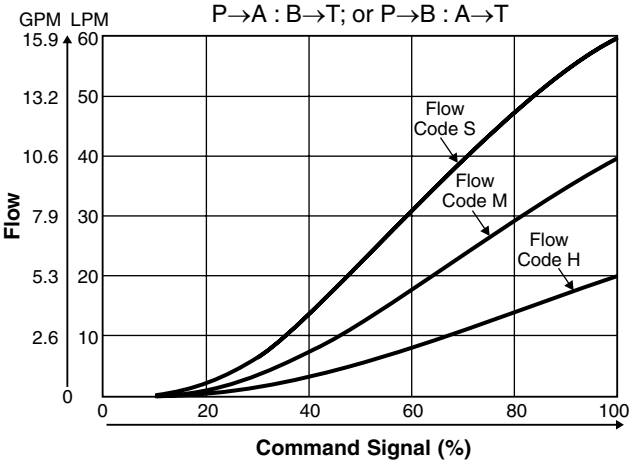
Note 1) Refer to ordering code page.

A

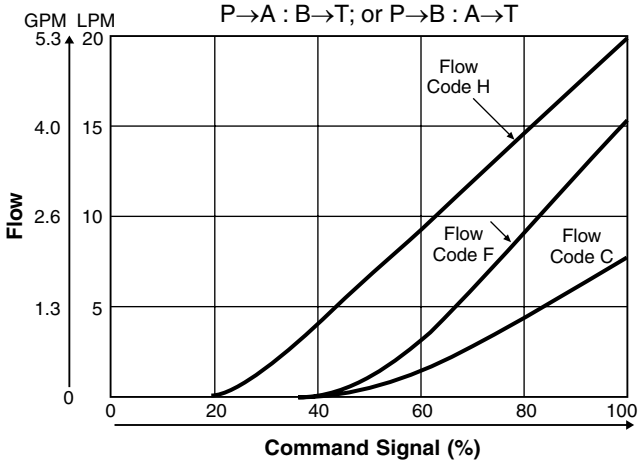
D1FT Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



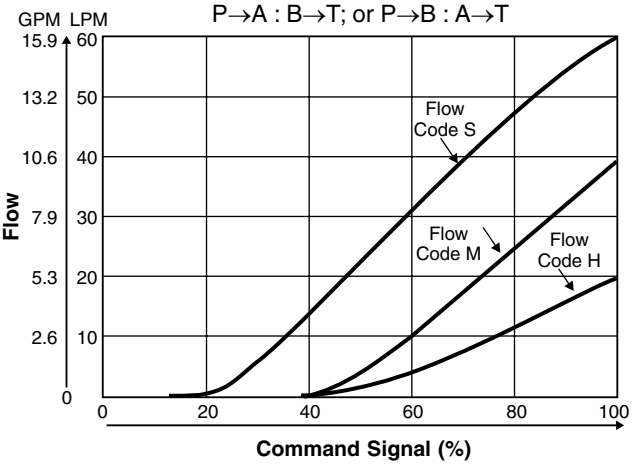
D3FT Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



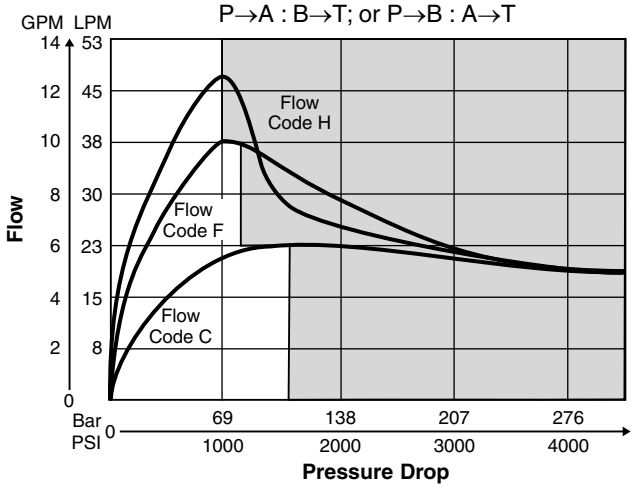
D1FW Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



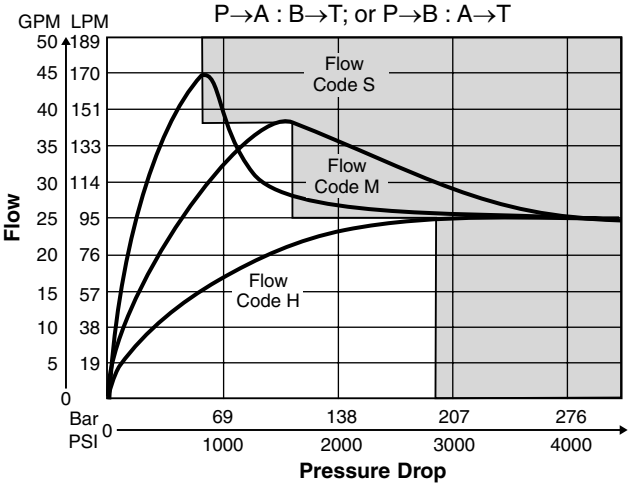
D3FW Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



D1F* Operating Limits [1]
at 100% Command
P→A : B→T; or P→B : A→T



D3F* Operating Limits [1]
at 100% Command
P→A : B→T; or P→B : A→T

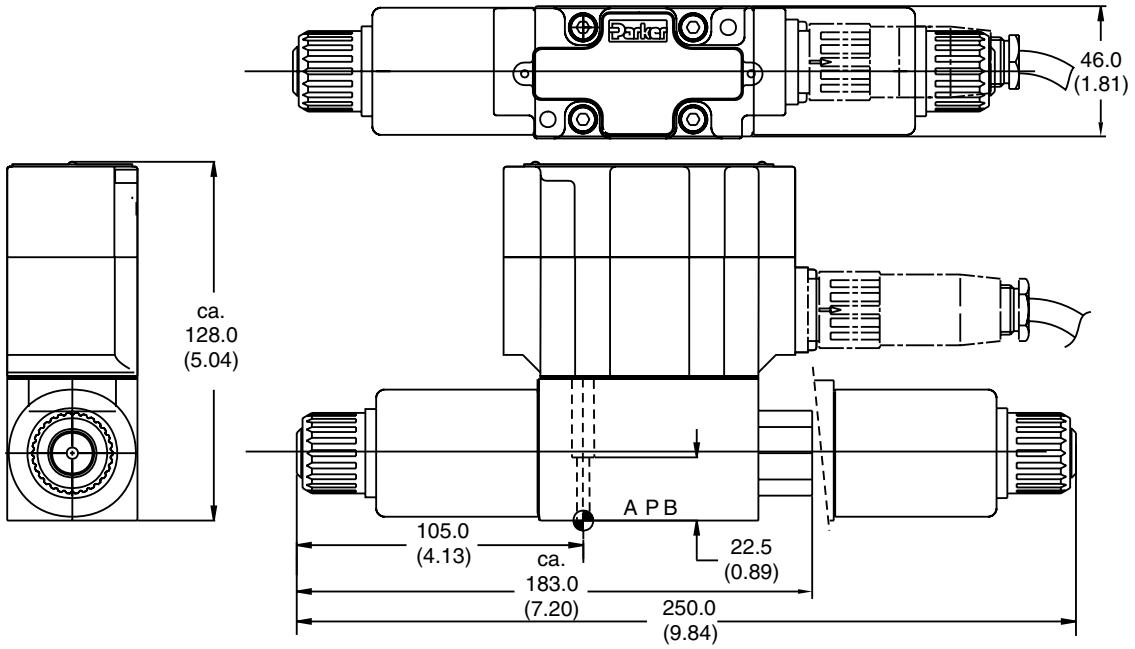


[1] Shaded area: Actual flow subject to the system load dynamics
Note: 81 and 82 spools - decrease limits by 15%

A

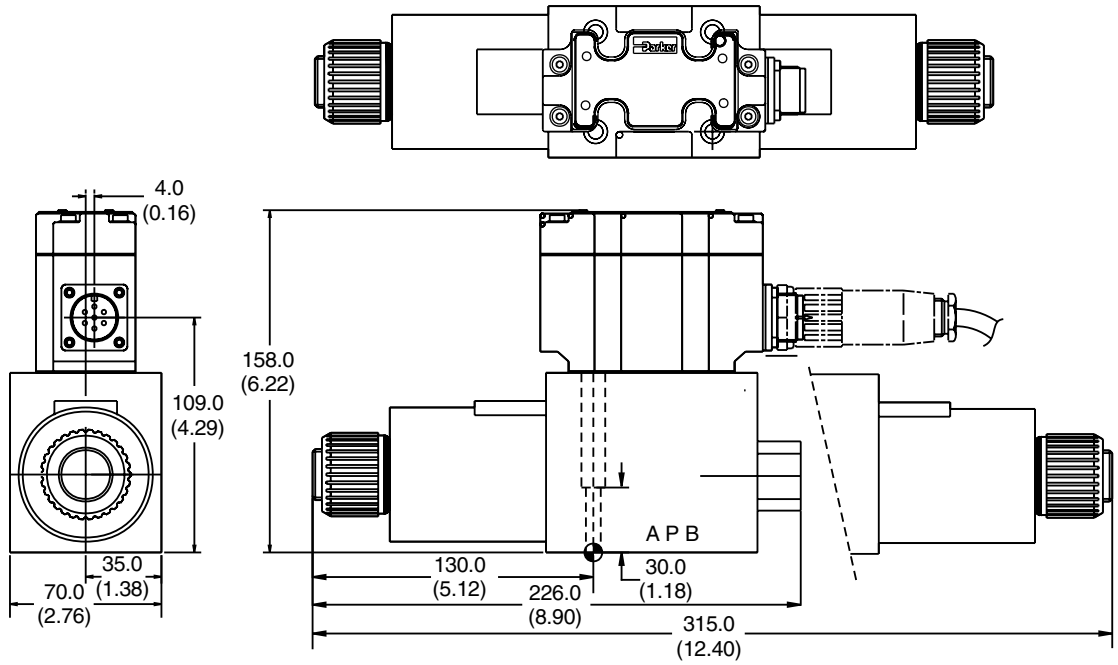
D1FT

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



D3FT

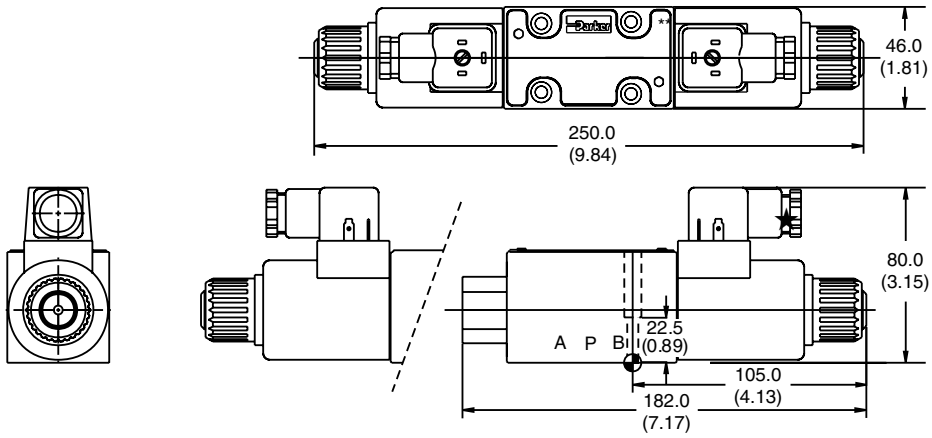
Inch equivalents for millimeter dimensions are shown in (**)



A

D1FW with Hirschmann Connectors

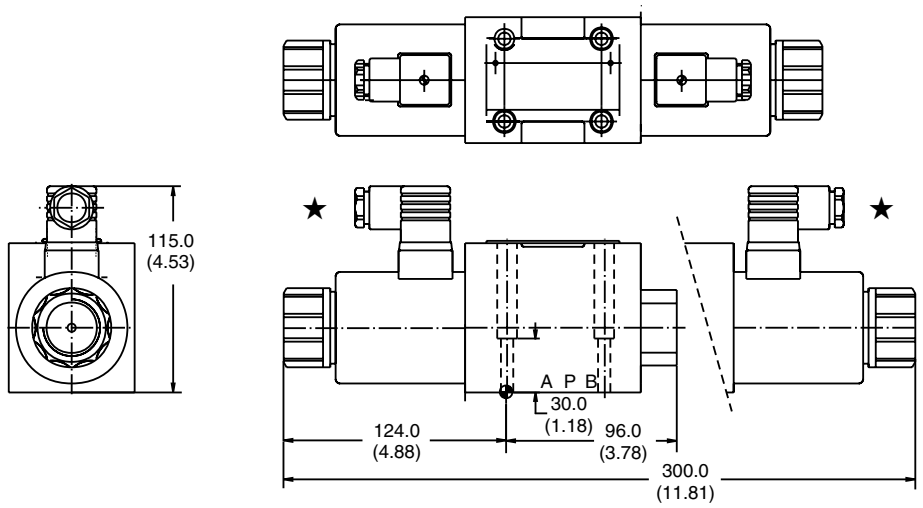
Inch equivalents for millimeter dimensions are shown in (**)



D3FW with Hirschmann Connectors

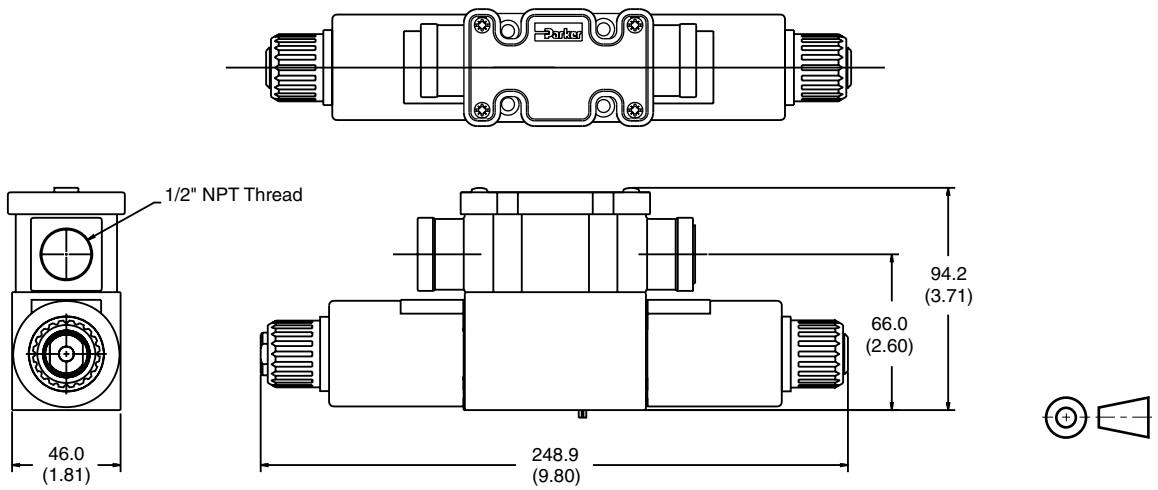
★ Order plugs separately.

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



D1FW with Conduit Box

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

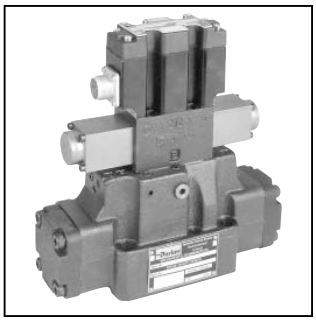


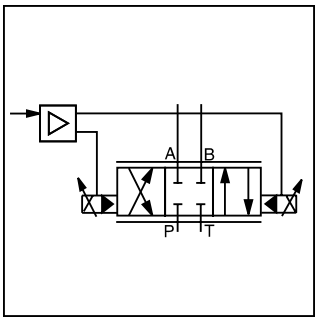
D_FW-D_FT.p65, dd

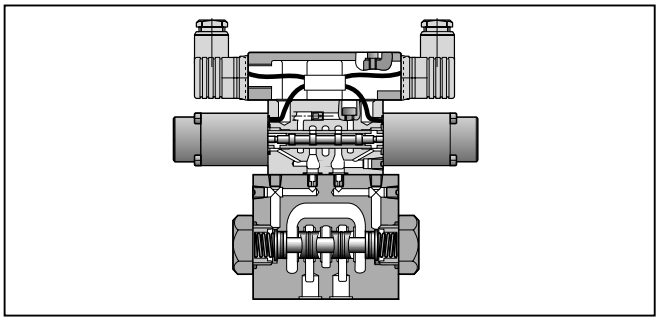
General Description

Series D*1FW and D*1FT two-stage pilot operated proportional directional control solenoid valves are available with or without integrated control electronics. Valves are available in sizes NG10 (CETOP 5), NG16 (CETOP 7) and NG25 (CETOP 8).

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







Features

- Standard DIN/ISO/CETOP/NFPA interfaces.
- Optional integrated control electronics with ramp adjustment.
- Progressive flow characteristics for improved low flow resolution.
- Spring centered main stage spool.
- Wide selecton of spool options and flow capacity.
- 2:1 ratio spool options.

CE

Specifications

Interface DIN (NFPA/ISO/CETOP)	NG10 (5)	NG16 (7)	NG25 (8)
Flow Rating @10 Bar (150 PSI) Δp (P→A, B→T) (Spool options up to) LPM (GPM)	75 (20)	200 (53)	400 (106)
Pilot Flow — Continuous LPM (GPM)	1.2 (0.3)	1.2 (0.3)	1.2 (0.3)
Step Response (time to reach 90% of a 100% step command) ms	60	75	100

Hysteresis	%	<5
Repeatability	%	<2
Operating Pressure		
Port P, A, B	Bar (PSI)	345 (5000) max.
Port P, internal pilot		20 (290) min.
Port T, internal drain		10 (150) max.
Port T, external drain		345 (5000) max.
Port Y, pilot drain		10 (150) max.
Port X, external pilot		20-345 (290-5000)

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)
Ambient Operating Temperature	-20°C to +60°C (-4°F to +140°F)

Series D*1FT with integrated electronics

Supply Voltage	14.5 to 30 VDC
Current	3 amps
Command Signal (impedance) (select by ordering code)	0 ± 10 VDC (100K) 0 ± 20 mA (500 ohms)
Command Polarity	Pin 'D' more positive than 'E'; flow P to B
Ramp Time Adjustment	0 to 3 seconds
Environmental Protection Class	NEMA 1 (IP54)
Mating Connector (order separately) (7-pin CE)	Part #5004072

Series D*1FW without integrated electronics

Solenoid (order code "L")	
Nominal Resistance	2.2 ohms
Nominal Current	2.5 amps
Nominal Voltage	6 volts
Solenoid (order code "X")[1]	
Nominal Resistance	9.8 ohms
Nominal Current	1.3 amps
Nominal Voltage	16 volts
Environmental Protection Class	NEMA 1 (IP54)
Mating Connectors Solenoid (DIN 43650)	Part # 692914 (black) Part # 692915 (gray)

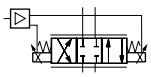
1) For use with 24 volt based electronic driver cards.

A

D		1	F	T			C					0		
Directional Control Valve	Size and Interface	Pilot Operated	Flow Control	Integrated Electronics	Spool Type	Flow	Style	Pilot Connection	Seal	Electronic Variation	Electronic Accessories	Valve Accessories	Design Series

NOTE: Not required when ordering.

Code	Description
3	NG10/CETOP 5
4	NG16/CETOP 7
9	NG25/CETOP 8

Code	Style
C	

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
0	Standard, no accessories
2	Pilot Pressure Reducer (2)

(2) Recommended for pilot pressure applications > 205 Bar (3000 PSI)

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

Code	Description
F	Voltage Input 0... ±10V (with reference output +10V/-10V)
G	Current Input 0... ±20mA

Sine Spool Options - Spool Type and Flow Codes

Code		Sine
$Q_A=Q_B$	$Q_A>Q_B$ [1]	Spool Type
E01	B31	
E02	B32	

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge		
	D31 LPM (GPM)	D41 LPM (GPM)	D91 LPM (GPM)
C	75 (20)	–	–
F	–	200 (53)	–
H	–	–	400 (106)

V-Notch Spool Options - Spool Type and Flow Codes

Code		V-Notch
$Q_A=Q_B$	$Q_A>Q_B$ [1]	Spool Type
E21	B41	
E22	B42	

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

1) Reduced Flow Rate on Port B, Nominal Flow Rate on Port A
Code A* for spool $Q_B>Q_A$ optional

Weight:

NG10	7.1 kg (16.0 lbs.)
NG16	10.8 kg (23.8 lbs.)
NG25	19.0 kg (42.0 lbs.)

Mating connector not included in delivery.

Accessories

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

Mounting Interface

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

D		1	F	W			C				W		
Directional Control Valve	Size and Interface	Pilot Operated	Flow Control	Open Loop	Spool Type	Flow	Style	Pilot Connection	Seal	Solenoid Voltage	Solenoid Variation	Valve Accessories	Design Series

NOTE: Not required when ordering.

Code	Description
3	NG10/CETOP 5
4	NG16/CETOP 7
9	NG25/CETOP 8

Code	Style
C	

Code	Description
L[2)]	6 VDC/2.5A
X	16 VDC/1.3A

2) Standard

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
0	Standard, no accessories
2	Pilot Pressure Reducer [(3)]

(3) Recommended for pilot pressure applications > 205 Bar (3000 PSI)

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

Code	Description
W	Socket Connector DIN 43650 without Plugs

Sine Spool Options - Spool Type and Flow Codes

Code		Sine Spool Type
$Q_A=Q_B$	$Q_A>Q_B$ [1)]	
E01	B31	
E02	B32	

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge		
	D31 LPM (GPM)	D41 LPM (GPM)	D91 LPM (GPM)
C	75 (20)	–	–
F	–	200 (53)	–
H	–	–	400 (106)

V-Notch Spool Options - Spool Type and Flow Codes

Code		V-Notch Spool Type
$Q_A=Q_B$	$Q_A>Q_B$ [1)]	
E21	B41	
E22	B42	

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

1) Reduced Flow Rate on Port B, Nominal Flow Rate on Port A
Code A* for spool $Q_B>Q_A$ optional

Weight:

NG10	7.1 kg (16.0 lbs.)
NG16	10.8 kg (25.0 lbs.)
NG25	19.0 kg (42.0 lbs.)

Accessories

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

Driver Cards

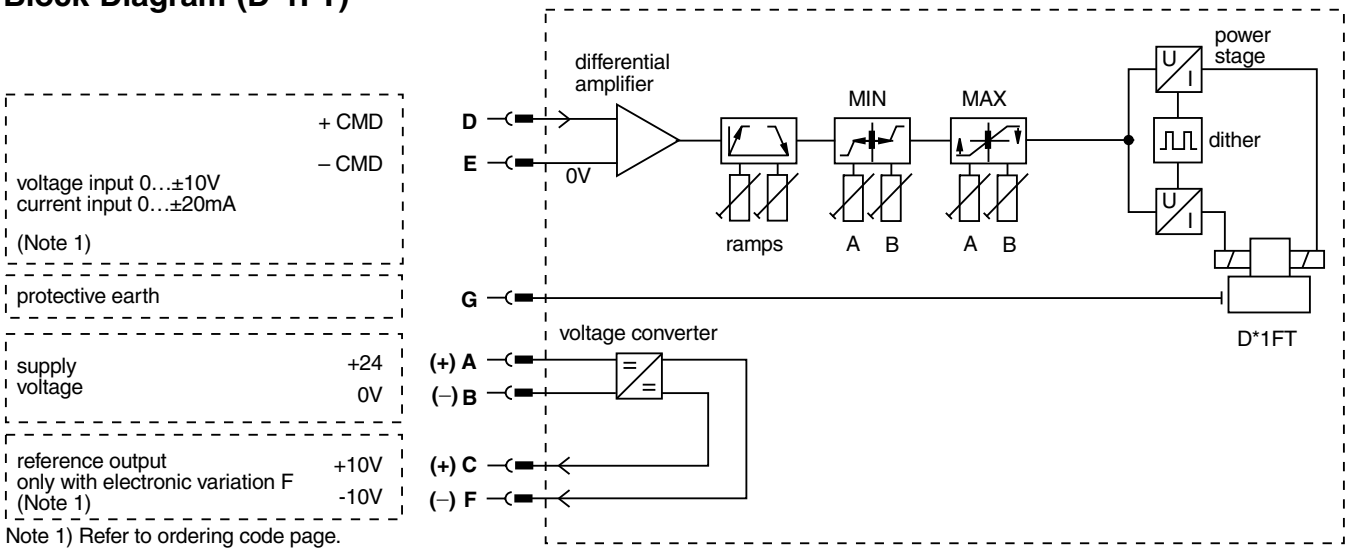
Refer to the Electronics section for driver cards and support electronics.

Mounting Interface

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

A

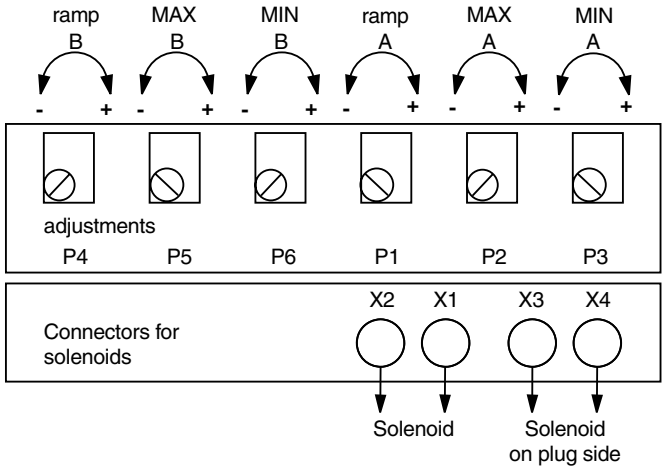
Block Diagram (D*1FT)



Note 1) Refer to ordering code page.

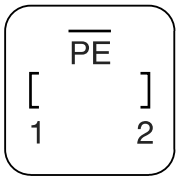
Integrated Control Electronics (D*1FT)

Arrangement of Potentiometers



Wiring D*1FW — Solenoid Coil

(without integrated electronics)

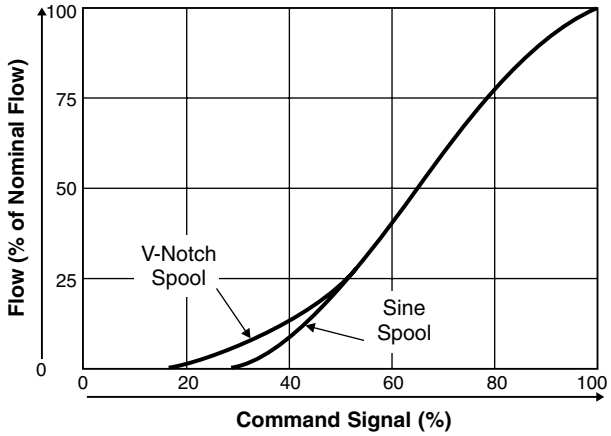


1 = coil connection
2 = coil connection
PE = ground potential

Performance Curves

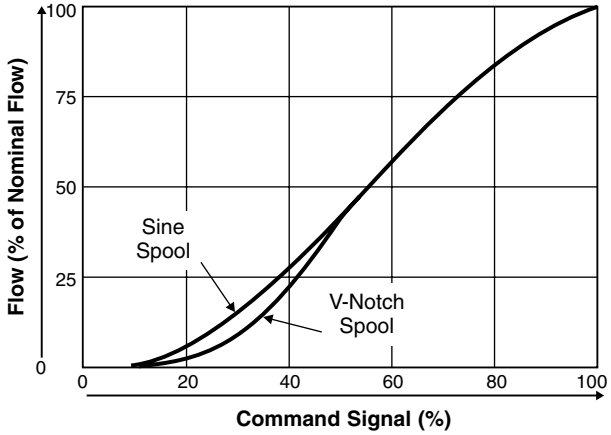
D*1FW Flow Characteristics

at Δp = 5 Bar (72.5 PSI) / metering edge



D*1FT Flow Characteristics (with integrated control electronics)

at Δp = 5 Bar (72.5 PSI) / metering edge



D_1FW-D_1FT.p65, dd

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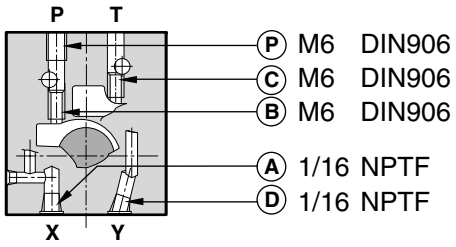
Hydraulic Valve Division
Elyria, Ohio, USA

A

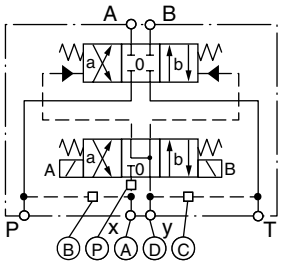
Pilot Connection

D31F*

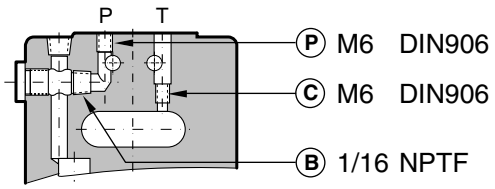


○ **open,** ● **closed**

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

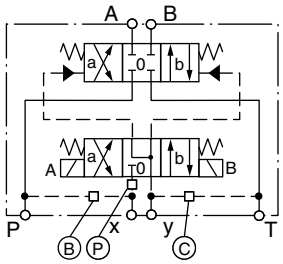


D41F*

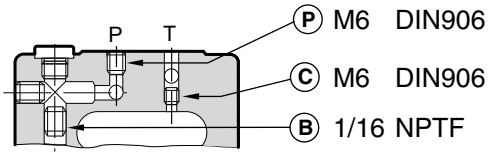


○ open, ● closed

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

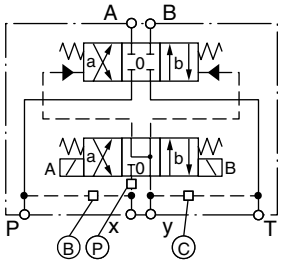


D91F*



○ open, ● closed

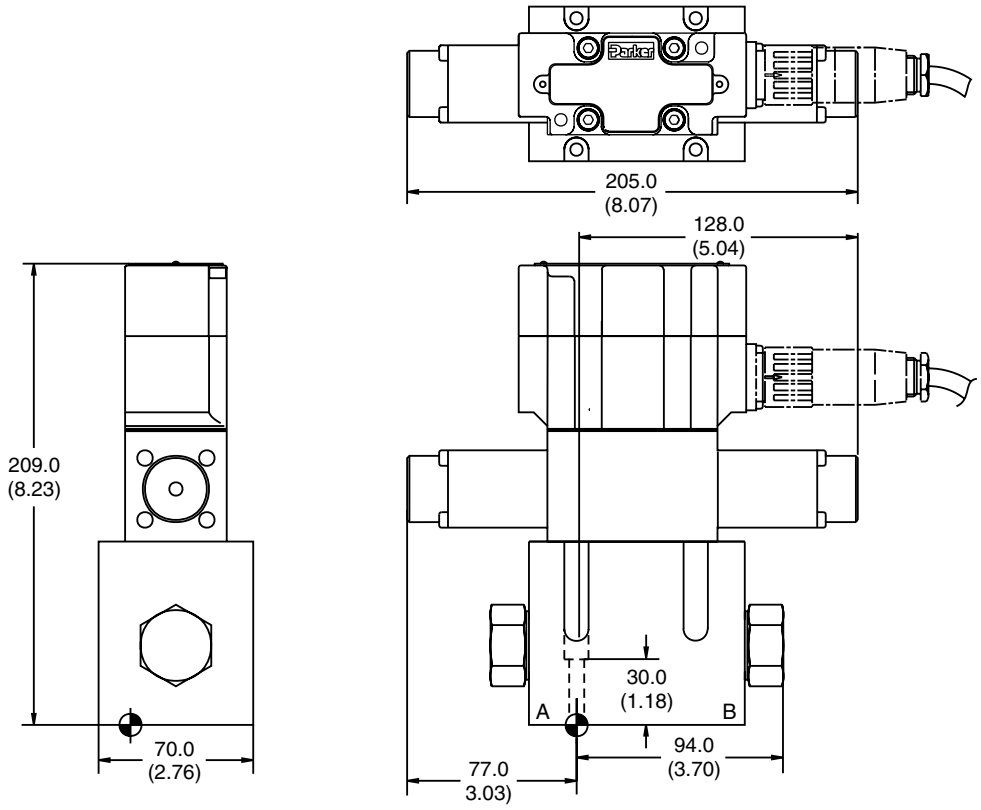
Pilot oil Inlet	Pilot oil Drain	B	C
internal	external	○	●
external	external	●	●
internal	internal	○	○
external	internal	●	○



A

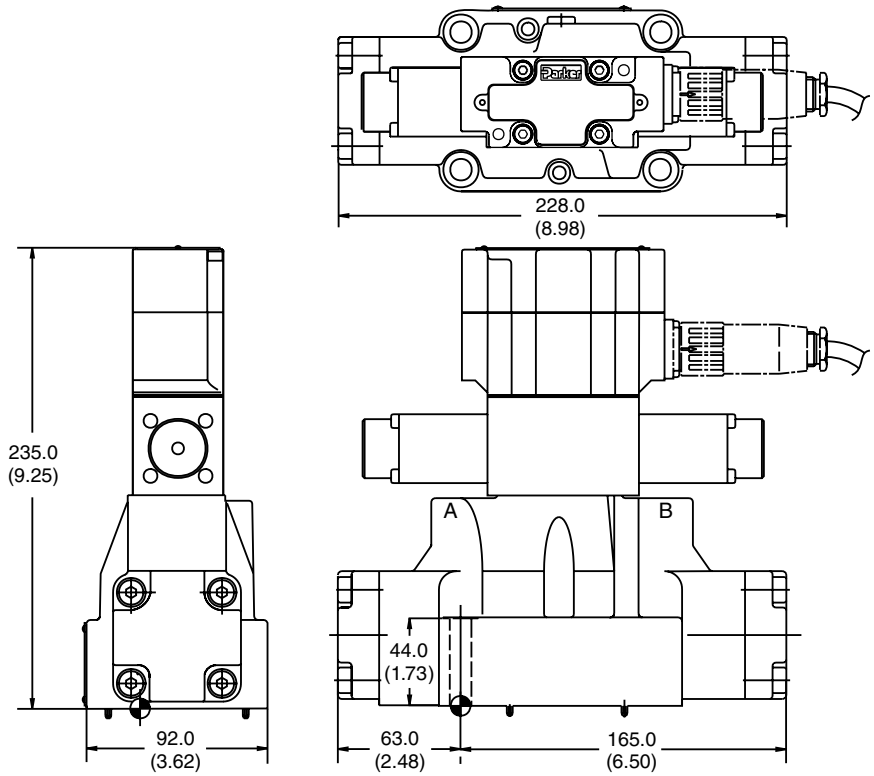
D31FT

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



D41FT

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



D_1FW-D_1FT.p65, dd

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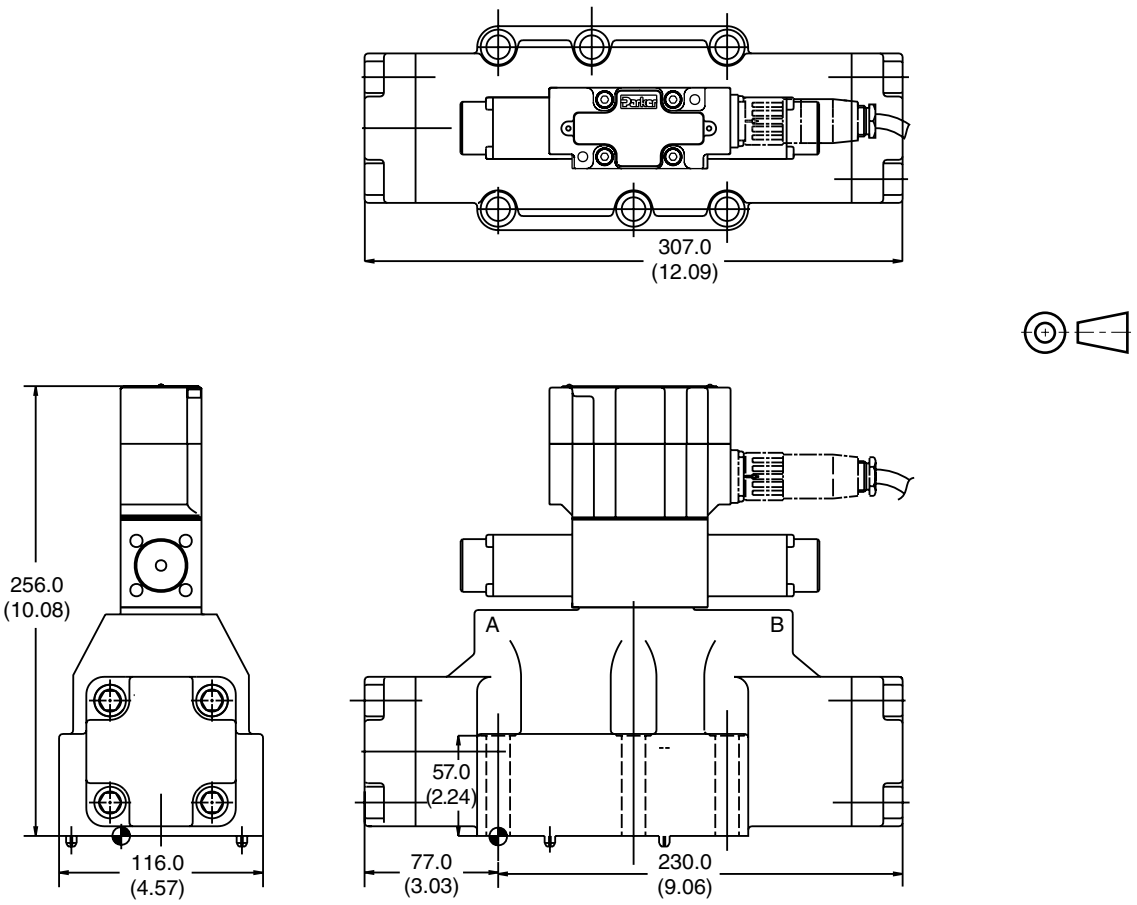
Hydraulic Valve Division
Elyria, Ohio, USA

A

D91FT

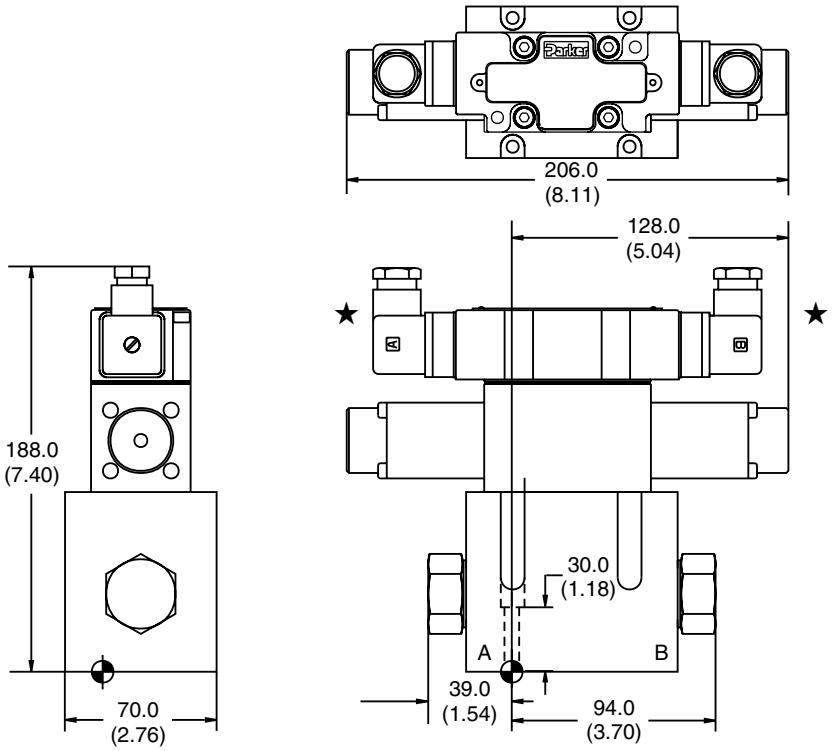
Inch equivalents for millimeter dimensions are shown in (**)



A

D31FW

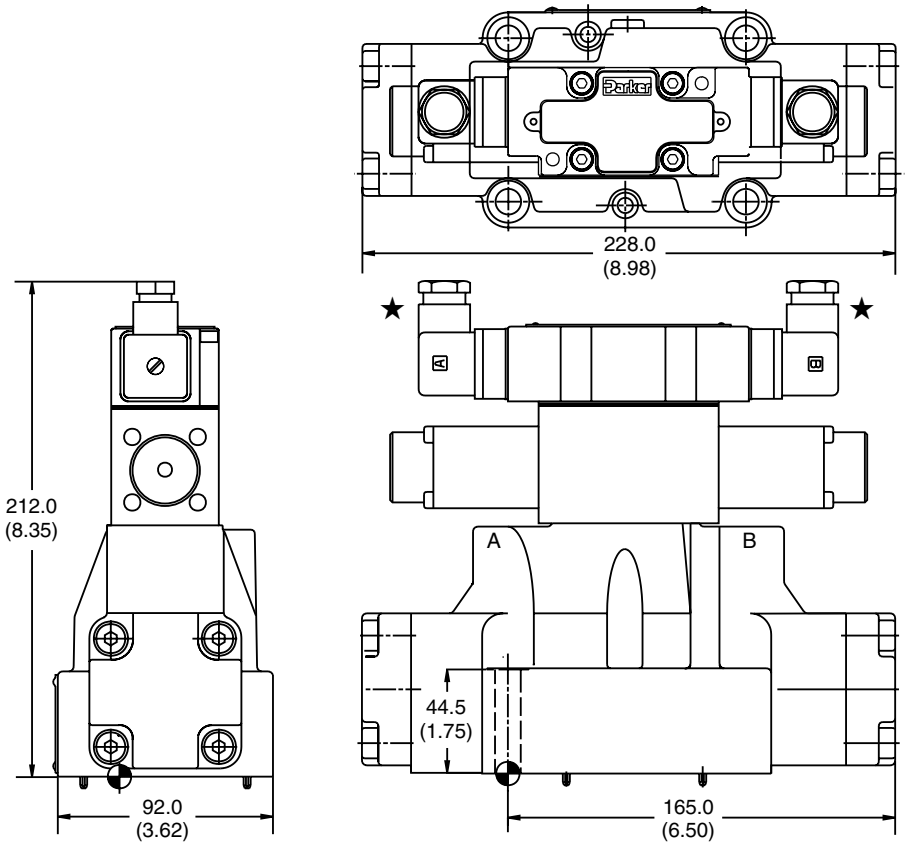
Inch equivalents for millimeter dimensions are shown in (**)



★ Order plugs separately.

D41FW

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

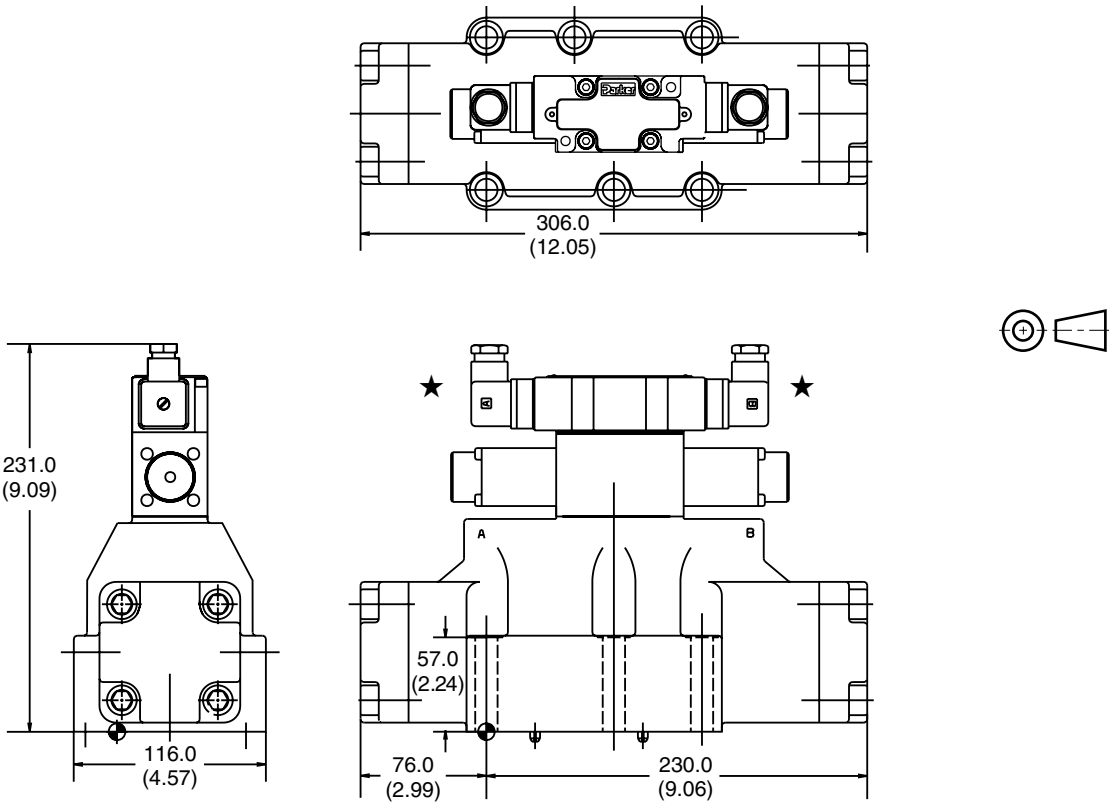


D_1FW-D_1FT.p65, dd

A

D91FW

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



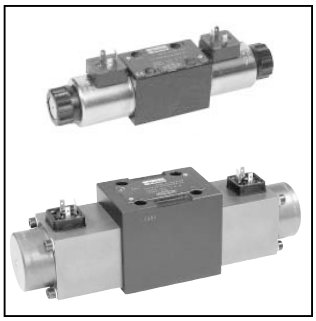
★ Order plugs separately.

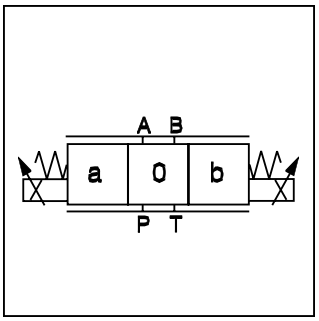
A

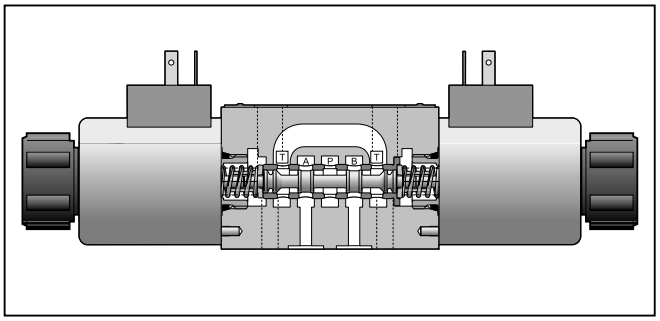
General Description

Series D1FB and D3FB directional control valves of nominal sizes NG6 (CETOP 3) and NG10 (CETOP 5) respectively, provide variable flow rates.

Due to a spool and sleeve combination with wire EDM window geometry the valves provide good repeatability from valve to valve. Series D1FB and D3FB valves are 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.





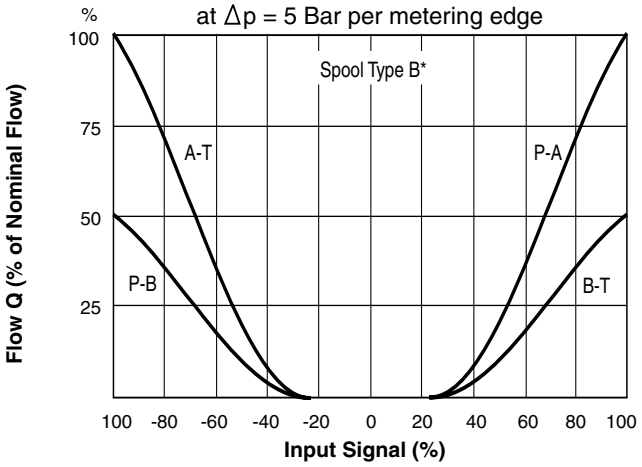


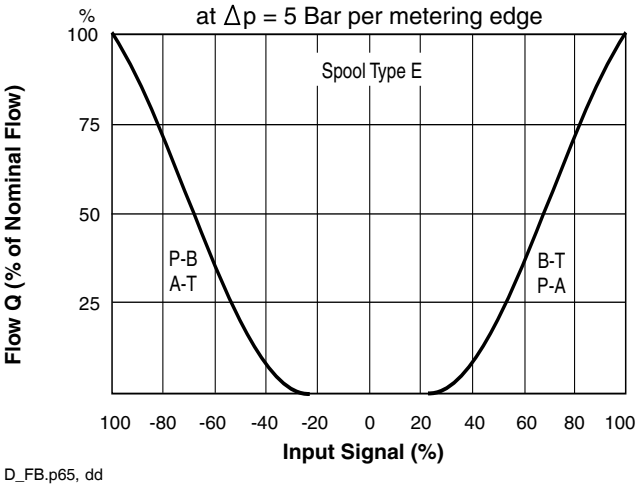
Features

- Spool/sleeve designs.
- High repeatability from valve to valve.
- Low hysteresis.
- Manual override.

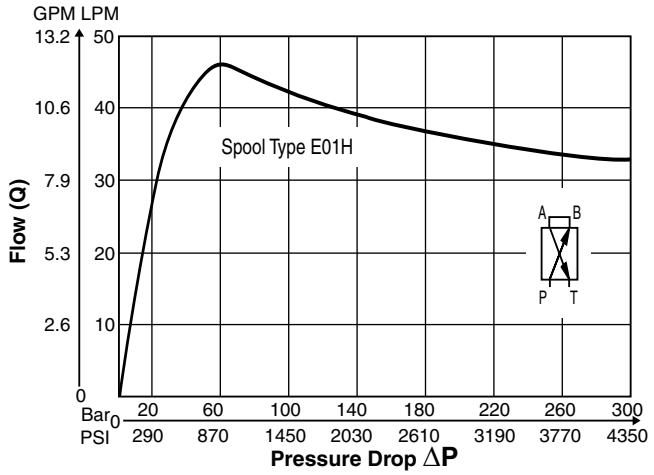
Performance Curves

D1FB and D3FB

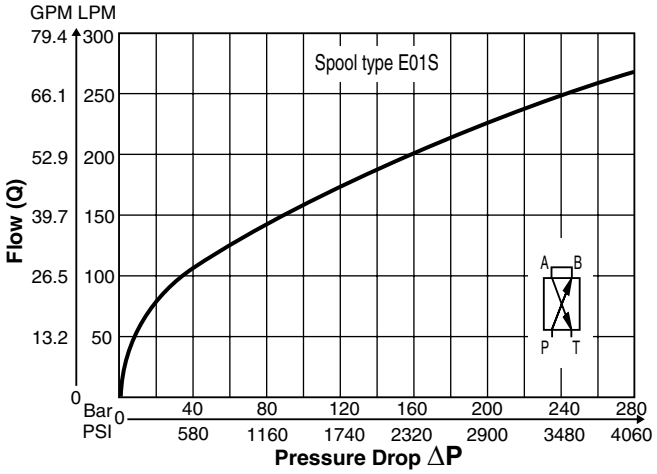




D1FB Flow Limit



D3FB Flow Limit



D_FB.p65, dd

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Elyria, Ohio, USA

A

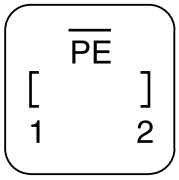
Specifications

General			
Design	Direct-operated proportional Directional control valve	**Ambient Temperature Range**	-20°C to +60°C (-4°F to +140°F)
Actuation	Proportional Solenoid	**Vibration Resistance**	25 g acc. DIN IEC68, part 2-6
Size	D1FB: NG6 (CETOP 3) D3FB: NG10 (CETOP 5)	**Protection Class**	D1FB: IP65 acc. DIN 40050 (plugged and mounted) D3FB: IP54
Mounting Interface	DIN 24340 / ISO 4401 / CETOP RP121 / NFPA		
Mounting Position	Any		
Hydraulic			
Operating Pressure Maximum	D1FB: Ports P, A, B: 350 Bar (5075 PSI) Port T: 250 Bar (3625 PSI) D3FB: Ports P, A, B, T: 350 Bar (5075 PSI)	**Viscosity Recommended**	30 to 80 cSt (140 to 370 SSU)
		Filtration	ISO 4406 (1999) 18/16/13 (acc. NAS 1683: 7)
Fluid	Hydraulic oil as per DIN 51524 to 535, other on request	**Flow**	nominal at Δp=5 Bar per control edge* D1FB: 6 / 12 / 20 LPM (1.6 / 3.2 / 5.3 GPM) D3FB: 25 / 40 / 60 LPM (6.6 / 10.6 / 15.9 GPM)
Fluid Temperature	-20°C to +60°C (-4°F to +140°F)		
Viscosity Permitted	20 to 380 cSt (97 to 1750 SSU)	**Leakage**	at 100 Bar (1450 PSI) D1FB: < 50 ml/min (3 in^3/min) D3FB: < 100 ml/min (6 in^3/min)
Electrical			
Duty Ratio	100%	**Resistance**	D1FB: 2.7 ohms D3FB: 1.8 ohms
Supply Voltage	9 VDC	**Coil Insulation Class**	F [155°C (311°F)]
Solenoid	Code M	**Connection**	2+PE acc. EN 175301-801
Current Consumption	D1FB: 2.7A D3FB: 3.4A	**Cable Specification**	3x1.5 (AWG 16) overall braid shield
Power Consumption	D1FB: 25 W D3FB: 31 W	**Cable Length**	50m (164 ft.)

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

Plug

Solenoid coil



1 = coil connection

2 = coil connection

PE = ground potential

A

D		F	B			0	N	M	W	0	
Directional Control Valves	Size	Flow Control	Open Loop	Spool	Style		Seals	Solenoid Voltage	Solenoid Accessories		Design Series

NOTE: Not required when ordering.

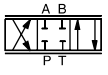
Code	Description
1	NG6/CETOP 3
3	NG10/CETOP 5

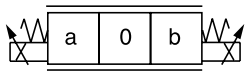
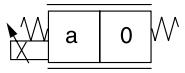
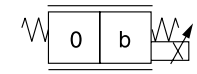
Code	Description	
M	D1FB	9V/2.7A
	D3FB	9V/3.4A
		Other current on request

Code	Description
N	Nitrile
	Others available on request

Code	Description
W	Socket Connector DIN 43650 without Plug

D1FB

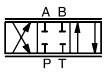
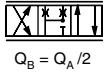
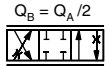
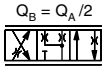
Code	Spool	Flow LPM (GPM) at Δp 5 Bar (72.5 PSI) per metering edge
E01H		20 (5.3)
E01F		12 (3.2)
E01C		6 (1.6)
E02H		20 (5.3)
E02F		12 (3.2)
E02C		6 (1.6)
E03H		20 (5.3)
E03F		12 (3.2)
E03C		6 (1.6)
B31H	$Q_B = Q_A/2$ 	20/10 (5.3/2.6)
B31F		12/6 (3.2/1.6)
B32H	$Q_B = Q_A/2$ 	20/10 (5.3/2.6)
B32F		12/6 (3.2/1.6)

Code	Style
C	
E	
K	

Weight:

NG6	2.2 kg (4.9 lbs.)
NG10	6.5 kg (14.3 lbs.)

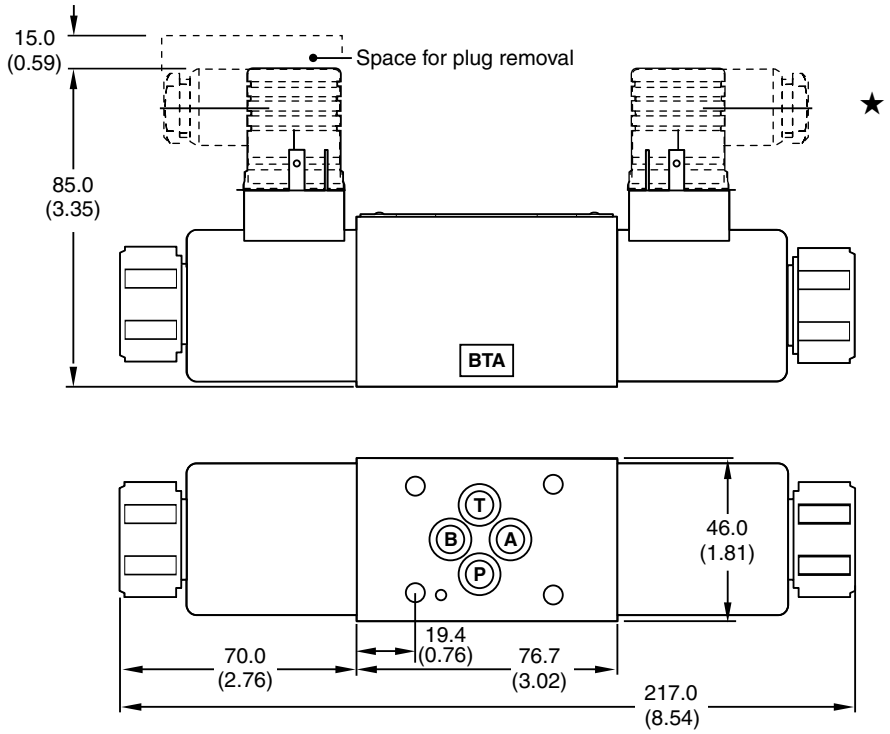
D3FB

Code	Spool	Flow LPM (GPM) at Δp 5 Bar (72.5 PSI) per metering edge
E01S		60 (15.9)
E01M		40 (10.6)
E01K		25 (6.6)
E02S		60 (15.9)
E02M		40 (10.6)
E03S		60 (15.9)
E03M		40 (10.6)
B31S	$Q_B = Q_A/2$ 	60/30 (15.9/7.9)
B31M		40/20 (10.6/5.3)
B32S	$Q_B = Q_A/2$ 	60/30 (15.9/7.9)
B32M		40/20 (10.6/5.3)

Please order plugs separately. See Accessories.

D1FB*C

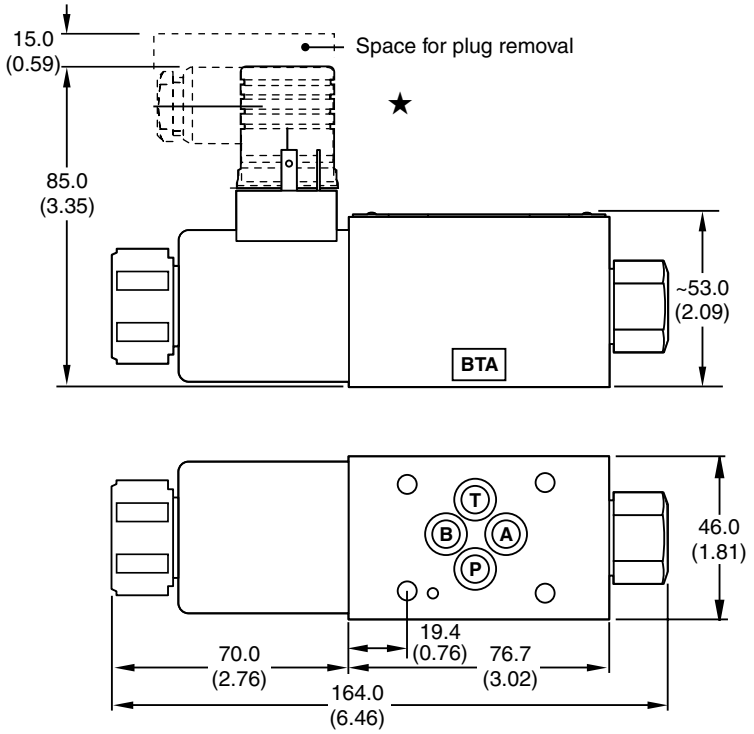
Inch equivalents for millimeter dimensions are shown in (**)



D1FB*K

★ Order plugs separately.

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



Surface finish	Kit			Kit NBR
$R_{max}6.3$ 0.01/100	BK375	4x M5x30 DIN 912 12.9	6.8 Nm (5.0 lb.-ft.) ±15 %	SK-D1FB-N
	BK209	4x10-24x1.25"	6.8 Nm (5.0 lb.-ft.)	

D_FB.p65, dd

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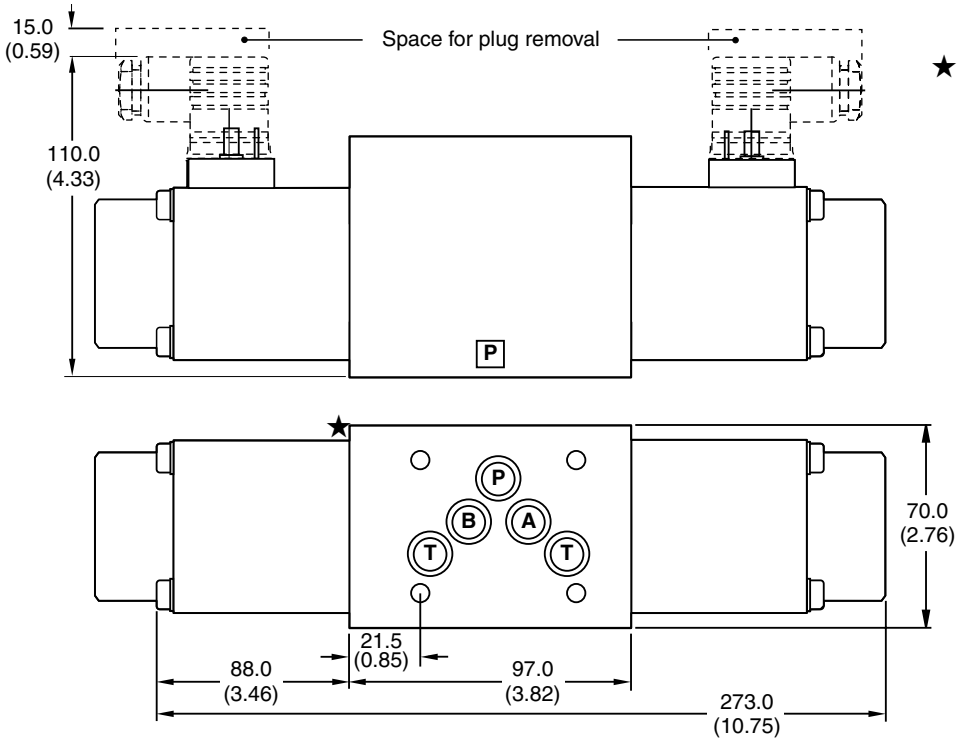
A

D3FB*C

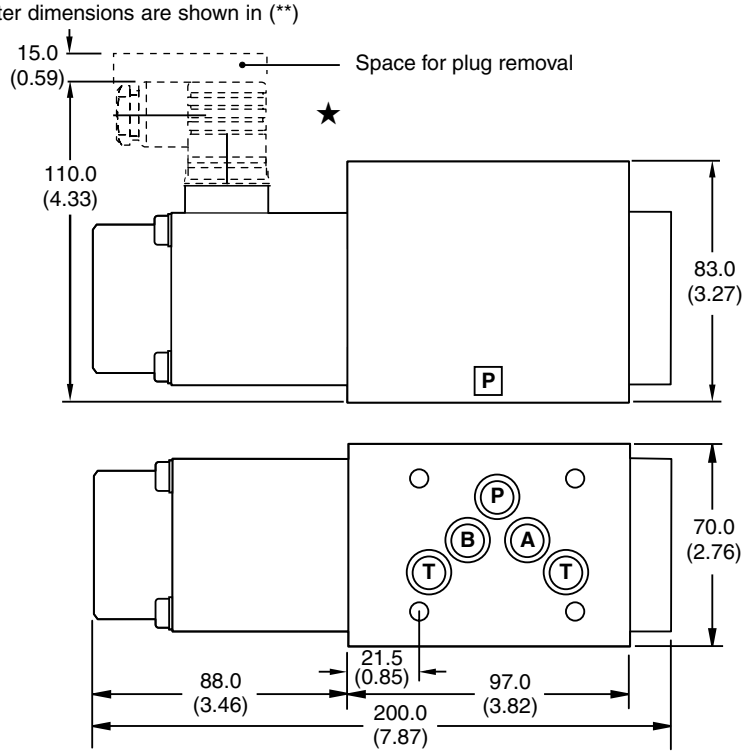
Inch equivalents for millimeter dimensions are shown in (**)



D3FB*K

★ Order plugs separately.

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



Surface finish	Kit			Kit NBR
$\sqrt{R_{max}6.3}$ ▱ 0.01/100	BK385	4x M6x40 DIN 912 12.9	11 Nm (8.1 lb.-ft.) ±15 %	SK-D3FB-N
	BK98	4x1/4-20x1.625"	11 Nm (8.1 lb.-ft.)	

D_FB.p65, dd

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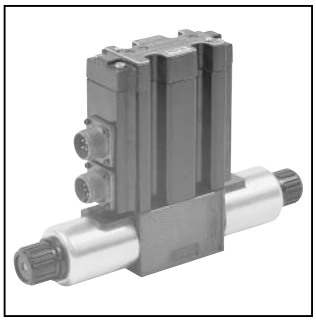
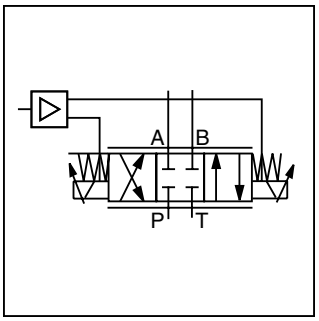
General Description

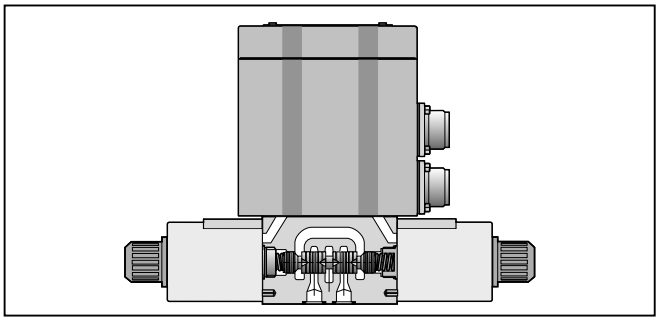
Series D**FL proportional directional control valves are packaged with an integrated microprocessor based open-loop motion profiler. The valve directly accepts electrical on/off logic signals which trigger simple motion profiles controlling actuator speed, acceleration, and deceleration.

D**FL valves are user configurable to operate in one of two control modes: 'Slow Shift' or 'Motion Profiler'. Refer to application guidelines for details. Both DC and AC voltage logic interfaces are available providing a direct interface to PLC's, for a simple field upgrade from AC operated directional valves.

Valves are available in sizes NG6 (CETOP 3), NG10 (CETOP 5), NG16 (CETOP 7) and NG25 (CETOP 8).







Features

- Integrated microprocessor based valve electronics.
- On-board, open-loop motion control profiler.
- Optically isolated 'on-off' inputs trigger motion profiles.
- User selectable operation modes: Slow Shift or Profiler.
- Test points indicating speed and ramp settings.
- On-board microprocessor self diagnostics on start-up.
- LED functional diagnostic indicators.
- Spring centered spool.
- Manual overrides.

Specifications

Interface DIN (NFPA/ISO/CETOP)		**NG6 (3)**	**NG10 (5)**	**NG16 (7)**	**NG25 (8)**
Flow Rating @10 Bar (150 PSI) Δp (P→A, B→T) (spool options up to)[1]	LPM (GPM)	20 (5.3)	60 (15.9)	100 (26)	200 (53)
Maximum Flow (refer to operating limits curves)	LPM (GPM)	30 (8)	118 (31)	144 (38)	372 (98)
Pilot Flow					
Continuous	LPM (GPM)	N/A	N/A	<1.2 (0.3)	<1.2 (0.3)
Step Input	LPM (GPM)	N/A	N/A	2.2 (0.6)	4.5 (1.2)
Operating Performance (Refer to valve model)		D1FT	D3FT	D41FT	D91FT
Operating Pressure					
Port P, A, B	Bar (PSI)	315 (4500)		345 (5000)	max.
Port P, internal pilot		N/A		20 (290)	min.
Port T, internal drain		35 (500)		10 (150)	max.
Port T, external drain		N/A		345 (5000)	max.
Port Y, pilot drain		N/A		10 (150)	max.
Port X, external pilot		N/A		20-345 (290-5000)	
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)			
Ambient Operating Temperature		-20°C to +60°C (-20°F to +140°F)			

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

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

A

D*FL — Proportional Directional Control Valves with Intergrated Motion Control Electronics

Code	Description
D1FL	NG6/CETOP 3
D3FL	NG10/CETOP 5

See Note 1.

Spool Type

Code		
$Q_A=Q_B$	$Q_A>Q_B$ [1]	Spool Type
E01	B31	
E02	B32	

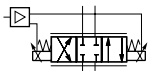
1) Reduced flow rate on Port B, nominal flow on Port A.

Flow

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge	
	D1FL LPM (GPM)	D3FL LPM (GPM)
C	7.5 (2.0)*	–
F	15 (4.0)	–
H	20 (5.3)*	20 (5.3)*
M	–	40 (10.6)
S	–	60 (15.9)*

* Only with spool type E*

C — Style

Code	Style
C	

Seal

Code	Description
N	Nitrile
V	Fluorocarbon

Electronic Variation

Code	Description
T	AC Voltage Logic Interface
W	DC Voltage Logic Interface

J — Supply Voltage

Code	Description
J	24 VDC

0 — Electronic Accessories

Valve Accessories

Code	Description
0	Standard
4	CSA Approved

Design Series

NOTE: Not required when ordering.

Note 1: NG10 (CETOP5) valves are supplied with bolt kit BK98 (1/4-20 x 1.625). For metric bolt kit BK385 (M6 x 40 mm), add "-X6181" to ordering code.

Weight:

NG6	3.2 kg (7.0 lbs.)
NG10	7.9 kg (17.5 lbs.)

DFL** — Pilot Operated Proportional Directional Control Valves with Intergrated Motion Control Electronics

Code	Description
D41FL	NG16/CETOP 7
D91FL	NG25/CETOP 8

Spool Type

V-Notch Spools			
Code			Spool Type
$Q_A=Q_B$	$Q_A>Q_B$	$Q_B>Q_A$	
E21	B41	A41	
E22	B42	A42	

Flow

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge	
	D41FL LPM (GPM)	D91FL LPM (GPM)
D	100 (26.5)	–
F	–	200 (53)

C — Style

Pilot Connection

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

Seal

Code	Description
N	Nitrile
V	Fluorocarbon

Electronic Variation

Code	Description
T	AC Voltage Logic Interface
W	DC Voltage Logic Interface

0 — Electronic Accessories

Valve Accessories

Code	Description
0	Standard
2	Pilot Pressure Reducer[3]
4	CSA Approved

(3) Recommended for pilot pressure applications >205 Bar (3000 PSI)

Design Series

NOTE: Not required when ordering.

Weight:

NG16	10.9 kg (24.0 lbs.)
NG25	19.1 kg (42.0 lbs.)

Mounting Interface

Refer to 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.

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Supply Voltage	V	12 to 28	
Maximum Current	A	3.5	
Motion Profile Adjustment Speed Ramps (minimum limited by actual valve step response)		User set; potentiometers inside electronics enclosure. 0 to 100% valve opening; two speeds forward, two speeds retract. 0.025 to 15 seconds; one acceleration, two deceleration adjustments. Shared both forward/retract.	
Test Points V1, V2, V3, V4 R1, R2, R3		Inside electronics enclosure. 0 to 5 volts, corresponding to 0 to 100% valve opening, or speed. 0 to 5 volts, corresponding to 0.025 to 15 seconds ramp time.	
Logic Interface Ordering code field: Electrical variation (options available all valve sizes)		**W**	**T**
Electrical Isolation		DC Optical-Coupled	AC Optical-Coupled
Polarity		Signal pins A, C & E; referenced to 0V pins B, D & F respectively.	Signal pins A, C & E; referenced to AC neutral pins B, D & F respectively.
Input Impedance	ohms	>2000	>2000
Input Voltage, Absolute Max.	V	28 VDC	130 VAC
Logic "on" (1), Min. Voltage	V	>9.6 VDC	>96 VAC
Logic "on" (1), Current	mA	3.2 mA	3.2 mA
Logic "off" (0), Min. Voltage	V	<6.0 VDC	<51 VAC
Logic "off" (0), Current	mA	3.2 mA	3.2 mA
Mating Connectors (order separately) **Power Supply Connector** **Logic Input Connector**		Part # 1210292 (4-pin MS) Part # MS3106E-14S-6S (6-pin MS)	

Application Guidelines

The D**FL series proportional valves accept discrete on/off logic signals which trigger simple motion profiles controlling actuator speed, acceleration, and deceleration. All motion control potentiometer adjustments and jumper headers are located inside the electronics enclosure. Two modes of operation are user selectable by a jumper setting (JP1): 'Motion Profiler' or 'Slow Shift'. The 'Motion Profiling' mode provides two-speed velocity control typically used in rapid traverse and feed circuits. The 'Slow Shift' provides single velocity control. Both modes allow individual speed adjustment for actuator extend and retract. Ramp adjustments for extend and retract profiles are shared.
Refer to **Interface and Motion Profile** diagrams on the following pages.

Both DC and AC voltage logic interfaces are available. Refer to ordering code field 'Electronic Variation' and the technical data sheet for more information. Note that the interface connections are polarity sensitive. Refer to the block diagram and technical specifications.

Refer to the Installation Guide for set-up, configuration, and application guidelines (packaged with each valve):

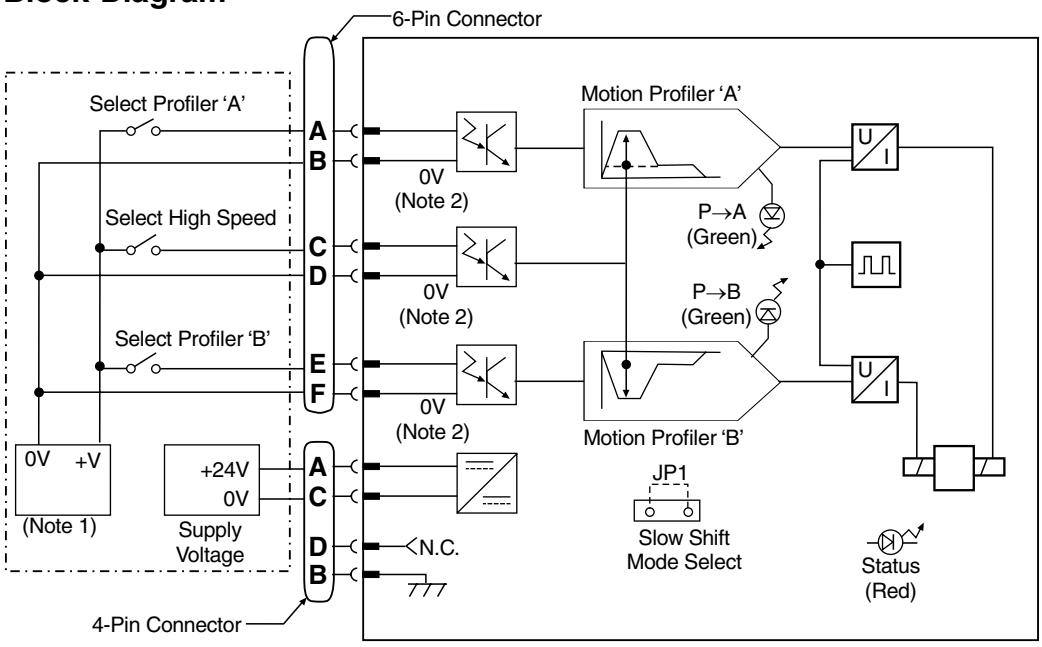
D1FL: Installation Guide Bulletin 2589-M2/USA

D3FL: Installation Guide Bulletin 2589-M3/USA

D41FL,
D91FL: Installation Guide Bulletin 2589-M1/USA

A

Block Diagram

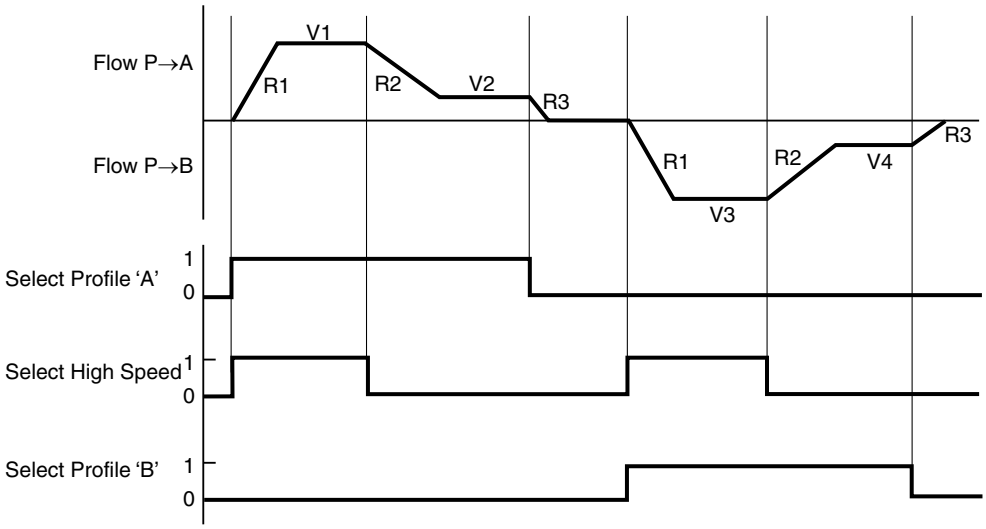


Notes:

1) DC logic source shown, refer to technical data for A.C.
2) 0V reference for DC interface, neutral for AC version.

Interface — 'Motion Profiler' mode (see timing diagram below)

The 'Motion Profiler' mode is selected by removing connecting jumper 'JP1' on the electronics card inside the electronics enclosure. To trigger a rapid traverse, opening the valve P→A / B→T; apply a positive logic signal to logic inputs 'Select Profile A', and 'Select High Speed' (6-pin connector input pins A&B, and C&D). The valve will smoothly accelerate the actuator to the velocity set by potentiometer 'V1', at a ramp rate set by potentiometer 'R1'. When logic input 'Select High Speed' is deselected the actuator will smoothly decelerate the actuator to the feed velocity set by Potentiometer 'V2', at a ramp rate set by potentiometer 'R2'. When logic input 'Select ProfileA' is deselected the actuator will smoothly decelerate the actuator to a stop at a ramp rate set by potentiometer 'R3'. When neither 'Select Profile' inputs are selected, regardless of the 'Select High Speed' input state, the valve is held in the centered hydraulic condition. Reversing the actuator, directing flow P→B / A→T, follows the same logic using logic input 'Select Profile B'. Refer to the timing diagram below for the corresponding potentiometers. Note that although all four speeds are independent, the three ramps are shared by both 'A' and 'B' profiles.



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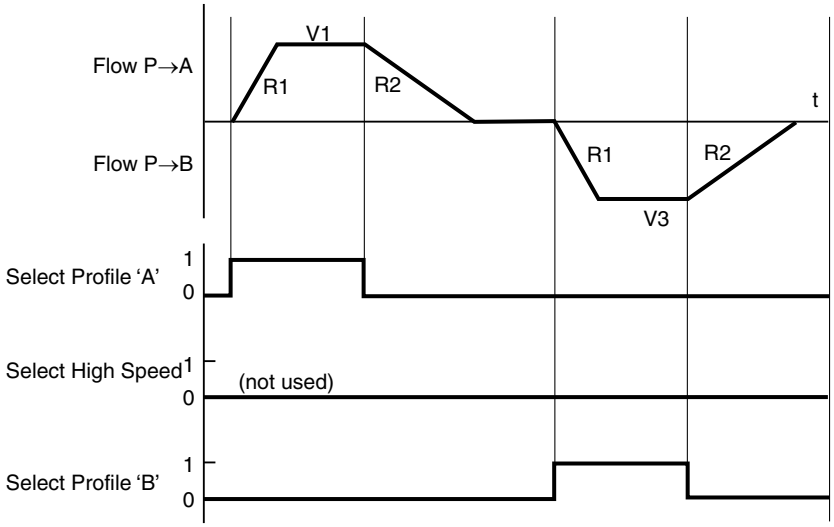
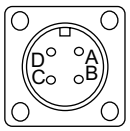
Interface — 'Slow Shift' mode (see timing diagram below)

The 'Slow Shift' mode is selected by connecting jumper 'JP1' on the electronics card inside the electronics enclosure. The 'Slow Shift' mode logically operates the same as the 'Motion Profiler' mode, except the 'Select High Speed' logic input is not used and only one speed for each actuator direction is available.

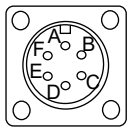


4-Pin Power Supply Plug



Pin	Description
A	Supply Voltage
B	Protective Ground
C	Supply 0V
D	Not Used

6-Pin Logic Input Plug

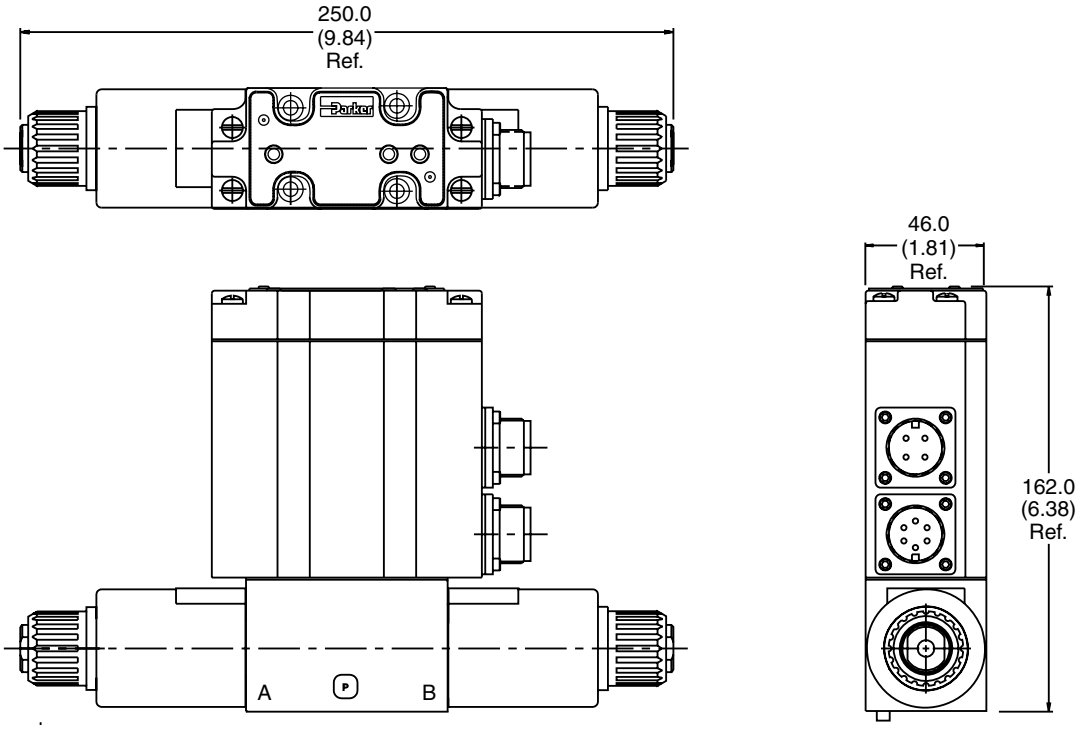


Pin	Description
A	Select Profile "A" (+)
B	Select Profile "A" (0V or neutral)
C	Select "High Speed" (+)
D	Select "High Speed" (0V or neutral)
E	Select Profile "B" (+)
F	Select Profile "B" (0V or neutral)

A

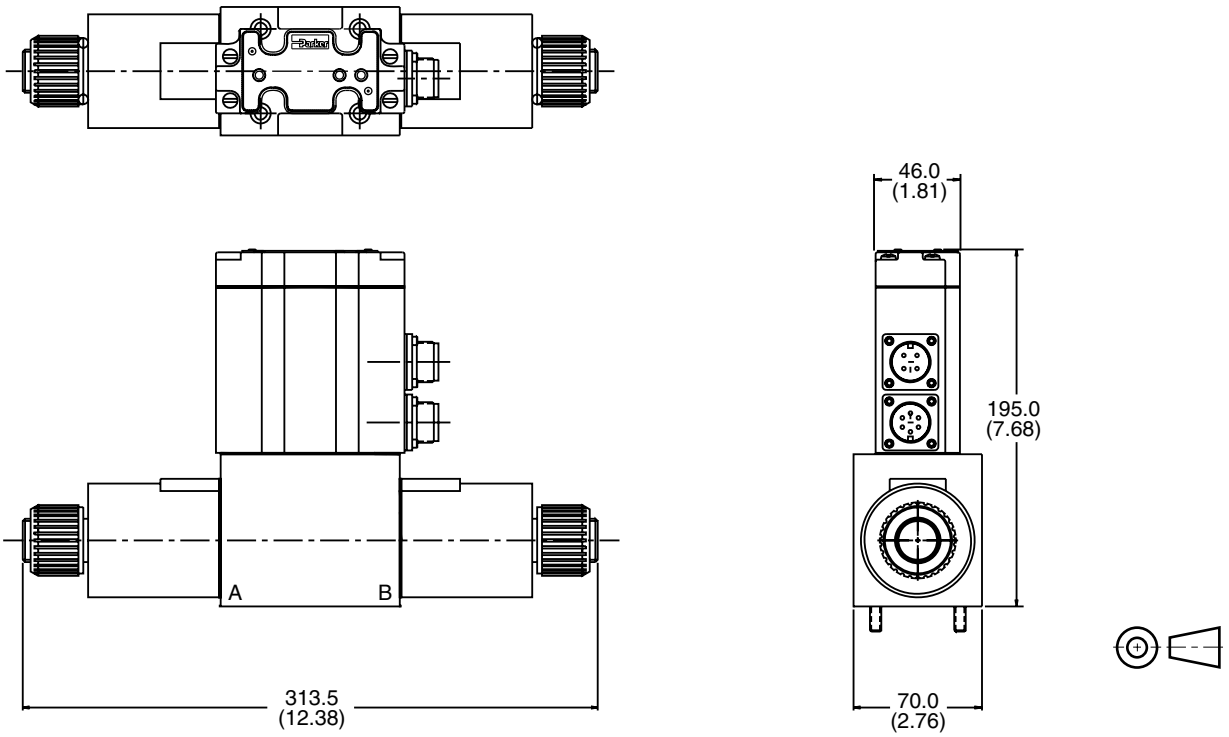
D1FL

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



D3FL

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



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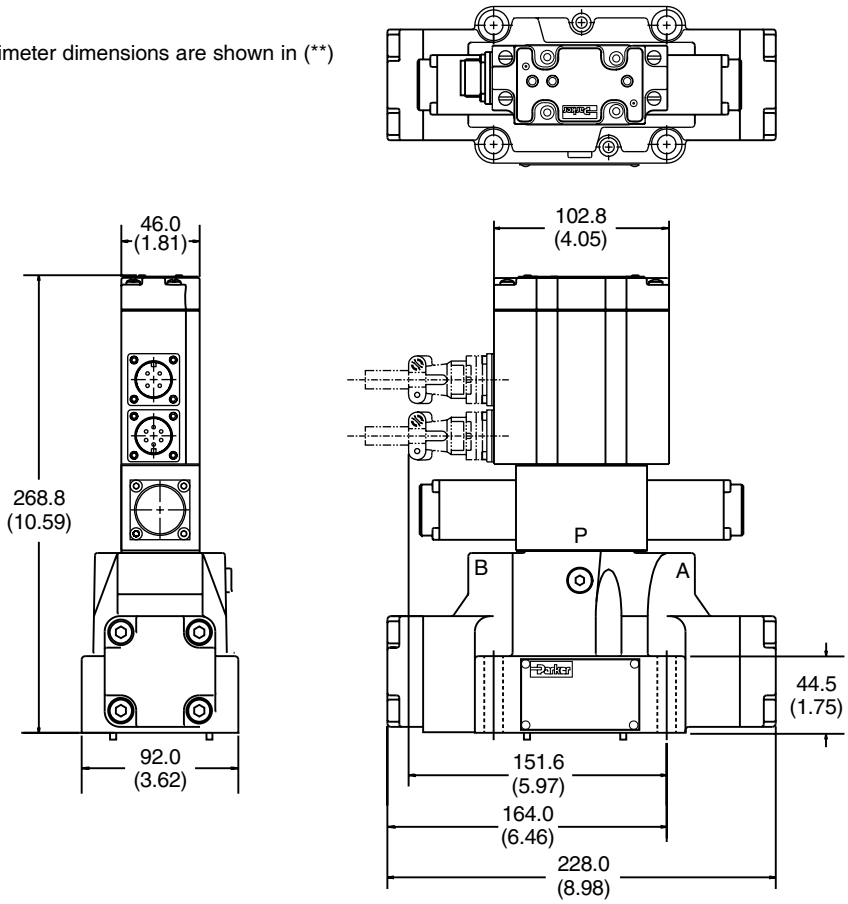
A

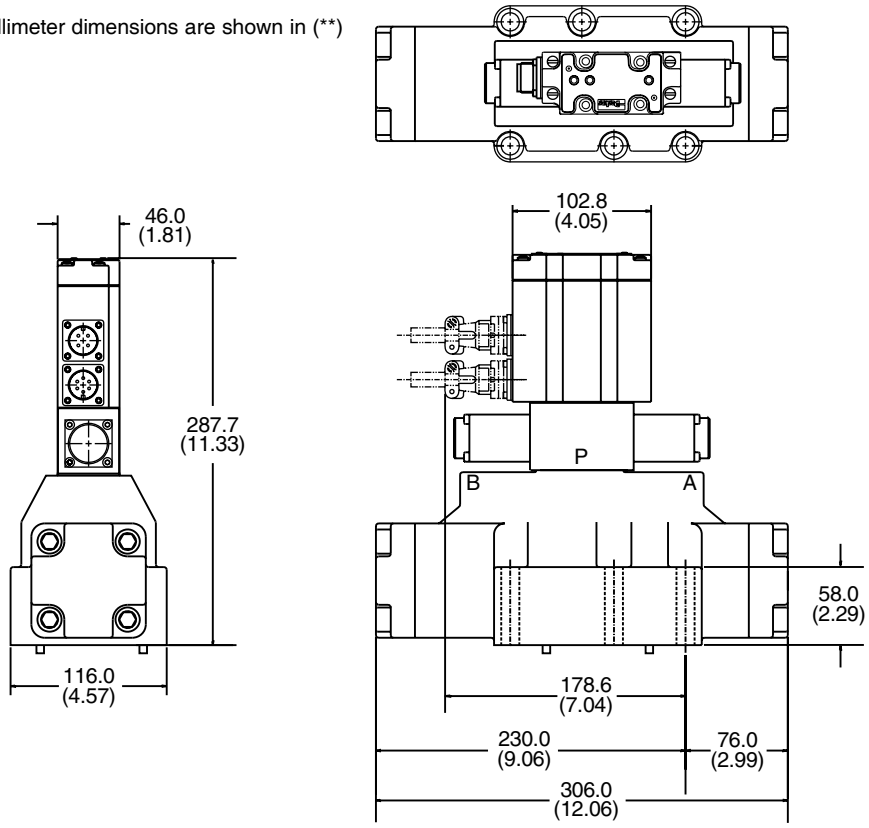
D41FL

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



D91FL

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



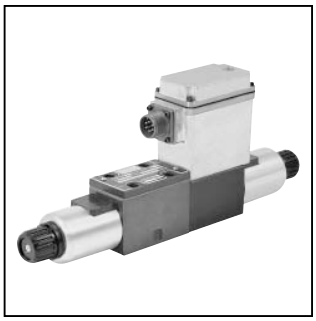
A

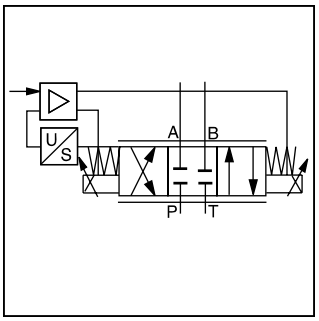
General Description

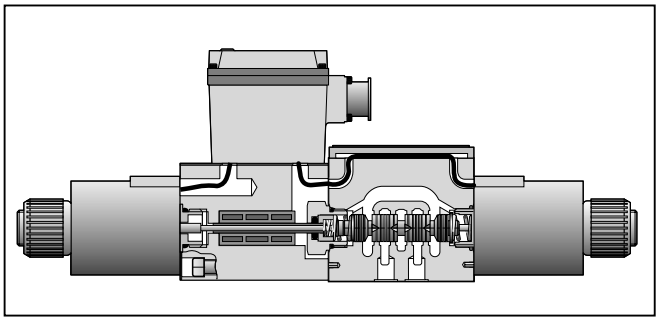
Series D*FX proportional directional control valves are direct operated solenoid valves with electronic spool position feedback, and on-board integrated control electronics. D*FX valves are user configurable to proportionally control flow in response to voltage or current command signals. Valves are available in sizes NG6 (CETOP 3) and NG10 (CETOP 5).

Three electronic control options are available simplifying user application. Configurations include the industrial standard 7-pin interface, or options for a user configurable simple proportional analog outer closed loop, or ± 10V reference outputs which can be used as user command voltage references.

D*FX valve performance is characterized by high resolution flow control, repeatability, and good dynamic performance. Typical applications include precise and reproducible control of actuator speed in rapid/slow speed profiling, and smooth acceleration and deceleration performance.







Features

- Integrated valve electronics.
- Versatile electronic control options.
- Spool position feedback.
- Spring centered spool.
- Manual override.
- Progressive flow characteristics for high resolution flow rate adjustment for small commands.
- LED functional diagnostics.

Specifications

Interface DIN (NFPA/ISO/CETOP)	**NG6 (3)**	**NG10 (5)**
Flow Rating @10 Bar (150 PSI) Δp (P→A, B→T) (spool options up to)[1] LPM (GPM)	20 (5.3)	60 (15.9)
Maximum Flow LPM (GPM)	47 (12.5)	170 (45)
Step Response (time to reach 90% of a 100% step command) ms	60	75

Hysteresis %	<1.5
Repeatability %	<0.5
Max. Operating Pressure Port P, A, B Bar (PSI) Port T	 315 (4500) 35 (500)
Fluid Cleanliness Level	ISO Class 18/16/13
Fluid Viscosity, Recommended	75 – 600 SSU
Fluid Temperature, Recommended	0°C to +60°C (+32°F to +140°F)
Ambient Operating Temperature	-20°C to +60°C (-20°F to +140°F)
Electrical Power Requirements 24V Version 'J': NG6 (03) 24V Version 'J': NG10 (05) 12V Version 'K': NG06 (03) only	 18 to 30 VDC, 3A 18 to 30 VDC, 4A 11.5 to 15 VDC, 4A

Command Signal (impedance) (select by ordering code) 24V Version 'J' 12V Version 'K'	 0 ± 10 VDC (100K ohm) 0 ± 20 mA (499 ohm) 0 ± 5 VDC (100K ohm) 0 ± 20 mA (249 ohm)
Command Polarity	Pin 'D' more positive than 'E'; Flow P to A
Spool Position Monitor 24V Version 'J' 12V Version 'K'	 0 ± 10 VDC 0 ± 5 VDC
Mating Connector 7-Pin CE for Electronic Design 'B' 6-Pin for Electronic Design 'C' & 'D'	 Part #5004072 Part #697561
Environmental Protection Class	NEMA 4 (IP65)

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

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

A

D*FX

Proportional Directional Flow Control Valve with Spool Position Feedback and Integrated Electronics

Code	Nominal Size
D1FX	NG6/CETOP 3
D3FX	NG10/CETOP 5

Spool Type | Flow | Style | Seal | Electronic Design | Supply Voltage | 0 Electronic Accessories | 0 Valve Accessories | Design Series

NOTE: Not required when ordering.

Code	Description
J	24 VDC
K	12 VDC*

* Available only with D1FX Electronic Design Codes C & D.

Code			Spool Type
$Q_A=Q_B$	$Q_A>Q_B$*	$Q_B>Q_A$**	
E01	B31	A31	
E02	B32	A32	
E85***	–	–	

* Reduced flow rate on port B.

** Reduced flow rate on port A.

*** 5% lap spool for special applications. Consult Factory;
D1FX: Flow code F, C style only.
D3FX: Flow code M, C style only.

Code	Description*
B	Standard CE Compliant
C	On-board Configurable Outer Closed Loop
D	On-board ±10V Reference Voltages

*All designs are user configurable to voltage or current command.

Code	Description
N	Nitrile
V	Fluorocarbon

Note: NG10 (CETOP5) valves are supplied with bolt kit BK98 (1/4 – 20 x 1.625). For metric bolt kit BK385 (M6 x 40 mm), add "-X6181" to ordering code.

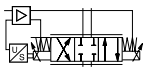
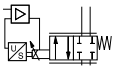
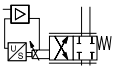
Weight:

NG6	3.4 kg (7.5 lbs.)
NG10	8.3 kg (18.3 lbs.)

Code	Flow at Δp 5 Bar (72.5 PSI) per metering edge	
	D1FX LPM (GPM)	D3FX LPM (GPM)
C	7.5 (2)*	–
F	15 (4)	–
H	20 (5.3)*	20 (5.3)*
K**	–	30 (7.9)
M	–	40 (10.6)
S	–	60 (15.9)*

* Spool type E only.

** Spool type E01 only.

Code	Style
C	
K	
E	

Mounting Interface

Refer to 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.

A

Application Guidelines

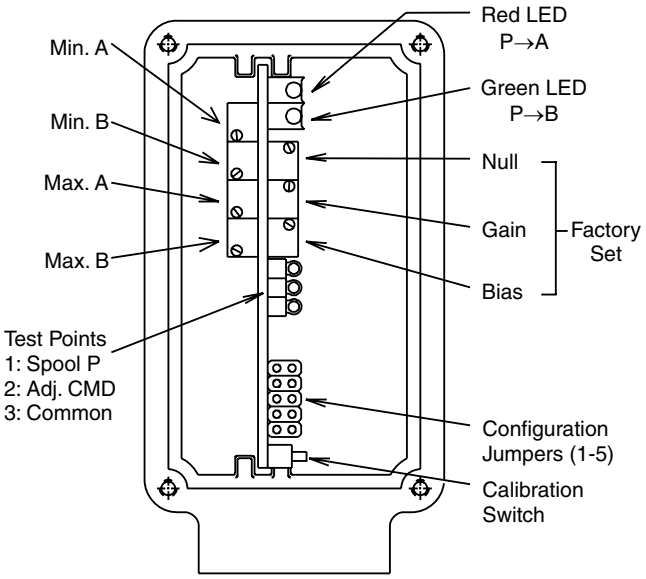
D*FX proportional valves are available in three control configurations. Option 'B' conforms to the industrial proportional valve standard and is interchangeable with most competitors' valves of this type. Options 'C' and 'D' are designed to simplify user application by providing specific features. Note that the 'B' control option uses the industrial standard CE compliant 7-pin MS connector while options 'B' and 'C' use a 6-pin MS conenctor. Refer to the table below for connector pin-out assignments.

Specifications		Electronic Design Option		
		'-B'	'-C'	'-D'
Function		Connector Pin Assignment		
Power Supply	+V	A	E	E
	0V	B	D	D
Reference	+10V	–	A	A
Outputs	-10V	–	F	F
Enable		C	–	–
Command	+CMD	D	B	B
	-CMD	E	–	–
Spool Position Monitor		F	–	C
Outer Loop Feedback – user		–	C	–
Protective Ground		G	–	–

Internal Adjustment

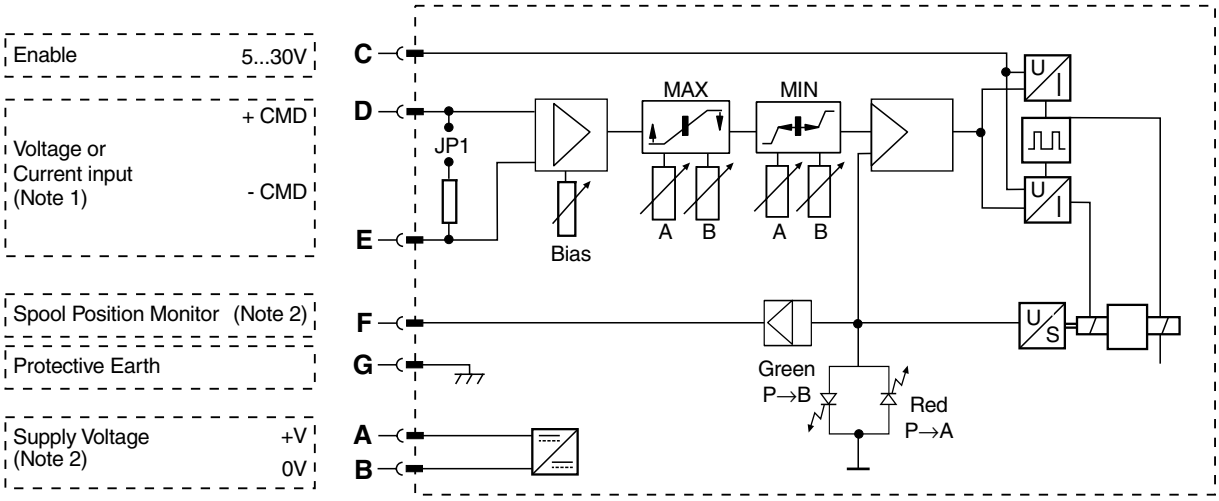
Refer to the Installation Guide for set-up, configuration, and application guidelines (packaged with each valve).

D1FX: Installation Bulletin 2583-M1/USA
D3FX: Installation Bulletin 2587-M1/USA



Design 'B' Option — Industrial Standard 7-Pin MS Connector Interface

Electronic design option 'B' implements the industrial standard 7-pin MS connector interface. The design provides a differential command input that is user configurable as voltage or current, an external valve enable feature, and a spool position monitor output. To specify this option, refer to the Ordering Information page, Electronic Design block.

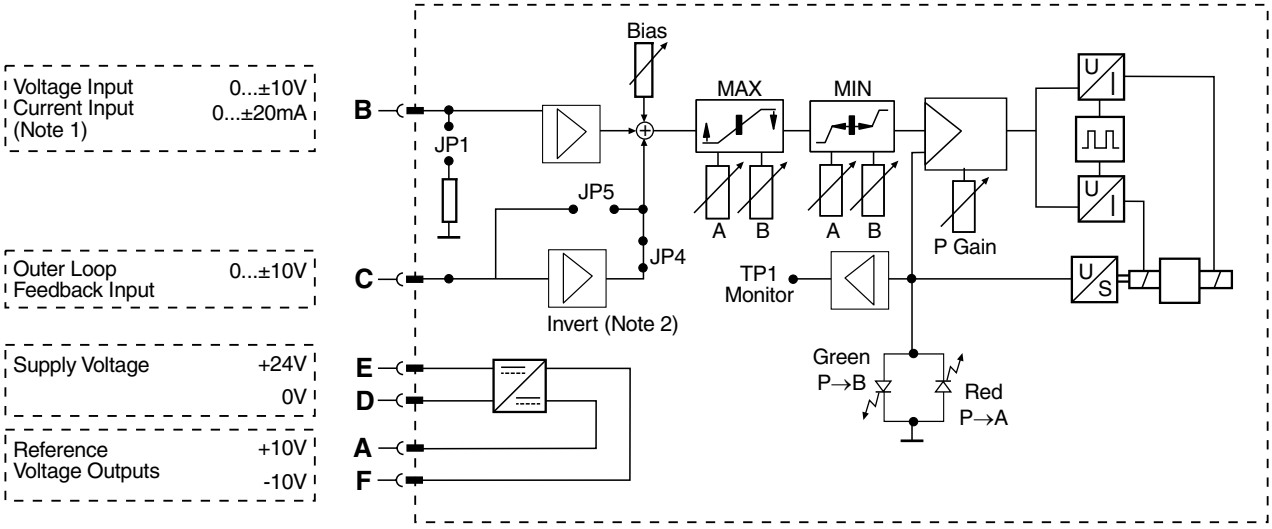


Note 1: Install jumper JP1 for current command input. Refer to Installation Bulletin 2583-M1/USA (D1FX).
Note 2: Refer to specifications.

A

Design 'C' Option — User Configurable Analog Outer Closed Loop

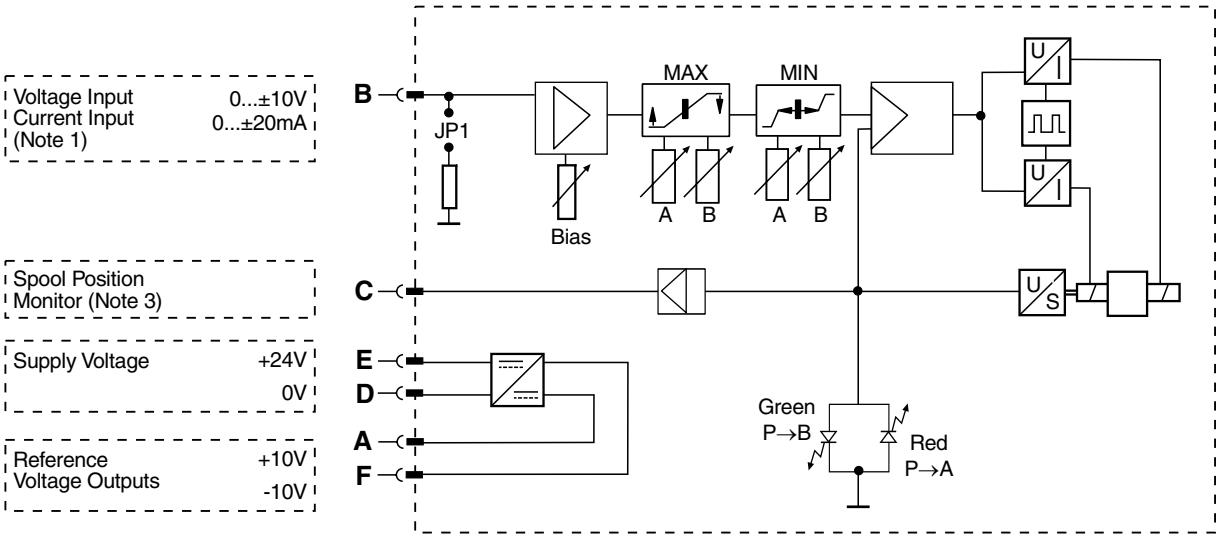
Electronic design option 'C' provides an additional analog closed outer loop function for user application. This feature can be used to control simple position control loops where analog resolution and a single proportional gain control are adequate. The design provides a single bipolar command input that is user configurable as voltage or current, and an outer loop feedback sensor voltage input. ±10 volt outputs are available to reference the outer loop feedback sensor if required. To specify this option, refer to the Ordering Information page, Electronic Design block.



Note 1: Install jumper JP1 for current command input. Refer to Installation Bulletin 2583-M1/USA (D1FX).
Note 2: Install jumper JP4 to invert user outer loop feedback input signal.

Design 'D' Option — Single Bipolar Command Input, with ± Volt Reference Output

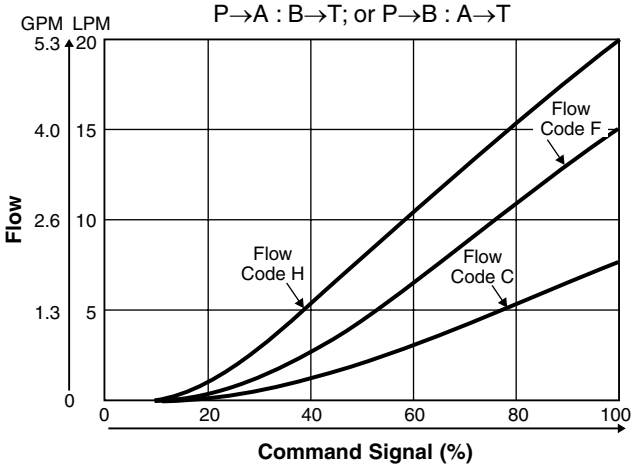
Electronic design option 'D' provides a single bipolar command input that is user configurable as voltage or current. ±10 volt references are available for user supplied off-board command potentiometers. A spool position monitor output is also provided. To specify this option, refer to the Ordering Information page, Electronic Design block.



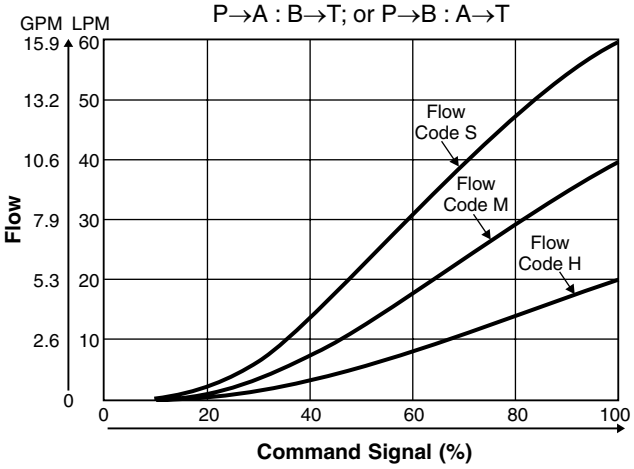
Note 1: Install jumper JP1 for current command input. Refer to Installation Bulletin 2583-M1/USA (D1FX).
Note 2: Install jumper JP4 to invert user outer loop feedback input signal.
Note 3: Refer to specifications.

A

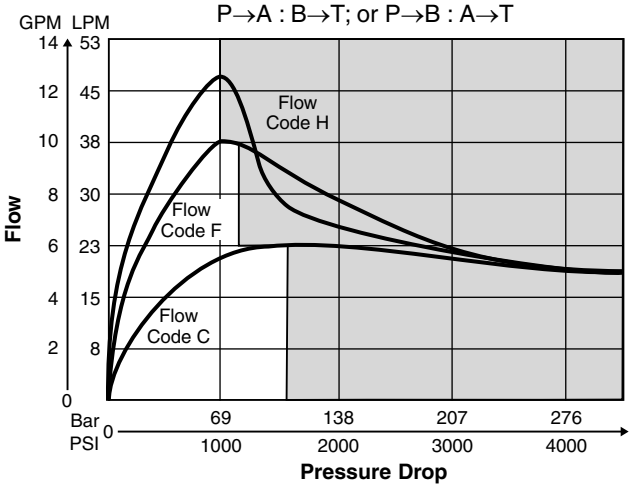
D1FX Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



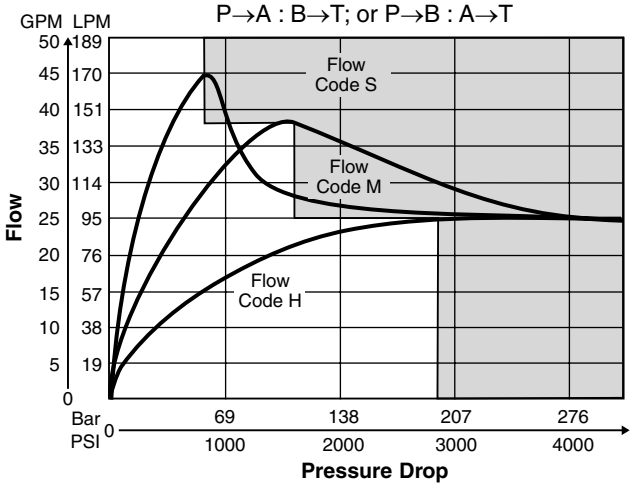
D3FX Flow Characteristics
at Δp = 5 Bar (72.5 PSI) / metering edge
P→A : B→T; or P→B : A→T



D1FX Operating Limits [1]
at 100% Command
P→A : B→T; or P→B : A→T

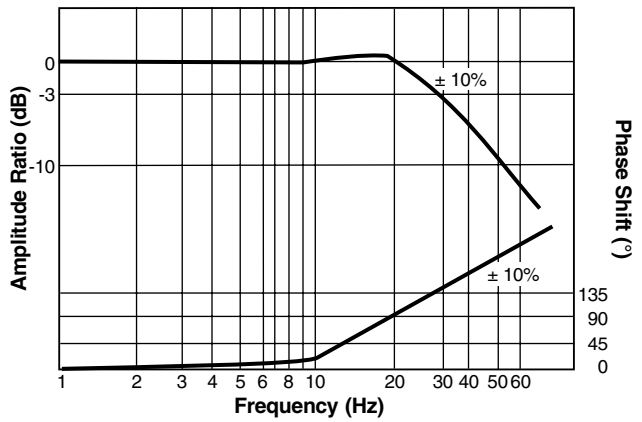


D3FX Operating Limits [1]
at 100% Command
P→A : B→T; or P→B : A→T

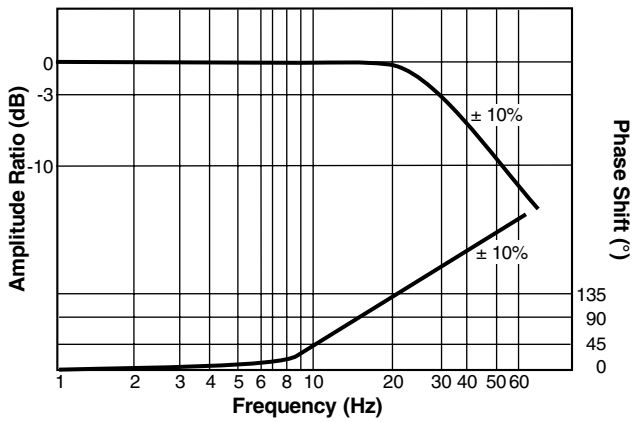


[1] Shaded area: Actual flow subject to the system load dynamics
Note: 81 and 82 spools - decrease limits by 15%

D1FX Frequency Response
at 10% Command, 50% Offset



D3FX Frequency Response
at 10% Command, 50% Offset



D_FX.p65, dd

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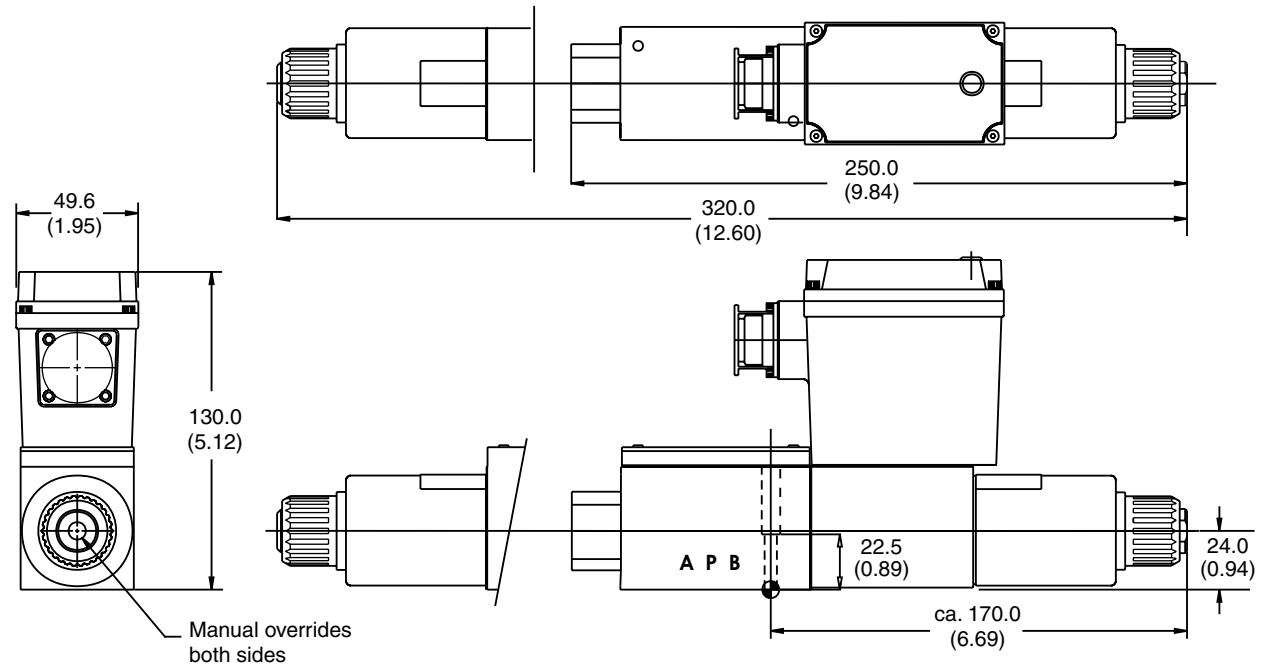
Elyria, Ohio, USA

A

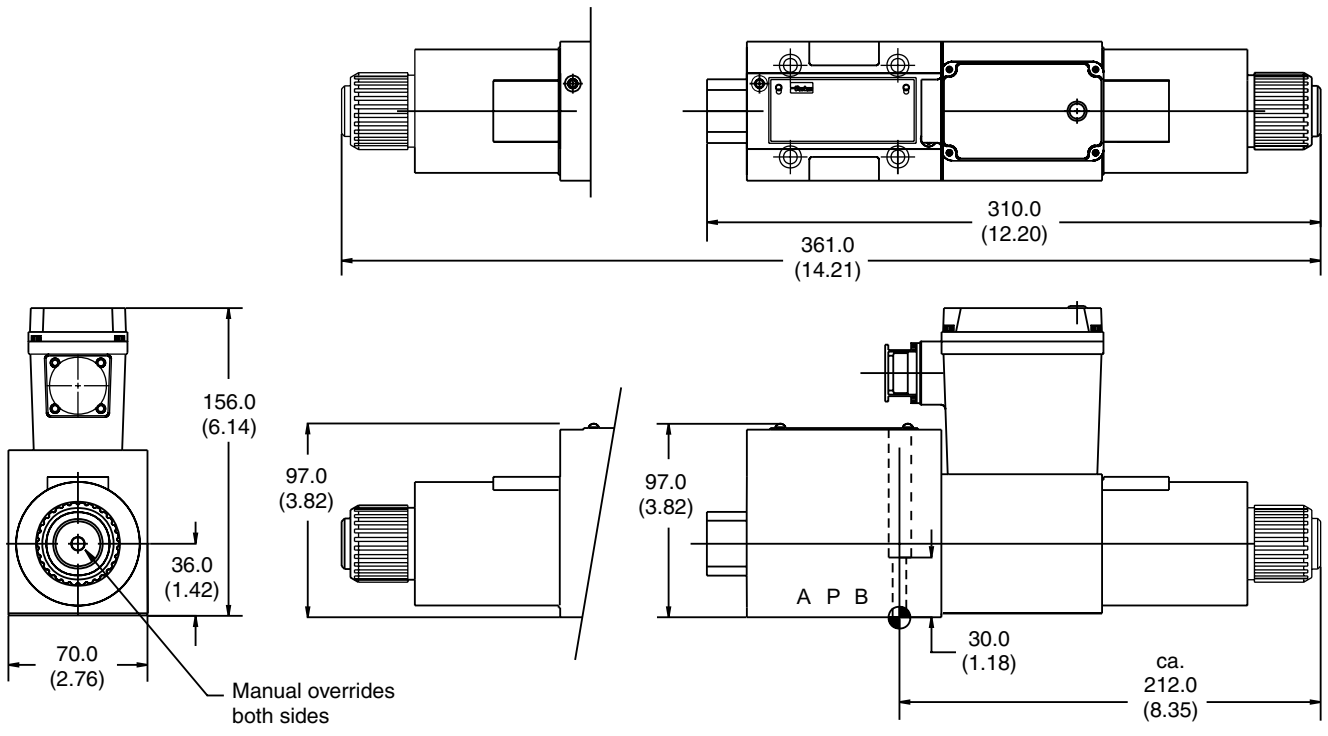
D1FX

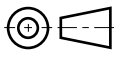
Inch equivalents for millimeter dimensions are shown in (**)



D3FX

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



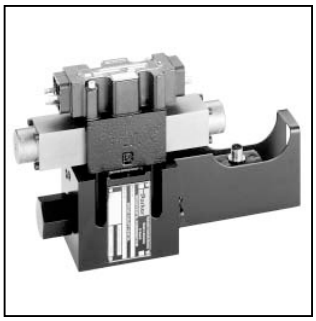


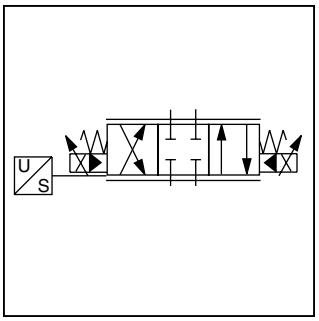
A

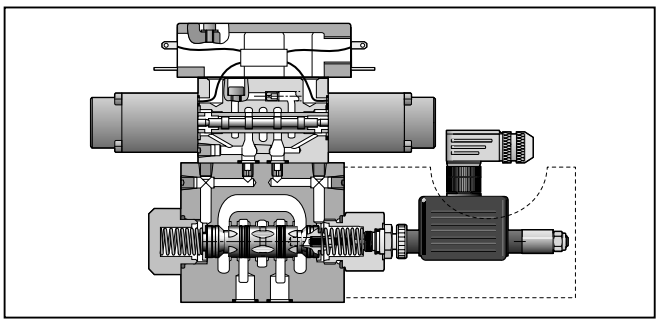
General Description

Series D*1FS proportional directional control valves are high performance, two stage pilot operated solenoid valves with electronic spool position feedback. Valves are controlled by 'PWD' Series DIN electronics. Valves are available in sizes NG10 (CETOP 5), NG16 (CETOP 7), NG25 (CETOP 8) and NG32 (CETOP 10).

D*1FS valve performance is characterized by high resolution flow control, repeatability and good dynamic performance. Typical applications include precise and reproducible control of actuator speed in rapid / slow speed profiling, and smooth acceleration and deceleration performance.

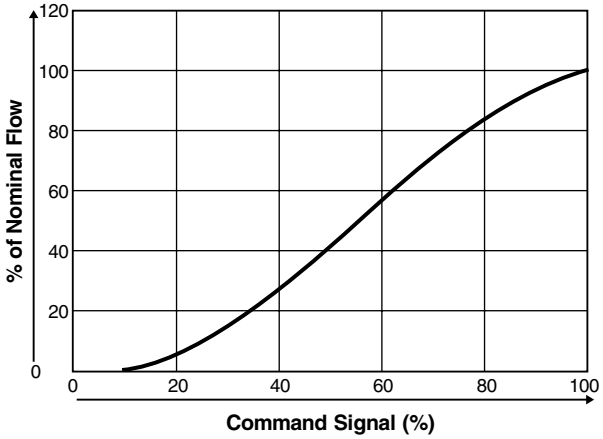






Performance Curve

Flow Characteristics
at 5 Bar (72.5 PSI) per metering edge
Typical flow curve



Features

- Standard DIN/ISO/CETOP/NFPA interfaces.
- Spool position feedback.
- High Frequency response.
- Spring centered main stage spool.
- LED functinal diagnostic indicator.
- Wide selection of spool options, and flow capacity.
- 2:1 ratio, and Regeneration spool options.

Specifications

Interface DIN (NFPA/ISO/CETOP)	**NG10 (5)**	**NG16 (7)**	**NG25 (8) D81/D91**	**NG32 (10)**
Flow Rating @10 Bar (150 PSI) Δp (P→A, B→T) LPM (GPM)	45 (12)	120 (32)	300/400 (79/106)	1000 (264)
Step Response (time to reach 90% of a 100% step command) ms	35	60	80	200

Repeatability	%	<0.5		
Hysteresis	%	<0.5		
Pilot Flow				
Continuous	LPM (GPM)	<1.2 (0.3)		
Operating Pressure				
Port P, A, B	Bar (PSI)	345	(5000)	max.
Port P, internal pilot		20	(290)	min.
Port T, internal drain		10	(150)	max.
Port T, external drain		345	(5000)	max.
Port Y, pilot drain		10	(150)	max.
Port X, external pilot		20-345	(290-5000)	
Fluid Viscosity, Recommended		80 – 1000 SSU		

Fluid Cleanliness Level	ISO Class 16/13
Fluid Temperature, Recommended	0°C to +60°C (+32°F to +140°F)
Ambient Operating Temperature	-20°C to +60°C (-20°F to +140°F)
Electronic Driver Boards (refer to electronics section)	PWD Series Drivers
Mating Connector	
Solenoid (DIN 43650)	Part #692914 (black) Part #692915 (gray)
LVDT (M12, 5 pin)	included w/valve
Environmental Protection Class	NEMA 1 (IP54)

A

D		1	F	S							W		
Directional Control Valve	Size and Interface	Pilot Operated	Flow Control	With Spool Position Feedback	Spool Type	Nominal Flow	Pilot Connection	Seal	Solenoid Voltage	Solenoid Variation	Valve Accessories	Design Series

NOTE: Not required when ordering.

Code	Description
3	NG10/CETOP 5
4	NG16/CETOP 7
8	NG25/CETOP 8
9[1)]	NG25/CETOP 8
11	NG32/CETOP 10

[1)] with enlarged ∅ 32mm ports

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
W	Socket connector DIN 43650 without plugs

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

Code	Description
L	6 VDC
X*	16 VDC

* For use with "EW" driver card

Code	Description
0	Std., no accessories
2	Pilot pressure reducer

V-Notch Spool Options - Spool Type and Flow Codes

Code		Spool Type
$Q_A=Q_B$	$Q_A>Q_B$ [2)]	
E01	B31	
E02	B32	

Code	Flow: LPM (GPM) at Δp 5 Bar per metering edge				
	D31	D41	D81	D91	D111
B	45 (12)	–	–	–	–
C	–	120 (32)	–	–	–
E	–	–	300 (79)	–	–
H	–	–	–	400 (106)	–
L	–	–	–	–	1000 (264)

2) Reduced flow rate on port B, nominal flow at port A
Code A* for spool $Q_B > Q_A$ optional

Weight:

NG10	7.1 kg (15.7 lbs.)
NG16	10.8 kg (23.8 lbs.)
NG25	19.0 kg (41.9 lbs.)

Accessories

Refer to the Accessories section for bolt kits, subplates, connectors.

Driver Cards

Refer to the Electronics section for driver cards and support electronics.

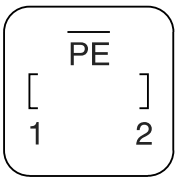
Mounting Interface

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

A

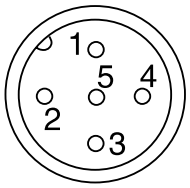
Wiring

Solenoid Coil



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

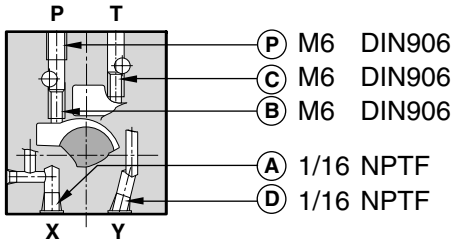
Spool position sensor (LVDT)



1 = output, spool position
2 = supply (+24V)
3 = GND (0V)
4 = not used
5 = protective ground

Pilot Connection

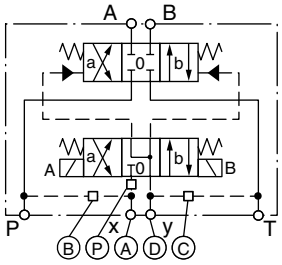
D31FS



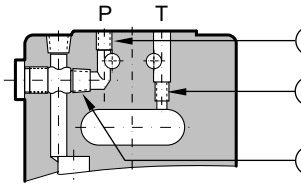
(P) M6 DIN906
(C) M6 DIN906
(B) M6 DIN906
(A) 1/16 NPTF
(D) 1/16 NPTF

○ **open,** ● **closed**

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



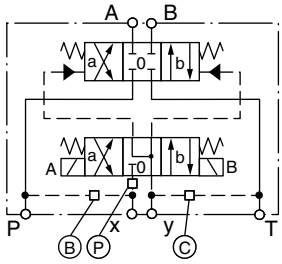
D41FS



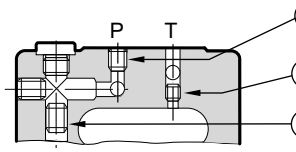
(P) M6 DIN906
(C) M6 DIN906
(B) 1/16 NPTF

○ open, ● closed

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



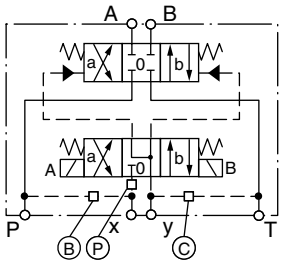
D91FS



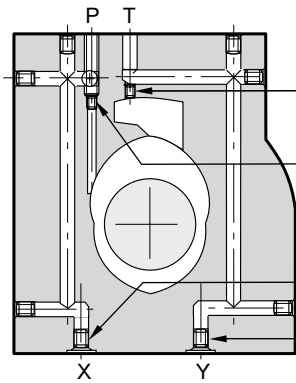
(P) M6 DIN906
(C) M6 DIN906
(B) 1/16 NPTF

○ open, ● closed

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



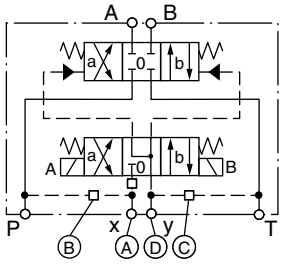
D111FS



(C) 1/16 NPTF
(B) 1/16 NPTF
(A) 1/8 NPTF
(D) 1/8 NPTF

○ open, ● closed

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



D_1FS.p65, dd

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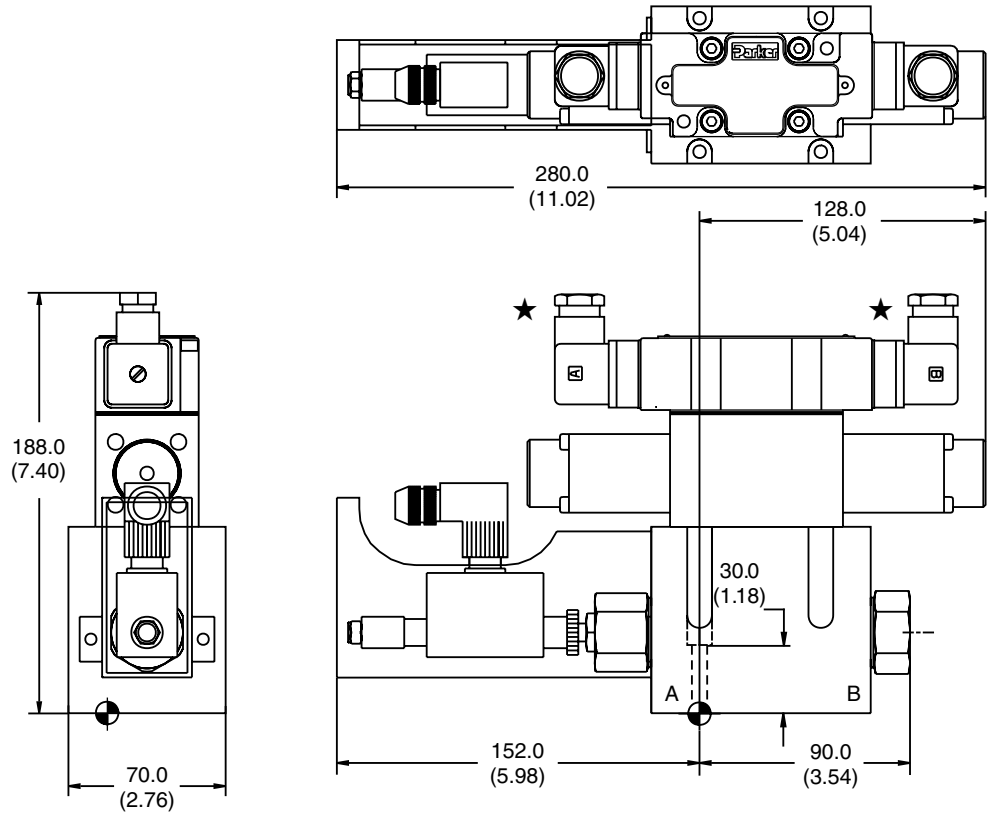
Hydraulic Valve Division
Elyria, Ohio, USA

D31FS

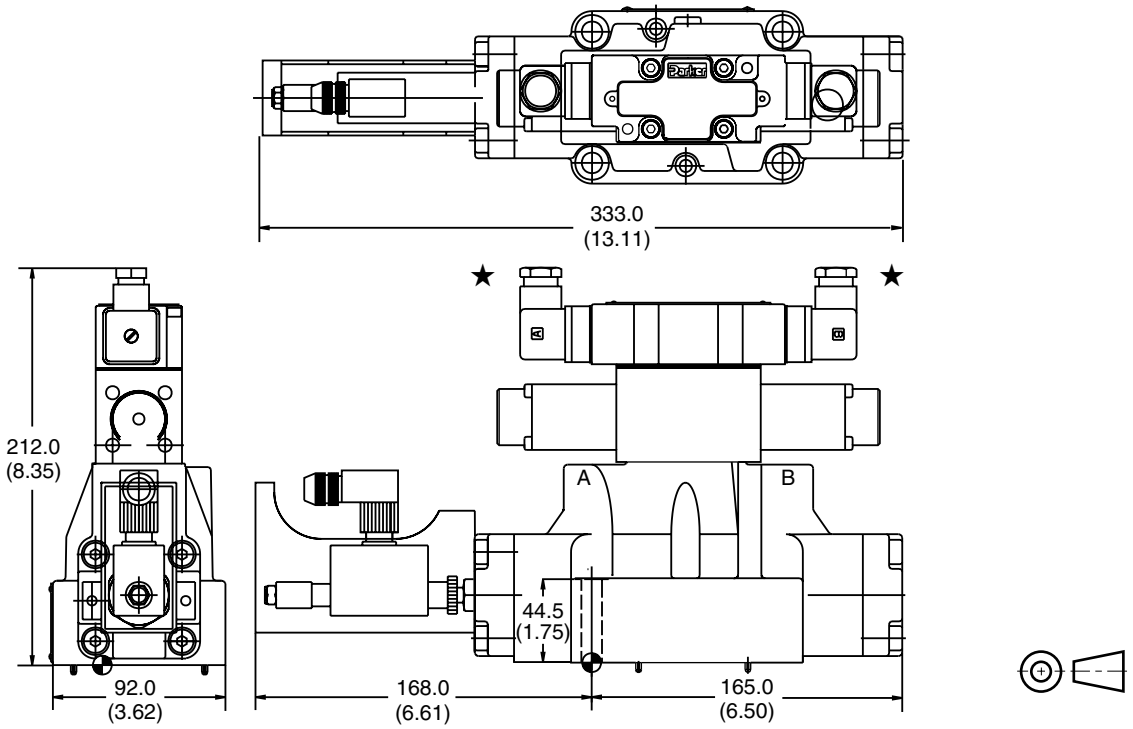
Inch equivalents for millimeter dimensions are shown in (**)



★ Order plugs separately.

D41FS

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

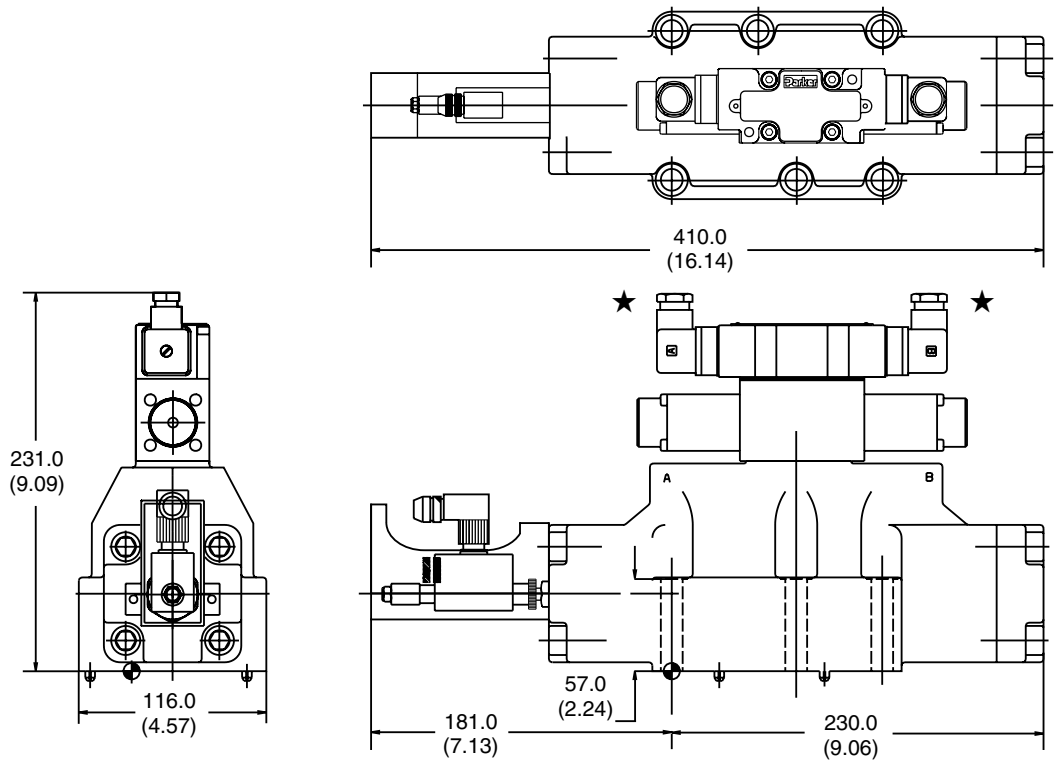


D_1FS.p65, dd

A

D81FS and D91FS

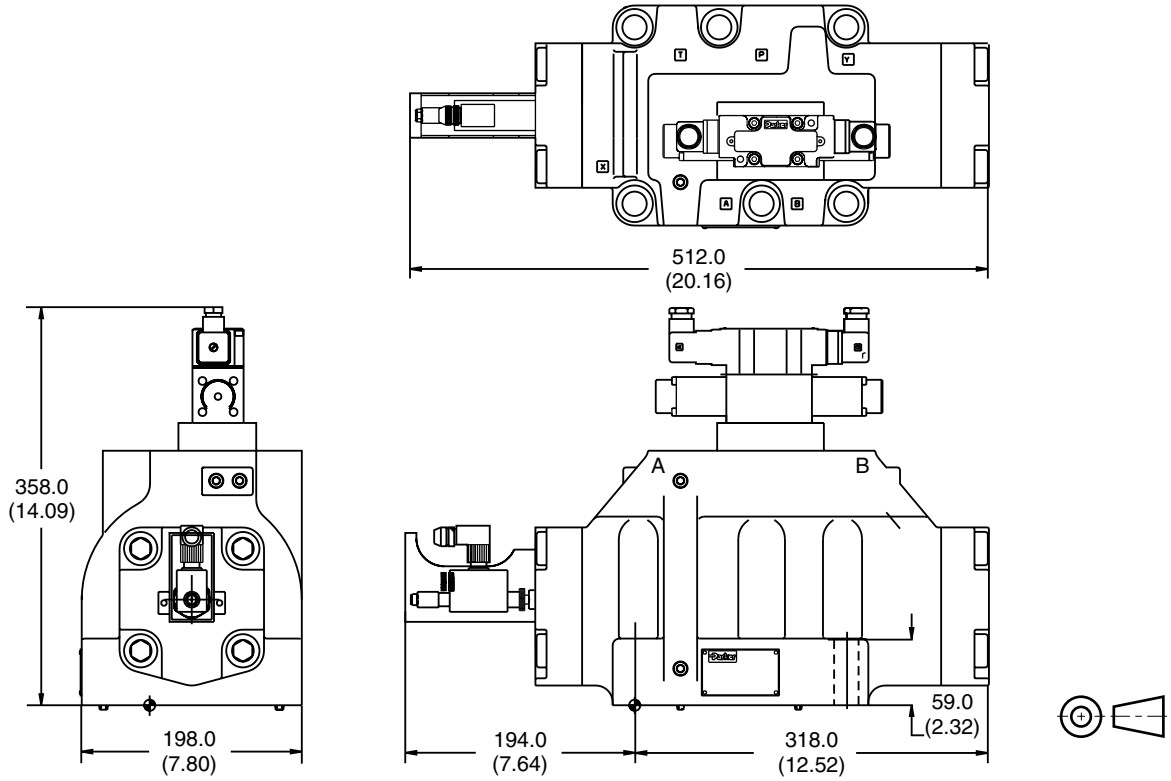
Inch equivalents for millimeter dimensions are shown in (**)



★ Order plugs separately.

D111FS

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



D_1FS.p65, dd

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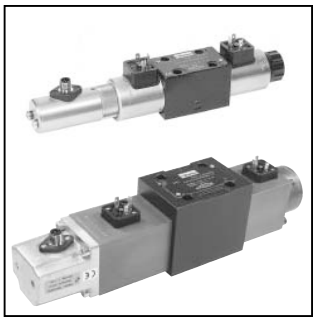
Elyria, Ohio, USA

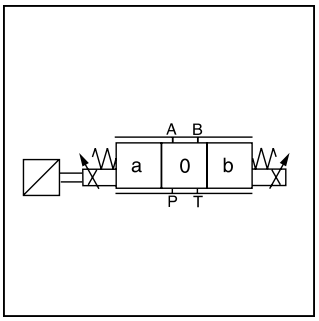
General Description

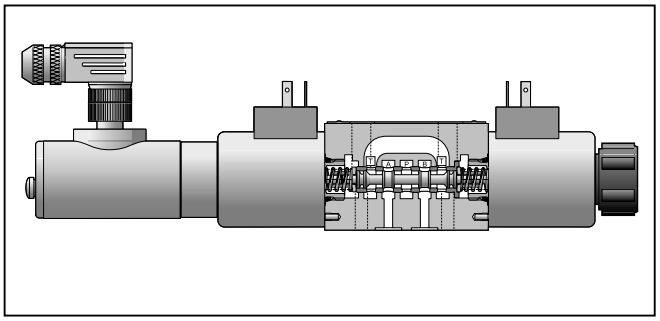
Series D1FC and D3FC directional control valves of nominal sizes NG6 (CETOP 3) and NG10 (CETOP 5) provide variable flow rates.

Due to a spool and sleeve combination, Series D1FC and D3FC valves provide good repeatability from valve to valve. With the addition of the spool position feedback, these valves have a higher level of control for position and velocity on systems requiring off-board electronics.

The valve repeatability in combination with the digital power amplifier PWDXXA-40*, where valve parameters can be saved, changed and duplicated, result in faster installation on identical machines.





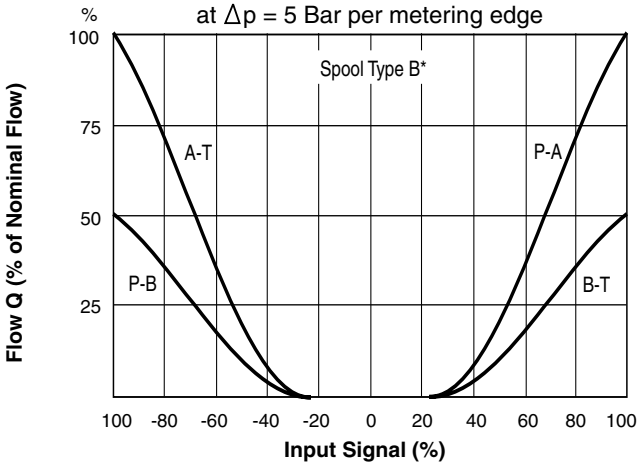


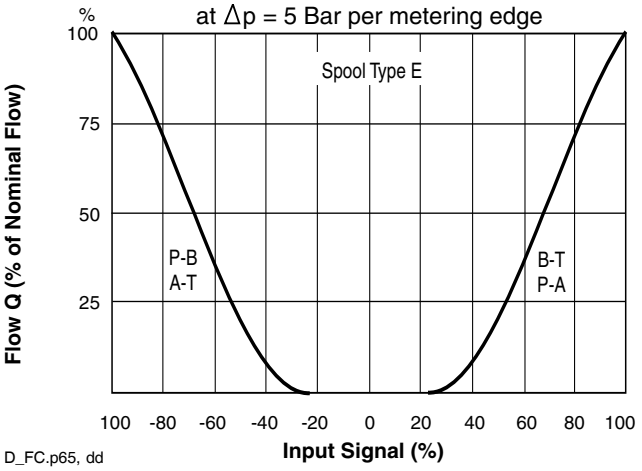
Features

- Spool/sleeve designs.
- Spool position feedback.
- High repeatability from valve to valve.
- Very low hysteresis.
- Manual override.

Performance Curves

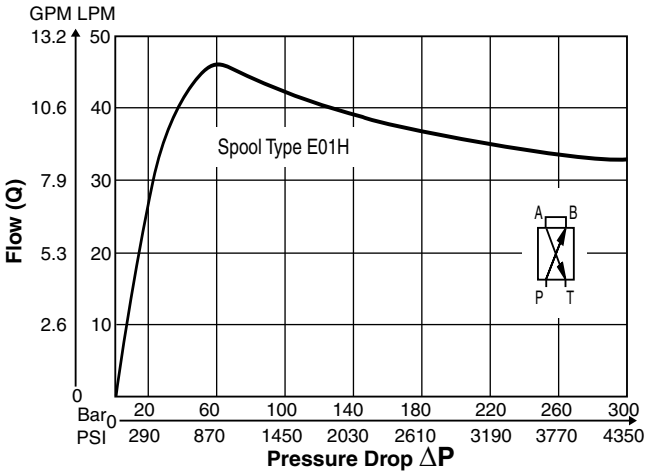
D1FC and D3FC



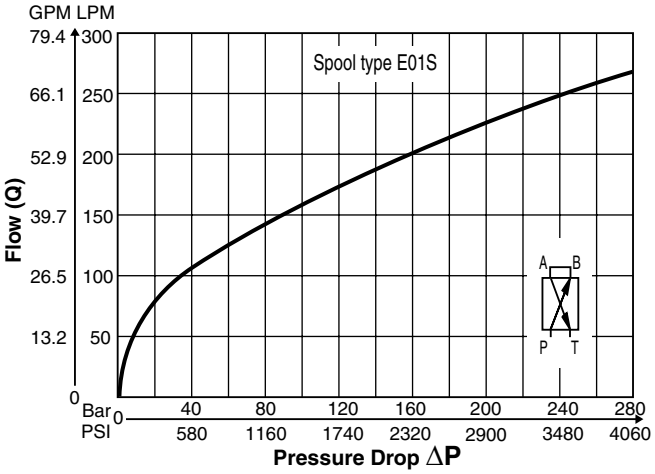


D_FC.p65, dd

D1FC Flow Limit



D3FC Flow Limit



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Hydraulic Valve Division
Elyria, Ohio, USA

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General			
Design	Direct-operated proportional Directional control valve	**Ambient Temperature Range**	-20°C to +60°C (-4°F to +140°F)
Actuation	Proportional Solenoid	**Vibration Resistance**	25 g acc. DIN IEC68, part 2-6
Size	D1FC: NG6 (CETOP 3) D3FC: NG10 (CETOP 5)	**Protection Class**	D1FC: IP65 acc. DIN 40050 (plugged and mounted) D3FC: IP54
Mounting Interface	DIN 24340 / ISO 4401 / CETOP RP121 / NFPA		
Mounting Position	Any		
Hydraulic			
Operating Pressure Maximum	D1FC: Ports P, A, B: 350 Bar (5075 PSI) Port T: 250 Bar (3625 PSI) D3FC: Ports P, A, B, T: 350 Bar (5075 PSI)	**Viscosity Recommended**	30 to 80 cSt (140 to 370 SSU)
		Filtration	ISO 4406 (1999) 18/16/13 (acc. NAS 1683: 7)
Fluid	Hydraulic oil as per DIN 51524 to 535, other on request	**Flow**	nominal at Δp=5 Bar per control edge* D1FC: 6 / 12 / 20 LPM (1.6 / 3.2 / 5.3 GPM) D3FC: 25 / 40 / 60 LPM (6.6 / 10.6 / 15.9 GPM)
Fluid Temperature	-20°C to +60°C (-4°F to +140°F)		
Viscosity Permitted	20 to 380 cSt (97 to 1750 SSU)	**Leakage**	at 100 Bar (1450 PSI) D1FC: < 50 ml/min (3 in^3/min) D3FC: < 100 ml/min (6 in^3/min)
Static / Dynamic			
Step Response @ 100%	D1FC: <20 ms D3FC: <30 ms	**Hysteresis**	<0.3%
		Sensitivity	<0.1%
Electrical			
Duty Ratio	100%	**Coil Insulation Class**	F [155°C (311°F)]
Supply Voltage	9 VDC	**Connection**	2+PE acc. EN 175301-801
Solenoid	Code M	**Cable Specification**	3x1.5 (AWG 16) overall braid shield
Current Consumption	D1FC: 2.7A D3FC: 3.4A	**Cable Length**	50m (164 ft.)
Resistance	D1FC: 2.7 ohms D3FC: 1.8 ohms		
Electrical LVDT			
Protection Class	IP65	**Current Consumption**	<50 mA
Ambient Temperature Range	-20°C to +50°C (-4°F to +122°F)	**EMC**	EN 50081-1 / EN50082-2
Supply Voltage/ Ripple	18 VDC to 36 VDC, ripple <10% eff.	**Interface**	4+PE acc. IEC 61076-2-101 (M12)
		Cable Specification	4x0.5 (AWG 20) overall braid shield
		Cable Length	50m (164 ft.)

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

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D		F	C		C	0	N	M	W	0	
Directional Control Valves	Size	Flow Control	Position Feedback	Spool	Style		Seals	Solenoid Voltage	Solenoid Accessories		Design Series

NOTE: Not required when ordering.

Code	Description
1	NG6/CETOP 3
3	NG10/CETOP 5

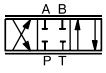
Code	Style
C	

Description	
D1FC	9V/2.7A
D3FC	9V/3.4A
	Other current on request

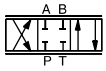
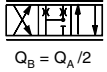
Code	Description
N	Nitrile
	Others available on request

Code	Description
W	Socket Connector DIN 43650 without Plug

D1FC

Code	Spool	Flow LPM (GPM) at Δp 5 Bar (72.5 PSI) per metering edge
E01H		20 (5.3)
E01F		12 (3.2)
E01C		6 (1.6)
E02H		20 (5.3)
E02F		12 (3.2)
E02C		6 (1.6)
E03H		20 (5.3)
E03F		12 (3.2)
E03C		6 (1.6)
B31H	$Q_B = Q_A/2$ 	20/10 (5.3/2.6)
B31F		12/6 (3.2/1.6)
B32H	$Q_B = Q_A/2$ 	20/10 (5.3/2.6)
B32F		12/6 (3.2/1.6)

D3FC

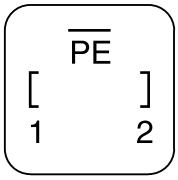
Code	Spool	Flow LPM (GPM) at Δp 5 Bar (72.5 PSI) per metering edge
E01S		60 (15.9)
E01M		40 (10.6)
E01K		25 (6.6)
E02S		60 (15.9)
E02M		40 (10.6)
E03S		60 (15.9)
E03M		40 (10.6)
B31S	$Q_B = Q_A/2$ 	60/30 (15.9/7.9)
B31M		40/20 (10.6/5.3)
B32S	$Q_B = Q_A/2$ 	60/30 (15.9/7.9)
B32M		40/20 (10.6/5.3)

Weight:

NG6	2.2 kg (4.9 lbs.)
NG10	6.5 kg (14.3 lbs.)

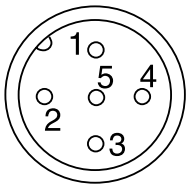
Plugs

Solenoid coil



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

Spool position feedback

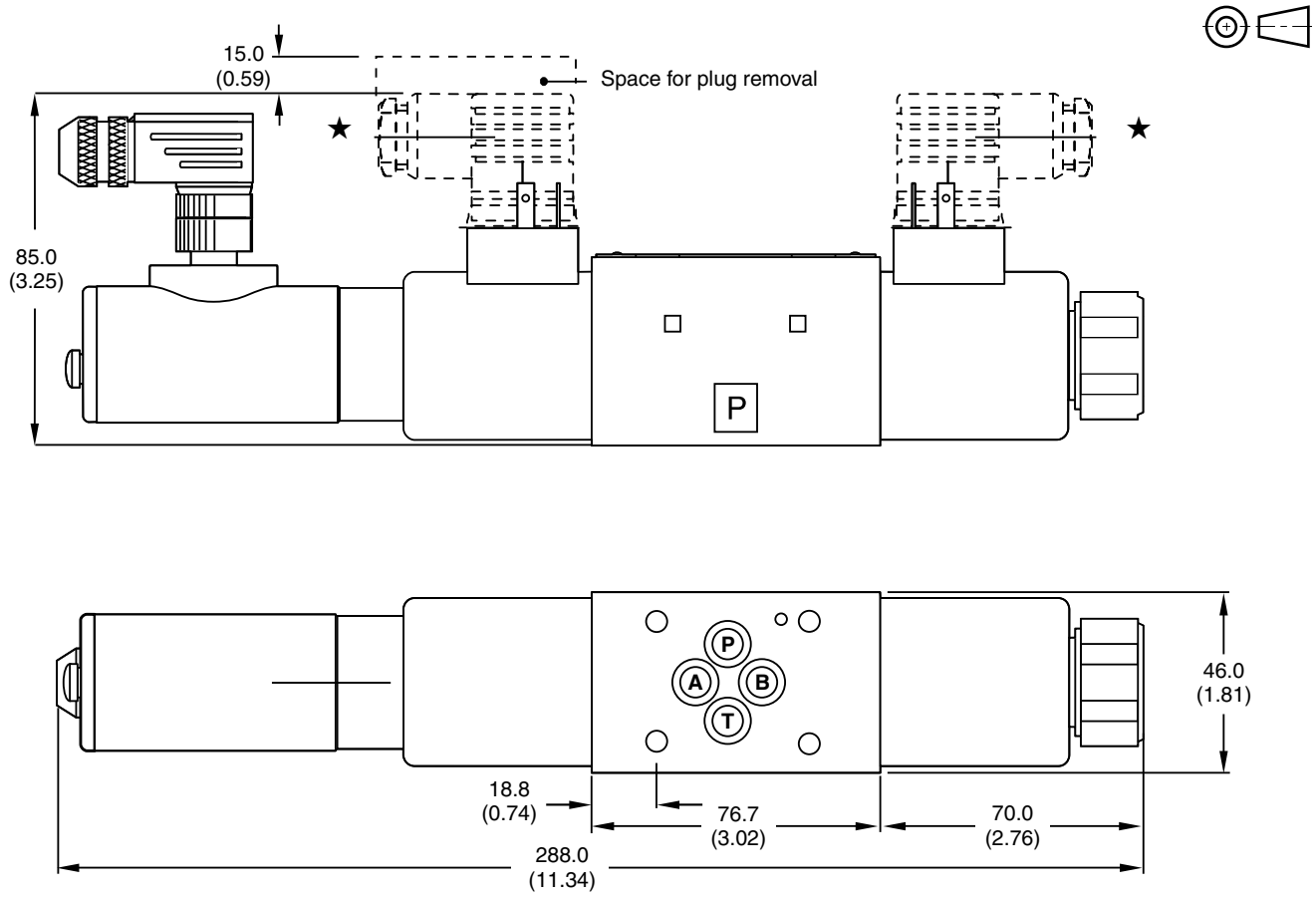


1 = output, actual spool position
2 = supply (18...36 VDC)
3 = GND (0V)
4 = not used
5 = PE

Please order plugs separately. See Accessories.

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

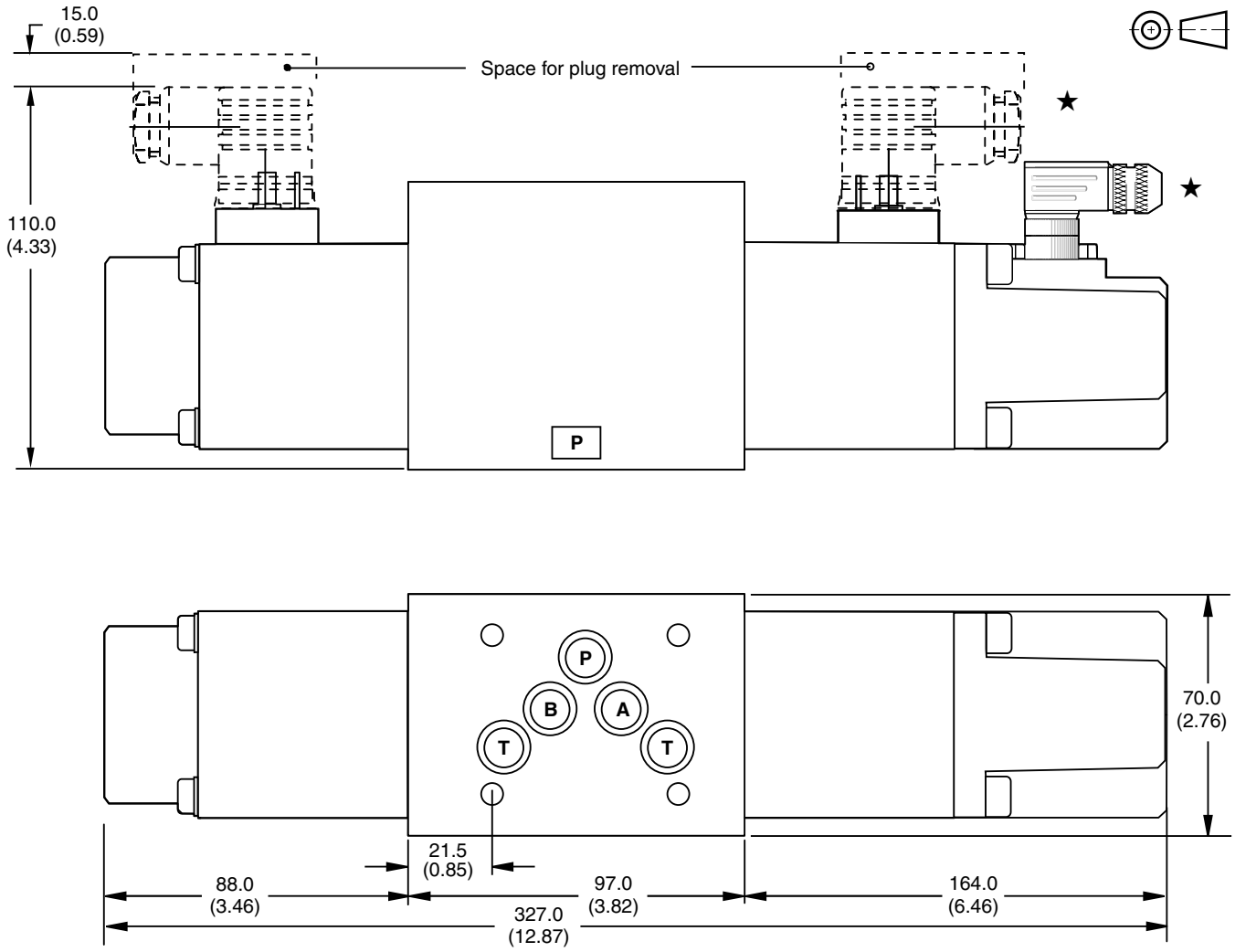
A



★ Order plugs separately.

Surface finish	Kit			Kit NBR
R_{max}6.3 0.01/100	BK375	4x M5x30 DIN 912 12.9	6.8 Nm (5.0 lb.-ft.) ±15 %	SK-D1FC-N
	BK209	4x10-24x1.25"	6.8 Nm (5.0 lb.-ft.)	

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



★ Order plugs separately.

Surface finish	Kit			Kit NBR
R_{max}6.3 ⏥ 0.01/100	BK385	4x M6x40 DIN 912 12.9	11 Nm (8.1 lb.-ft.) ±15 %	SK-D3FC-N
	BK98	4x1/4-20x1.625"	11 Nm (8.1 lb.-ft.)	

A

General Description

Series D*FH is a high response, proportional servovalve with an on-board drive amplifier. The D*FM is a high response, direct actuated servovalve with high resolution around low command inputs. The D*FM is designed for more precise control of position loops, force loops, and machine tool feed rates.

Series D*FH and D*FM incorporate the use of state-of-the-art drive electronics with an LVDT for continuous monitoring of the spool position. Zero lap spools are standard for closed loop applications with two different 'power down' configurations. The valves feature frequency response levels greater than 100 Hz for D1FH and D1FM, and 45 Hz for D3FH and D3FM, along with low hysteresis and excellent repeatability.

Operation

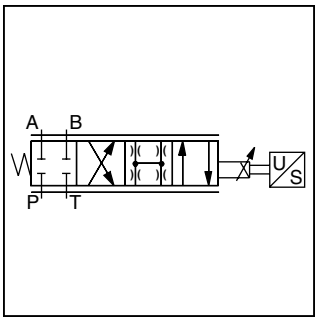
Series D*FH

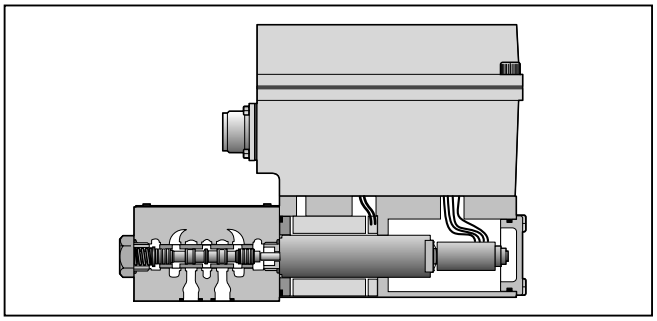
Series D*FH valve uses a precision lapped spool and sleeve configured with four control positions. During normal operation, the valve will shift from the center position to either side providing flow out the 'A' or 'B' port. When the drive amplifier is disabled by either removing the enable or loss of electrical power, the valve will shift through P→B in less than 10ms to a fourth position. The fourth position will block all four ports in one version. A second version that is available will block the 'P' port and allow the 'A' and 'B' ports to bleed to the 'T' (tank line). (Refer to the "Flow With No Enable" in Troubleshooting section)

Series D*FM

The high resolution Series D*FM adds hydraulic and electronic control compensation to the standard D*FH valve. This feature enhances the tuning and accuracy of systems utilizing high resolution feedback transducers and control compensation available in high performance motion controllers. The D*FM valve uses a precision lapped spool and sleeve configured with four control positions. The fourth position (disabled) is available in an all ports blocked configuration or 'A' and 'B' ports bleed to tank configuration.

Note:
The tank line of either style valve must have a minimum pressure of 1.4 Bar (20 PSI). Maximum tank line pressure is 35 Bar (500 PSI).





Features

- **On-Board Electronic Drive Amplifier —** The unit is shipped as a factory preset and tested unit. (No adjustment is necessary)
- **High Frequency Response —** The valve has a very high frequency response which is necessary for many closed loop applications.
- **Four Position Spool Capability —** The four position spool provides predictable flow in the event of a power failure to the drive electronics, within the limits of the power curve.
- **315 Bar Pressure Capability —** The maximum operating pressure rating for the D*FH and D*FM is 315 Bar or 4500 PSI (Port P, A, B).
- **Spool Position Feedback —** The LVDT continuous feedback monitoring circuit provides low hysteresis and excellent repeatability.
- **Drive Enable Feature —** Output to the coil is shut down when the enable signal (10 to 30 VDC) is not present. The valve will then shift to the fourth position flow path selected by the user. (E50 or E80 spool)
- **High Resolution Around Null —** For precise control of critical position, force, or feed rates (D*FM Version only)
- **Cylinder Ratio Adjust —** To match following error on extend and retract. (D*FM Version only)

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Specifications

	D1FH, D1FM	D3FH, D3FM
Interface	NFPA D03, CETOP 3, NG6	NFPA D05, CETOP 5, NG10
Flow Rating At 35 Bar DP (500 PSI) per metering edge	1) B spool 5 LPM (1.3 GPM) 1) D spool 10 LPM (2.6 GPM) 1) H spool 20 LPM (5.3 GPM) 1,2) M spool 40 LPM (10.6 GPM) 2) F spool 12 LPM (3.2 GPM)	1) P spool 50 LPM (13.2 GPM) 1,2) Y spool 100 LPM (26.4 GPM)
Frequency Response	> 100 Hz (-3 dB at 5% signal)	> 45Hz (-3 dB at 5% signal)
Step Response	< 12 ms at 100% signal	< 25 ms at 100% signal
Power Consumption	40 VA max (See voltage supply)	60 VA max (See voltage supply)

D1FH, D1FM, D3FH, D3FM			
Max. Operating Press. **Port P, A, B** **Port T**	315 Bar (4500 PSI) 35 Bar (500 PSI)	**Operating Temp. Range (Ambient)**	0 to 60° C (32 to 140° F)
Min. Tank Line Press.	1.4 Bar (20 PSI)	**Fluid Cleanliness Level**	ISO Class 15/12/10 (For longer life) ISO Class 16/14/11 (For normal operation)
Typical Spool Overlap	Zero Lap	**Voltage Supply**	24 VDC (21 VDC Min., 30 VDC Max.) Peak Current 4A (PS24 power supply recommended)
Pressure Gain **% of Change/1%** **Change in Command**	1) Typical 40% 1) Minimum 25% 2) Typical 90%	**Command Signals**	± 10 VDC at 100 K ohm input impedance ± 20 mA at 499 ohm input impedance
Hysteresis	< 0.5%		
Repeatability	< 0.5%		
Viscosity Range	17 to 65 cSt (75 to 300 SSU)		
Fluids	Mineral base hydraulic fluid	**Protection Class**	IP65, NEMA 4 (As factory sealed)

Note: 1) D*FH only 2) D*FM only

Maximum Flow and Pressure Differential

Spool Code		Flow Code						
		B	**D**	**F**	**H**	**M**	**P**	**Y**
E50	**Max ΔP Per Land**	100 Bar (1500 PSI)	100 Bar (1500 PSI)	60 Bar (850 PSI)	70 Bar (1000 PSI)	52 Bar (750 PSI)	70 Bar (1000 PSI)	50 Bar (725 PSI)
	Max Flow	8.3 LPM (2.2 GPM)	16.3 LPM (4.3 GPM)	9.7 LPM (5.2 GPM)	26.9 LPM (7.1 GPM)	46.2 LPM (12.2 GPM)	69.6 LPM (18.4 GPM)	121 LPM (32 GPM)
E80	**Max ΔP Per Land**	100 Bar (1500 PSI)	100 Bar (1500 PSI)	60 Bar (850 PSI)	70 Bar (1000 PSI)	52 Bar (750 PSI)	70 Bar (1000 PSI)	50 Bar (725 PSI)
	Max Flow	8.3 LPM (2.2 GPM)	16.3 LPM (4.3 GPM)	9.7 LPM (5.2 GPM)	26.9 LPM (7.1 GPM)	46.2 LPM (12.2 GPM)	69.6 LPM (18.4 GPM)	121 LPM (32 GPM)

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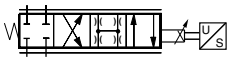
D		F				C		B	J	0	0		
Directional Control Valve	Nominal Size	Flow Control	Style	Spool Type	Flow	Design	Seal	Electronic Variation	Supply Voltage	Electric Accessories	Valve Accessory	Design Series	Product Variation

NOTE: Not required when ordering.

Code	Description
1	NG6/CETOP 3
3	NG10/CETOP 5

Code	Description
H	High Response
M	High Response, Dual Gain

Spool Type
Flow QA equal to flow QB

Code	Symbol
E50[1)]	
E80[1)]	
E53[2)] (60/40)	
E83[2)] (60/40)	
E84[2,3)] (40/60)	

1) D1FH and D3FH only
2) D1FM only
3) D1FM*M flow code only
D3FM*Y flow code only

Code	Description
C	Bi-directional, 4 way, with 4th position on power down

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
B	Voltage Input 0 ... ±10 V (user configurable to 0 ... ± 20 mA)

Code	Description
J	24 VDC

Code	Description
Omit	Standard (with enable)
X6262	Pin 'C' is 0V reference instead of an enable (for competitive interchange only). Valve enables with power. (note 4)

Note 4: **Do NOT apply an enable signal to Pin C.** Unlike many other valves with the same 7-pin connector, Pin C is not for an enable signal. Pin C is a 0V reference used for DMMs or scopes to monitor pin F. It is not a power supply common. Using it as a power supply common will damage the PC board.

Code	Flow at Δp 35 Bar (500 PSI) per metering edge			
	D1FH LPM (GPM)	D1FM LPM (GPM)	D3FH LPM (GPM)	D3FM LPM (GPM)
B	5 (1.3)	–	–	–
D	10 (2.6)	–	–	–
F	–	12 (3.2)	–	–
H	20 (5.3)	–	–	–
M	40 (10.6)	40 (10.6)	–	–
P	–	–	50 (13.2)	–
Y	–	–	100 (26.5)	100 (26.5)

Maximum supply pressure is 315 Bar (4500 PSI). This is the pressure drop across the load and the valve. For maximum pressure drop per land, refer to the table on page A47.

Weight:

NG6	3.7 kg (8.2 lbs.)
NG10	7.7 kg (17.0 lbs.)

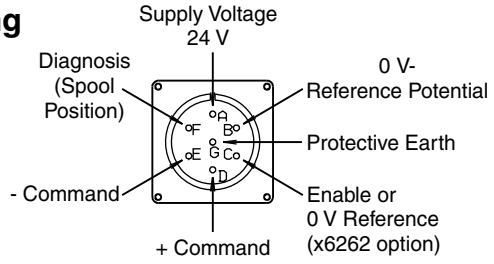
Mounting Interface

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.

Wiring



Installation Guidelines

Refer to the Installation Guide for set-up, configuration, and application guidelines (packaged with each valve).

D*FH and D*FM: Bul. HY14-2599-M1/US

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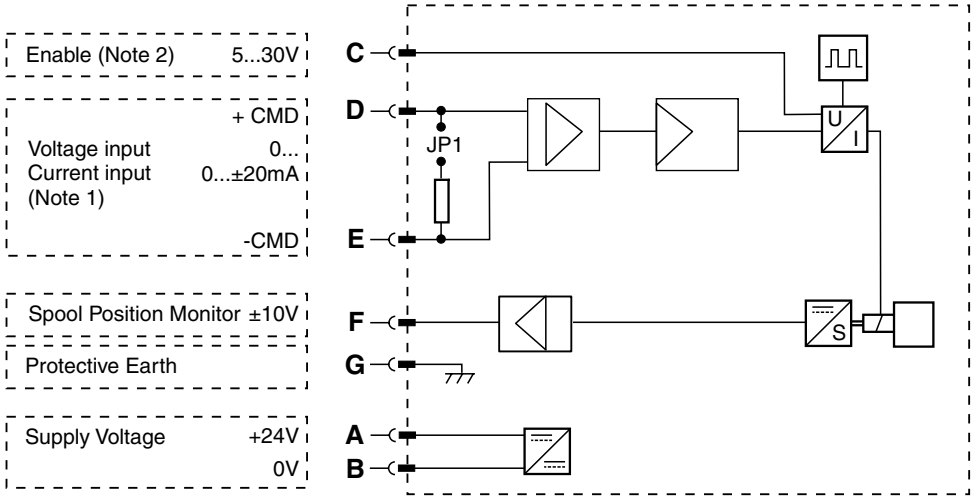
Block Diagram

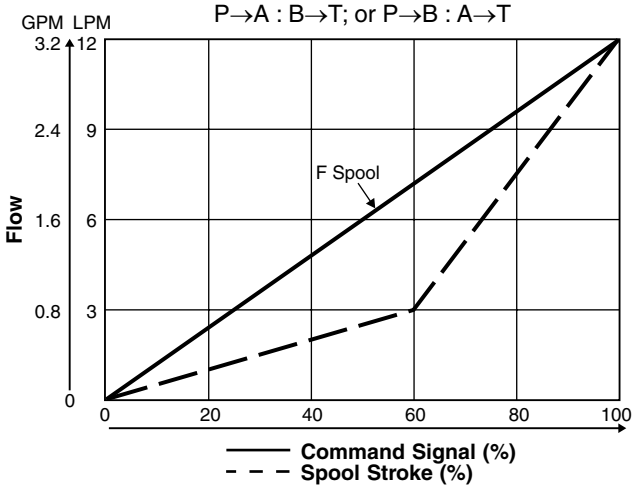


Note 1: Install jumper JP1 for current command input. Refer to installation guide Bul. HY14-2599-M1/US.
Note 2: Valves can be ordered with pin 'C' internally grounded to be interchangeable with some competitor products. Refer to Ordering Information page.

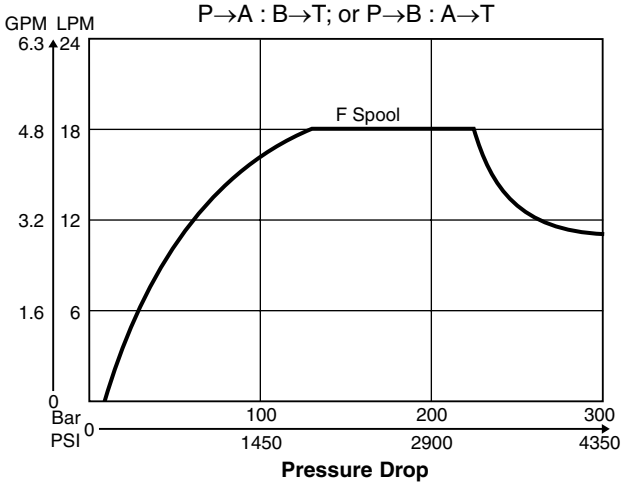
Performance Curves

D1FM series proportional valves are electronically compensated dual flow-gain valves. The command voltage/flow transfer function is linear while the actual spool stroke/flow gain is designed to provide very high resolution at low flows. The D1FM series proportional valves are particularly well suited for machine tool feed applications, or where very fine flow resolution is required while maintaining a rapid advance function in a single valve. The D1FM frequency response is the same as the D1FH; refer to the next page.

D1FM Flow Characteristics
at Δp = 35 Bar (500 PSI) / metering edge
P→A : B→T; or P→B : A→T



D1FM Operating Limits
at 100% Command
P→A : B→T; or P→B : A→T



D_FH-D_FM.p65, dd

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Hydraulic Valve Division
Elyria, Ohio, USA

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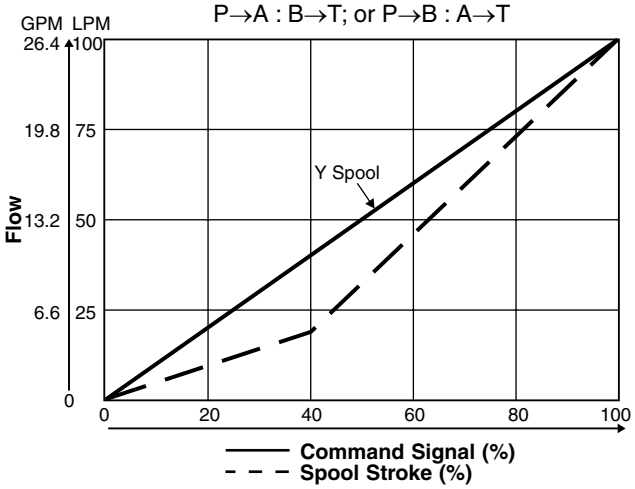
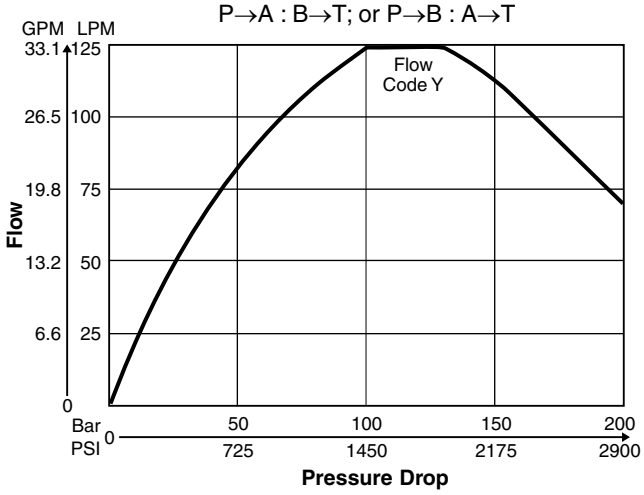
D3FM Flow Characteristics

at Δp = 35 Bar (500 PSI) / metering edge
P→A : B→T; or P→B : A→T



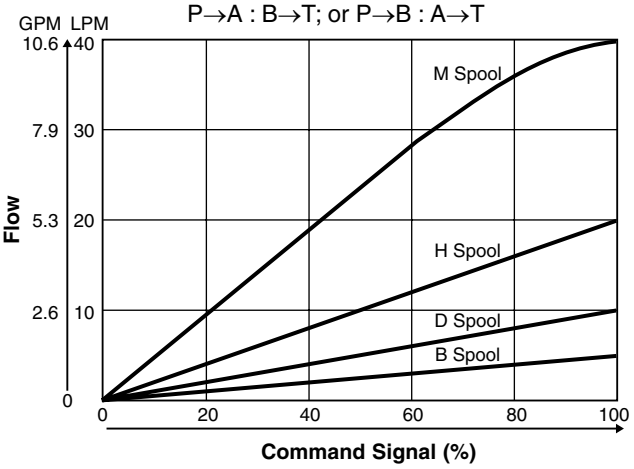
D3FM Operating Limits

at 100% Command
P→A : B→T; or P→B : A→T



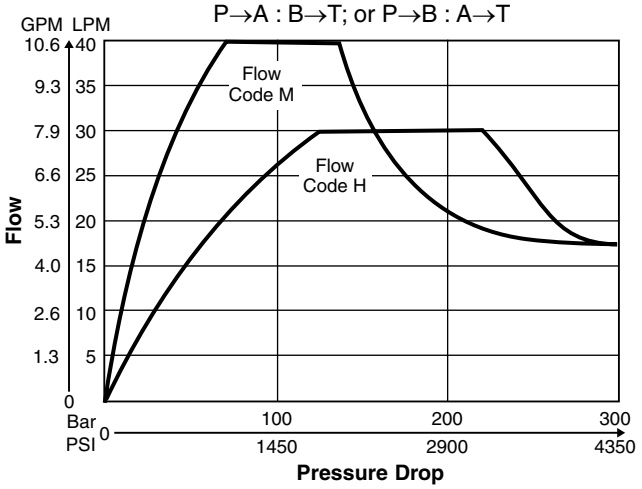
D1FH Flow Characteristics

at Δp = 35 Bar (500 PSI) / metering edge
P→A : B→T; or P→B : A→T



D1FH Operating Limits

at 100% Command
P→A : B→T; or P→B : A→T



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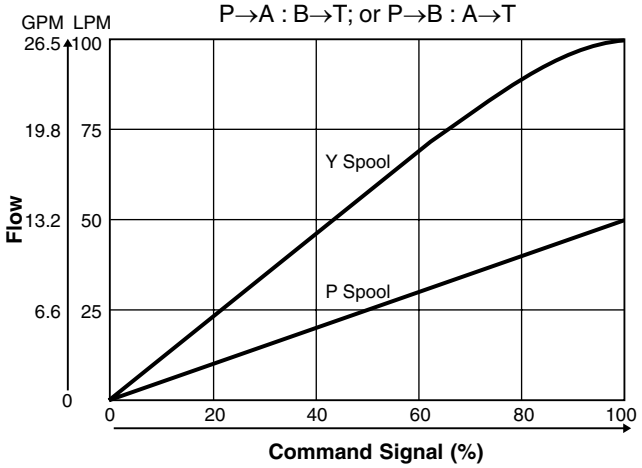
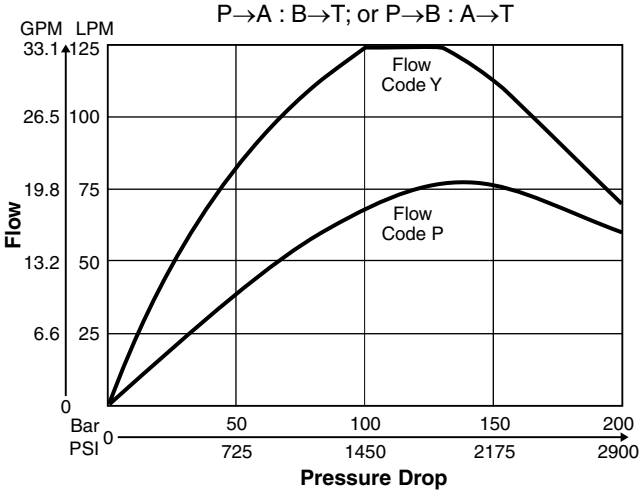
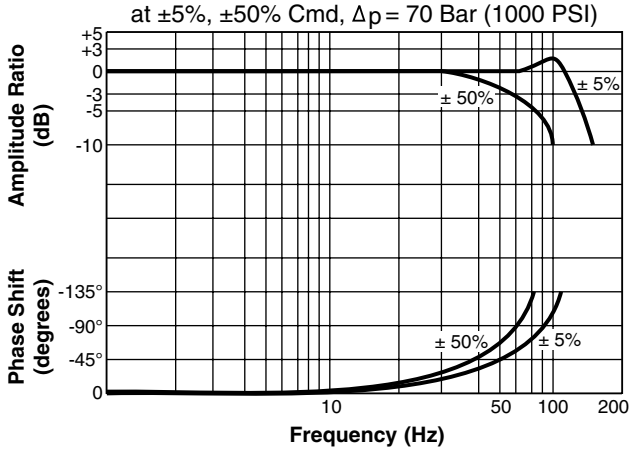
D3FH Flow Characteristics
at Δp = 35 Bar (500 PSI) / metering edge
P→A : B→T; or P→B : A→T



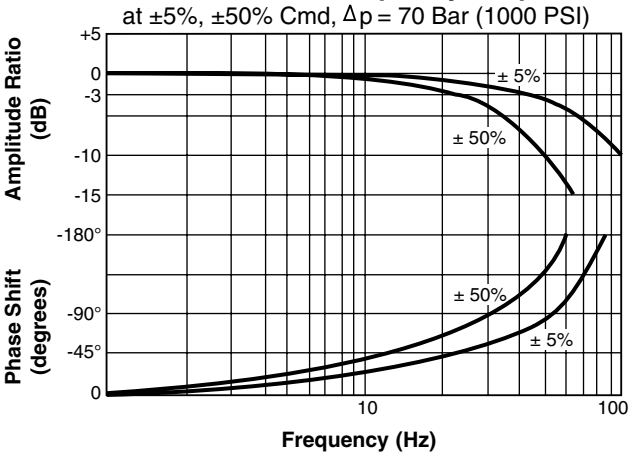
D3FH Operating Limits
at 100% Command
P→A : B→T; or P→B : A→T



D1FH and D1FM Frequency Response
at ±5%, ±50% Cmd, Δp = 70 Bar (1000 PSI)



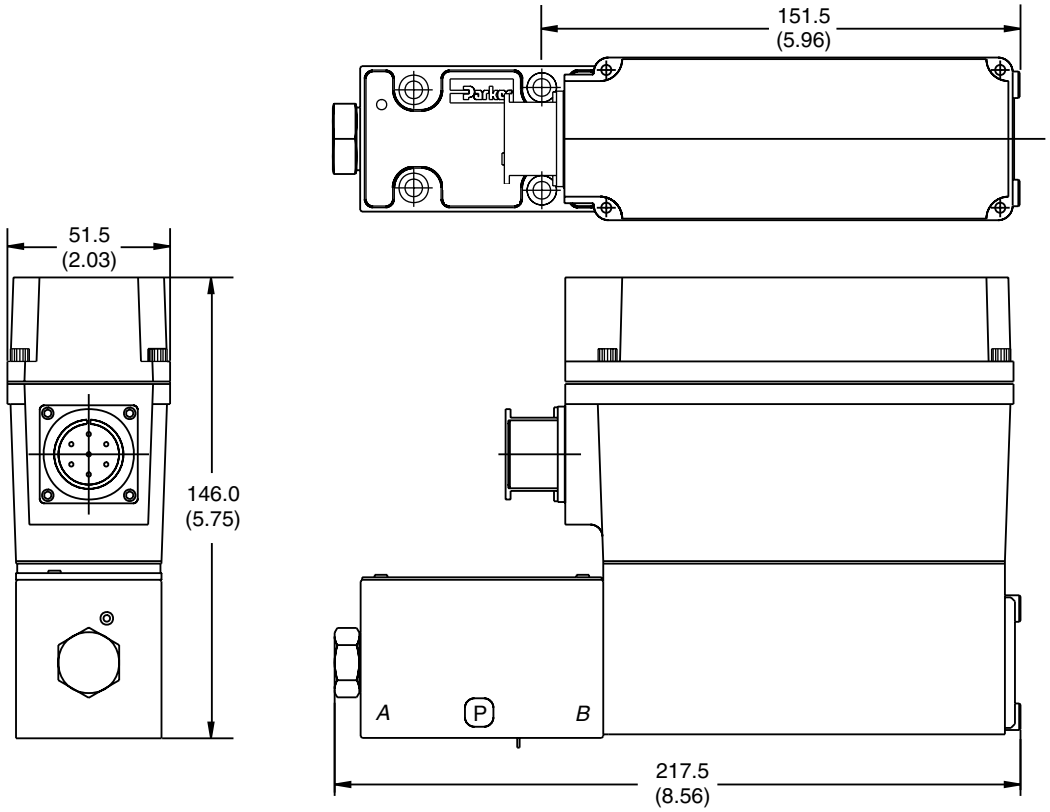
D3FH and D3FM Frequency Response
at ±5%, ±50% Cmd, Δp = 70 Bar (1000 PSI)



A

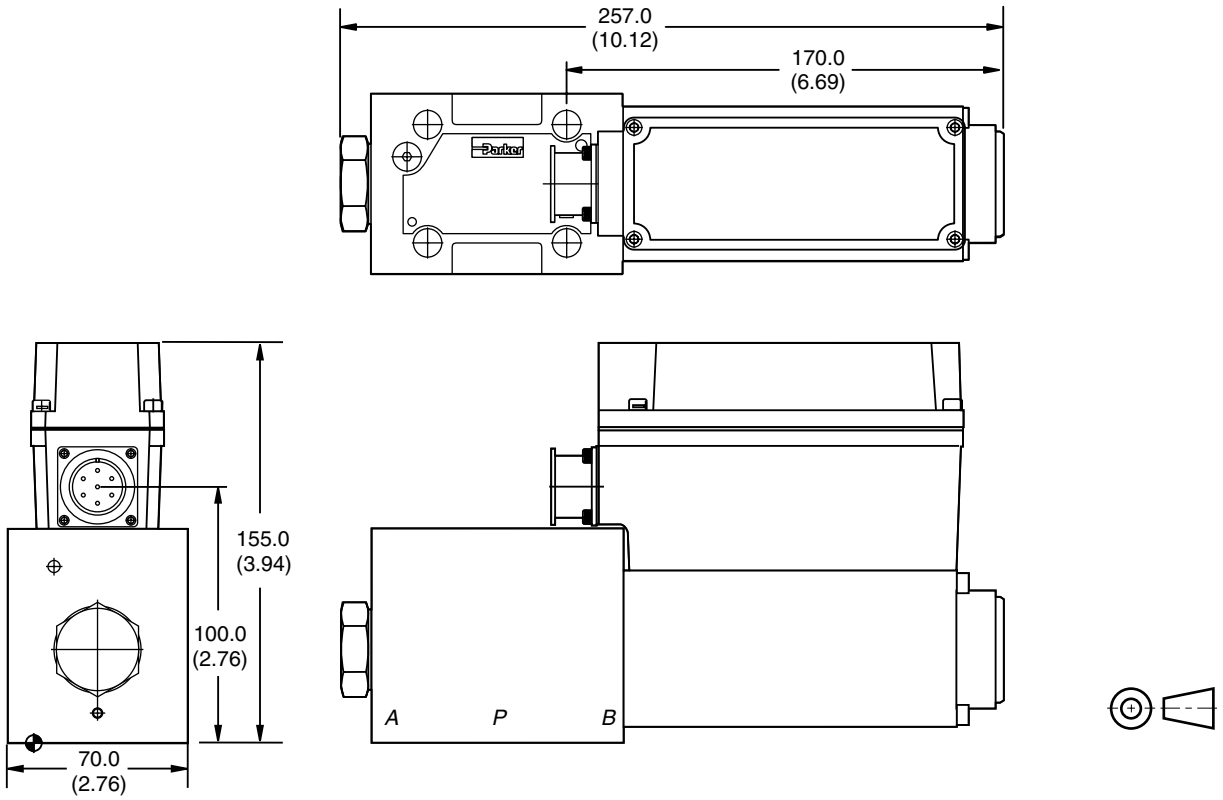
D1FH and D1FM

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



D3FH and D3FM

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



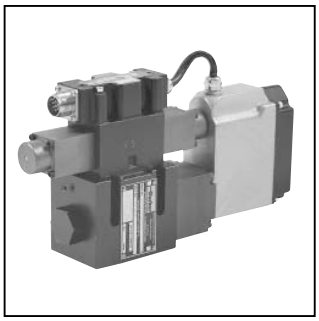
D_FH-D_FM.p65, dd

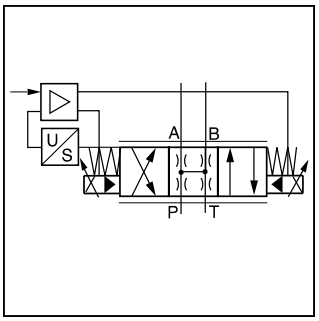
A

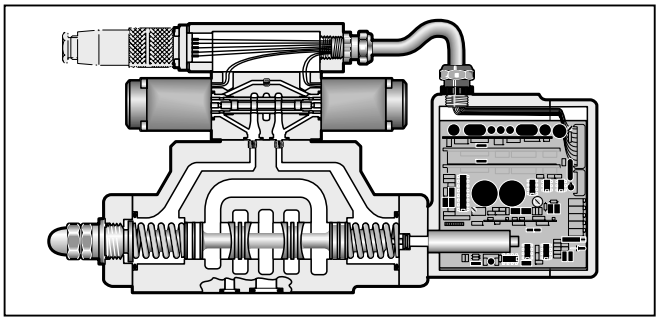
General Description

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

Specifications

Interface DIN (NFPA/ISO/CETOP)	**NG10 (5)**	**NG16 (7)**	**NG25 (8)**	**NG32 (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
Repeatability %	<0.5
Operating Pressure	
Port P, A, B Bar (PSI)	345 (5000) max.
Port P, internal pilot	20 (290) min.
Port T, internal drain	10 (150) max.
Port T, external drain	345 (5000) max.
Port Y, pilot drain	10 (150) max.
Port X, external pilot	20-345 (290-5000)
Electrical Power Requirements	18 to 30 VDC, 2.2A
Command Signal (impedance) (select by ordering code)	0 ± 10 VDC (100K ohm) 0 ± 20 mA (500 ohm)
Command Polarity	Pin 'D' more positive than 'E' produces flow P to B

Mating Connector (order separately)	Part #5004072 (7-pin CE)
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)
Ambient Operating Temperature	-20°C to +60°C (-20°F to +140°F)
Temperature Drift	0.005%/°C (0.009%/°F)

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

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

A

D		1	F	H						0	0	
Directional Control Valve	Size and Interface	Pilot Operated	Flow Control	High Response	Spool Type	Flow	Pilot Oil Connection	Seal	Electronic Variation	Electronic Accessories	Valve Accessories	Design Series

NOTE: Not required when ordering.

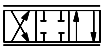
Code	Description
3	NG10/CETOP 5
4	NG16/CETOP 7
8	NG25/CETOP 8
9[1)]	NG25/CETOP 8
11	NG32/CETOP 10

[1)] with enlarged ports ∅ 32mm

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
B	Voltage Input 0 ... ±10V
E	Current Input 0 ... ±20 mA

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

Code			Spool Type
$Q_A=Q_B$	$Q_A>Q_B$[1)]	$Q_B>Q_A$[2)]	
			Overlap Sine
E01	B31	A31	
E02	B32	A32	
			Zero Lap C-Notch
E50[3)]	B60[3)]	A60[3)]	
			Zero Lap Sine
E52[4)]	B61[4)]	A61[4)]	

1) 2:1 Ratio: Reduced Flow Rate; Port B, Rated Flow Rate; Port A
2) 2:1 Ratio: Reduced Flow Rate; Port A, Rated Flow Rate; Port B
3) Only D31FH
4) Not Available D111FH

Code	Flow at Δp 5 Bar (72.5 PSI) per Metering Edge				
	C-Notch	Sine Notch Spools			
	D31 LPM (GPM)	D31 LPM (GPM)	D41 LPM (GPM)	D81/91 LPM (GPM)	D111 LPM (GPM)
A	20 (5.3)[5] 33 (8.7)[6]	55 (14.6)	–	–	–
B	–	–	105 (27.8)	–	–
C	32 (8.5)[5] 55 (14.6)[6]	80 (21)	140 (37)		
E	–	–	190 (50)	250 (66)	–
F	–	–	240 (63)	310 (82)	–
H	–	–	–	400 (106)	500 (132)
L	–	–	–	–	1000 (264)

5) E50 Spool Only
6) B60 and A60 Spool Only

Weight:

NG10	8.1 kg	(17.9 lbs.)
NG16	11.6 kg	(25.6 lbs.)
NG25	20.7 kg	(45.6 lbs.)
NG32	62.0 kg	(137.0 lbs.)

V-Notch Spool Options - Spool Type and Flow Codes

Code		V-Notch
$Q_A=Q_B$	$Q_A>Q_B$[7)]	Spool Type
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)

7) 2:1 Ratio: Reduced Flow Rate on Port B, Rated Flow Rate on Port A
Code A* for spool $Q_B>Q_A$ optional

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

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.

D_1FH.p65, dd

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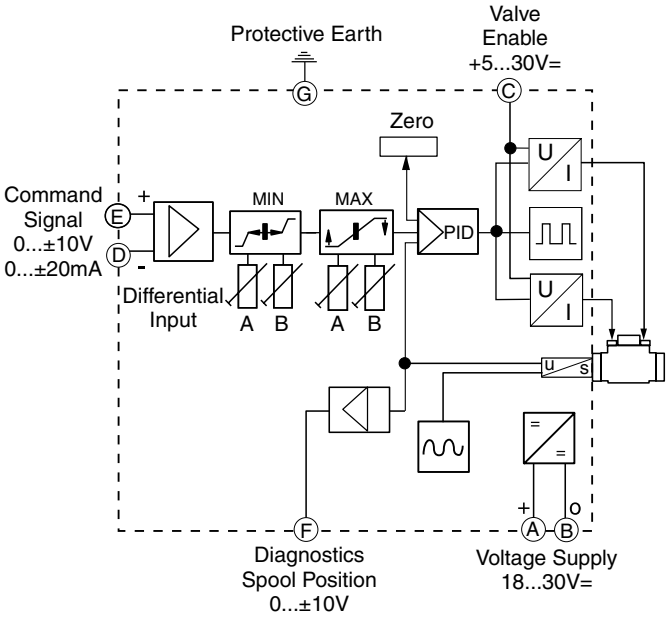
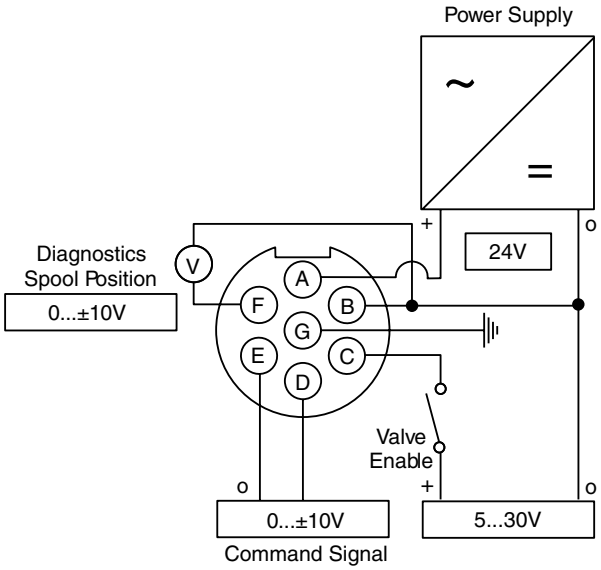
Function Diagram, Valve Electronics



Wiring



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.

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.

Status LED

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

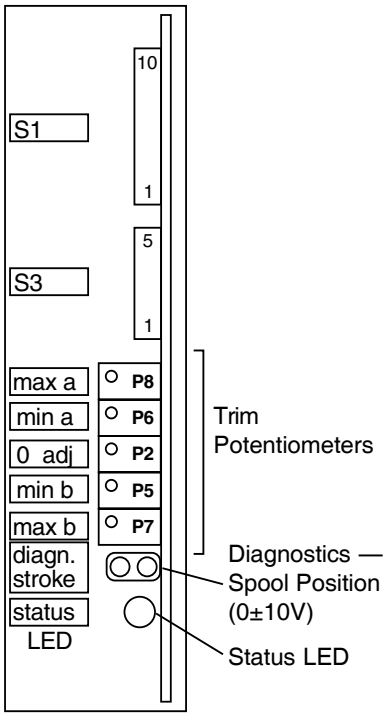
Display Color	Indicates
Green	Normal operation
Off	Supply voltage outside permissible range of 18 to 30 VDC
Red	Spool position error / Low pilot pressure

Electronics Adjustment

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

Integrated Control Electronics

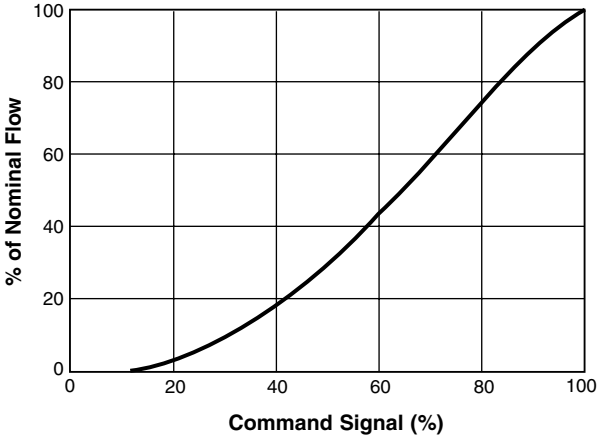
Arrangement of potentiometers, status LED, and internal valve spool monitor point.



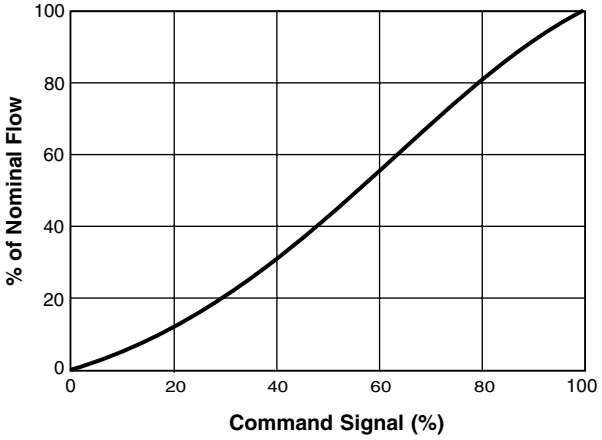
A

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

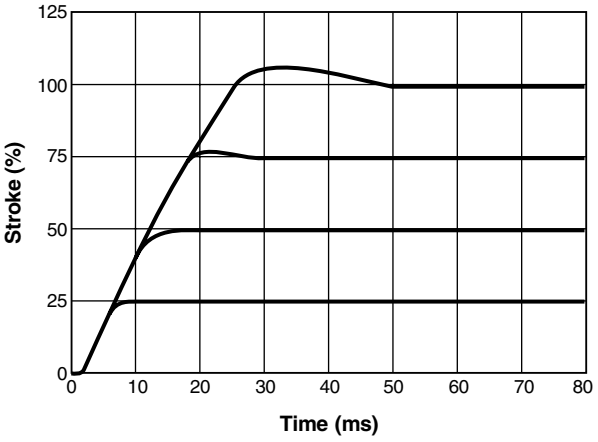
Flow Characteristics – Overlap Spools
Typical, at 5 Bar (72.5 PSI) per metering edge



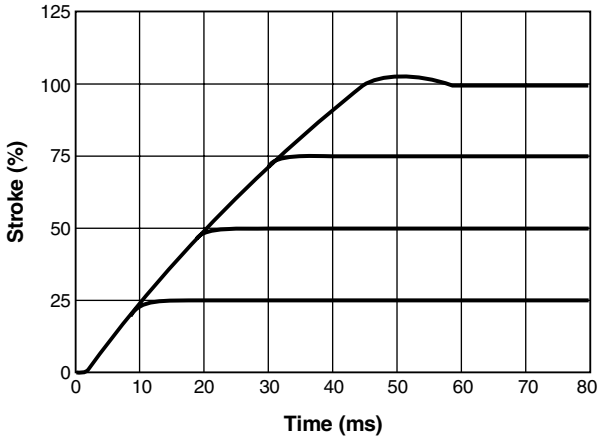
Flow Characteristics – Zero Lap Spools
Typical, at 5 Bar (72.5 PSI) per metering edge



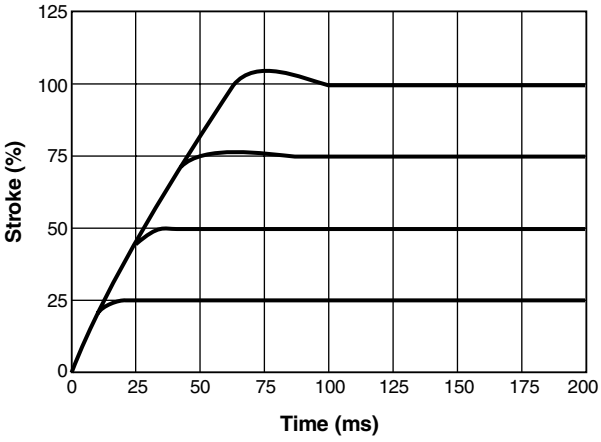
D31FH Step Response



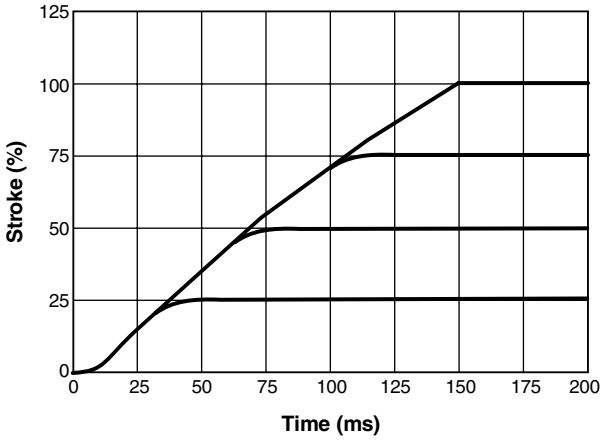
D41FH Step Response



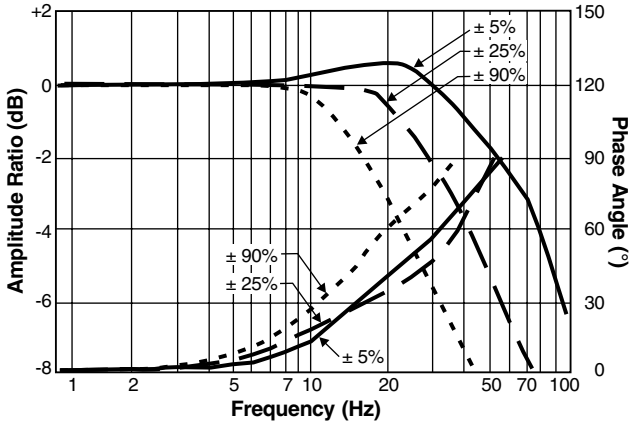
D81FH and D91FH Step Response



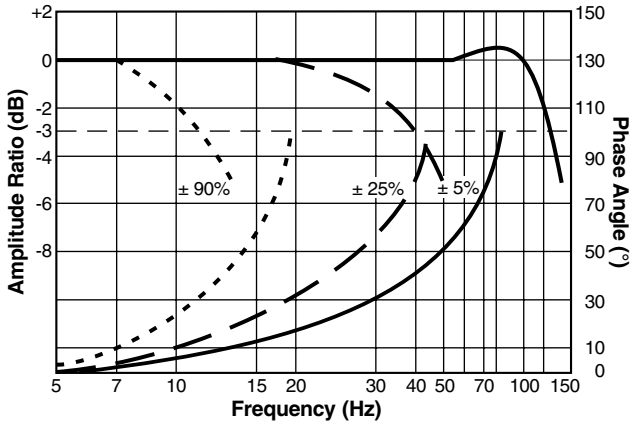
D111FH Step Response



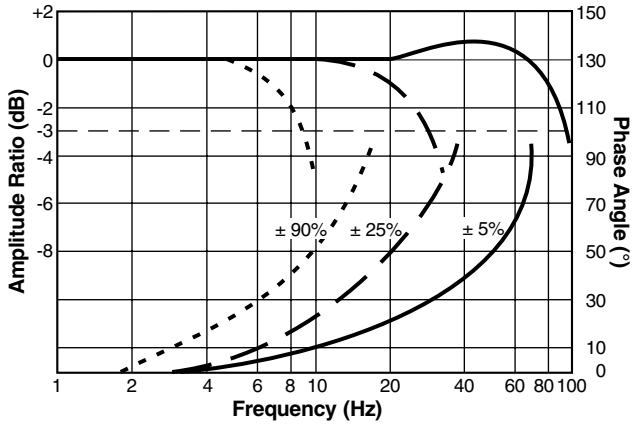
D31FH Frequency Response



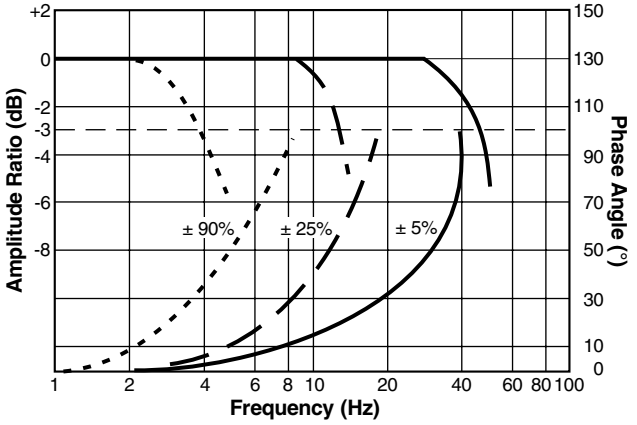
D41FH Frequency Response



D81FH and D91FH Frequency Response



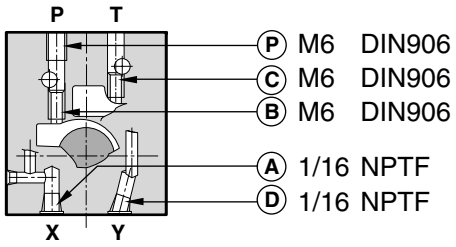
D111FH Frequency Response



A

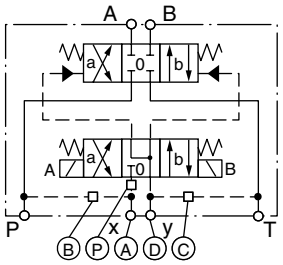
Pilot Connection

D31FH

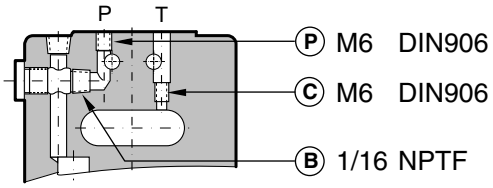


○ **open,** ● **closed**

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

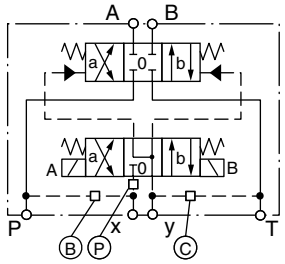


D41FH

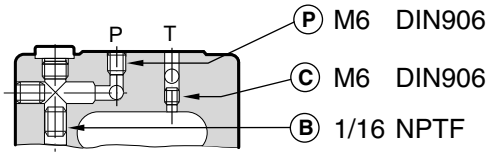


○ open, ● closed

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

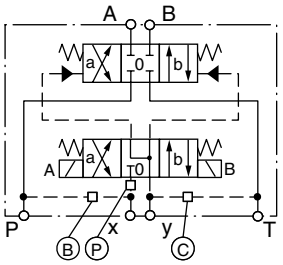


D81FH and D91FH

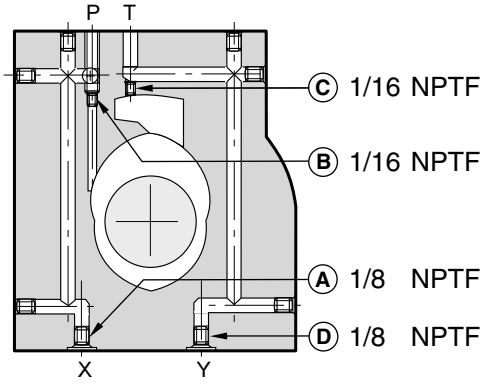


○ open, ● closed

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

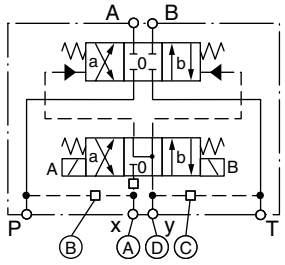


D111FH



○ open, ● closed

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

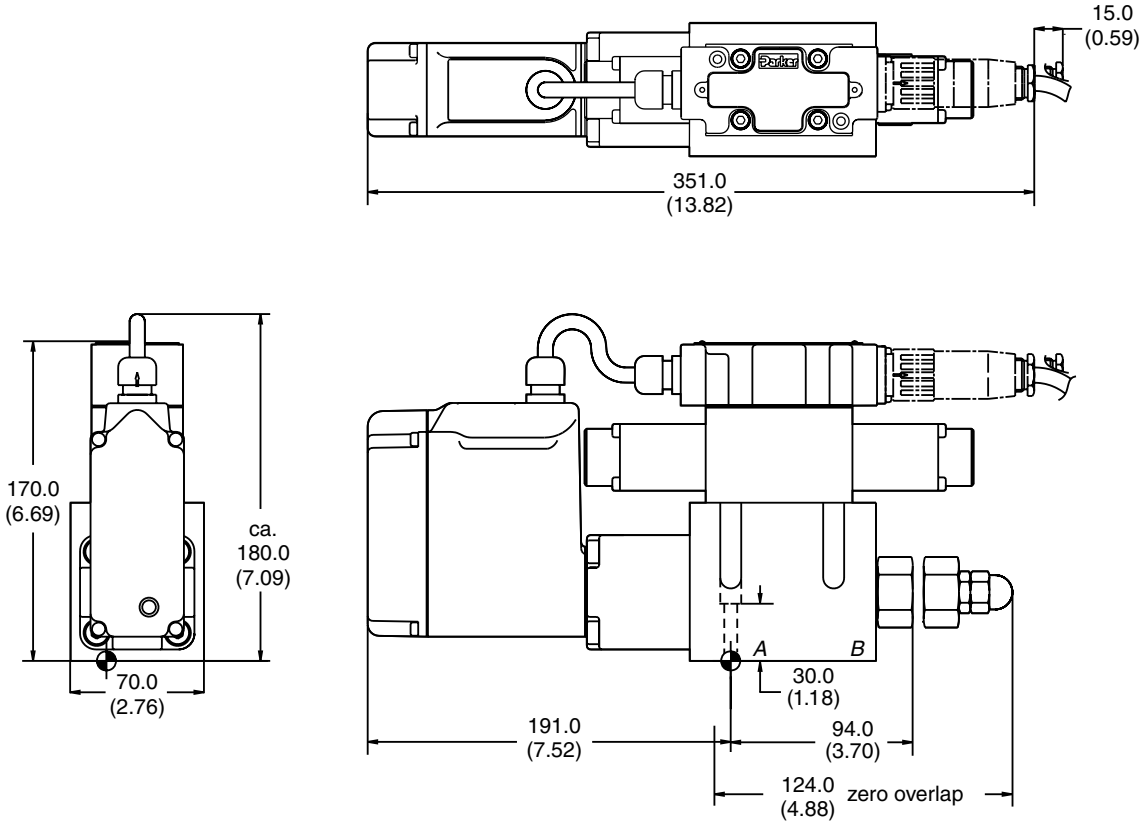


D_1FH.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

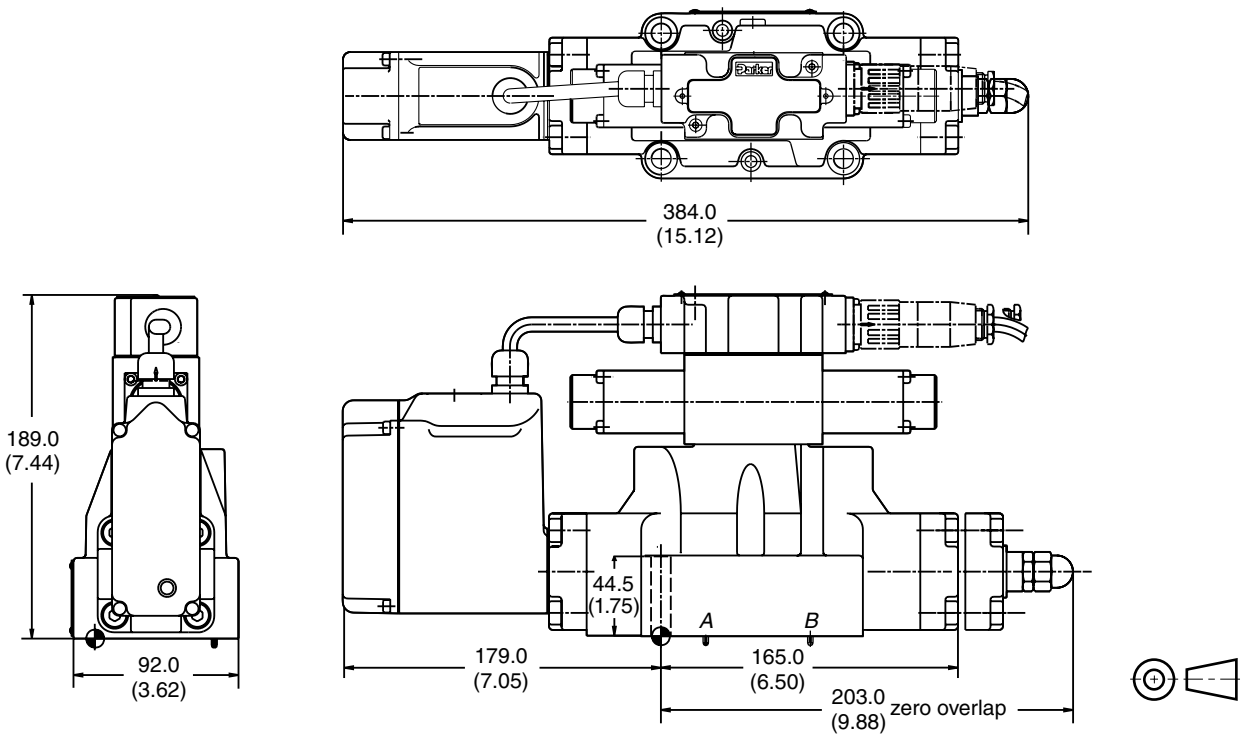
D31FH

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



D41FH

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



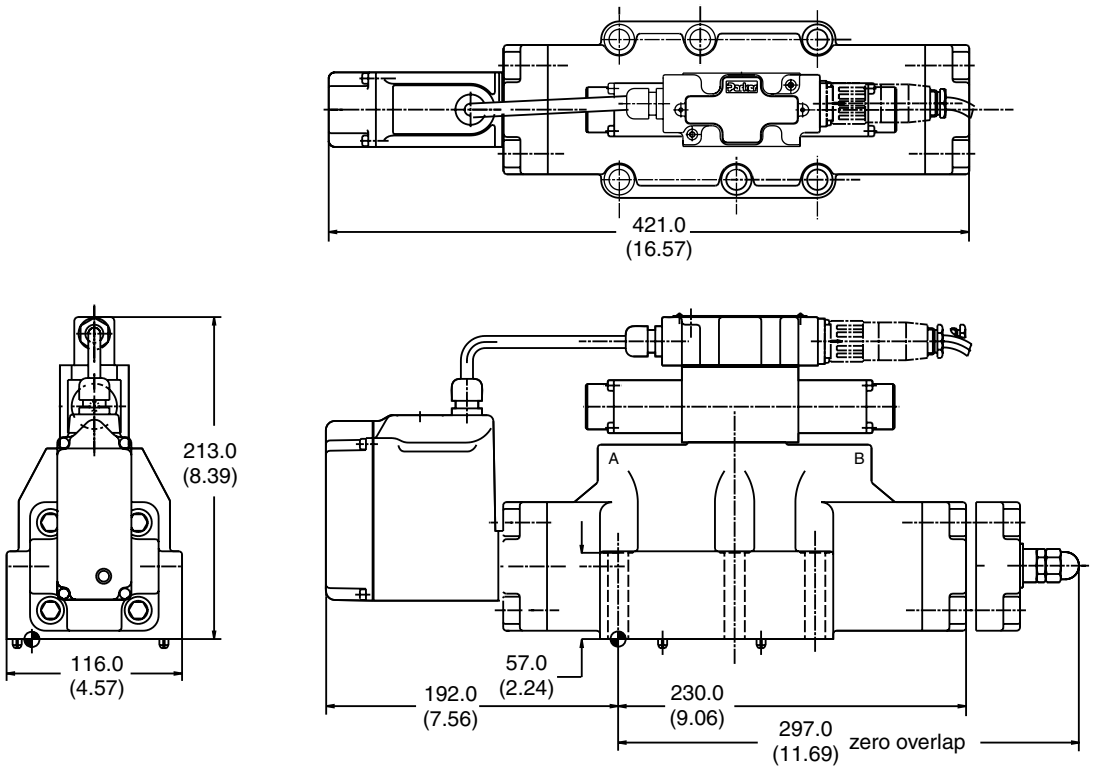
D_1FH.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

A

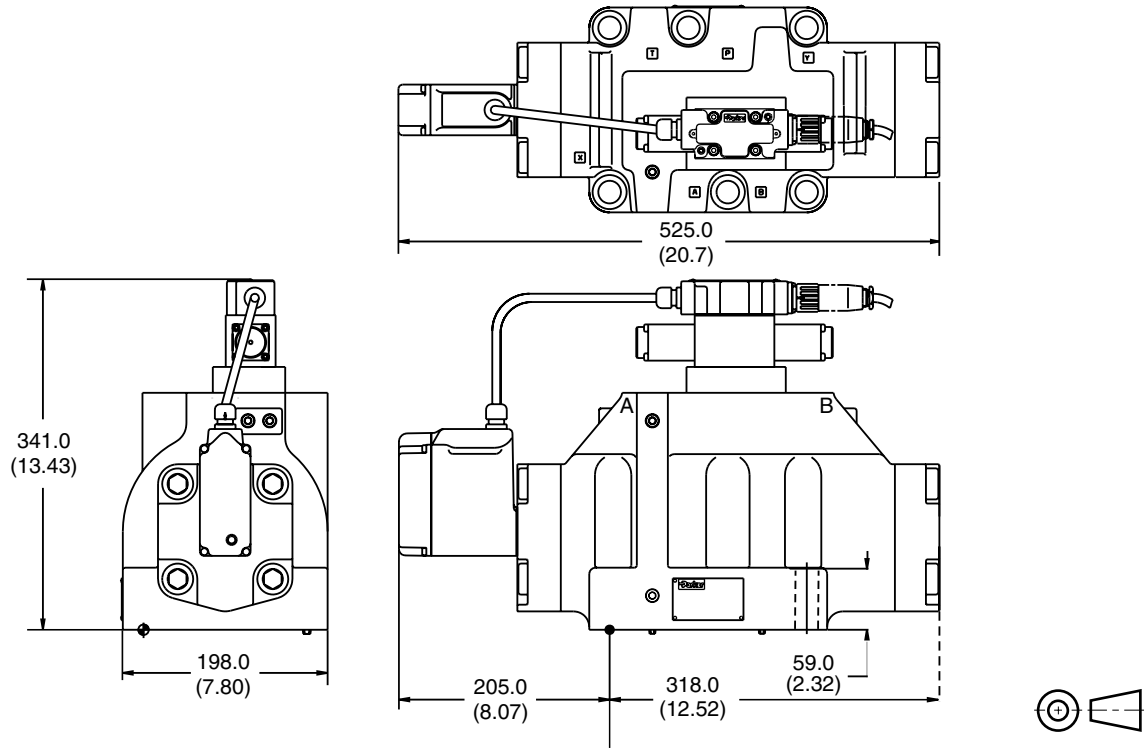
D81FH and D91FH

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



D111FH

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



D_1FH.p65, dd

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Parker VCD® — New Patented Valve-Drive Technology

Parker has revolutionized the drive technology of high response control valves with VCD® technology.

In contrast to standard proportional solenoid drives, this technology actuates the spool (1) by using a moveable coil (2).

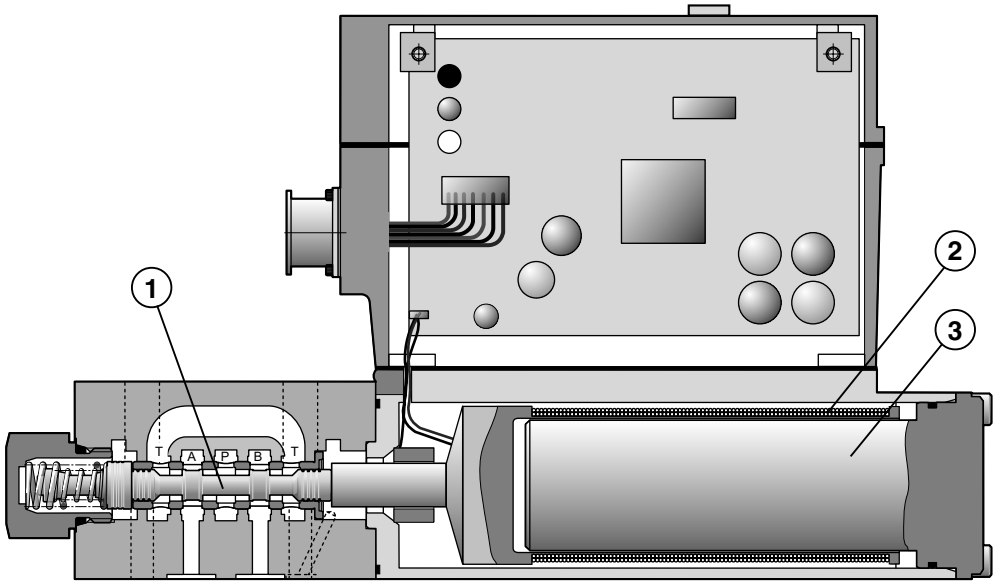
The spool is rigidly connected to the coil, which moves over a permanent magnetic cylinder (3) free of friction.

When the coil is energized, the spool is moved to the desired position. The spool position is fed back into the control electronics via a high resolution feedback system.

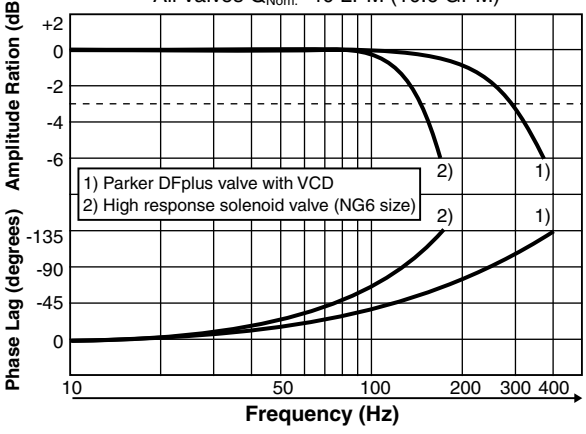
When the power supply is powered down, the spool is driven by a spring to a defined position.

Advantages Compared to Traditional Valve Drives

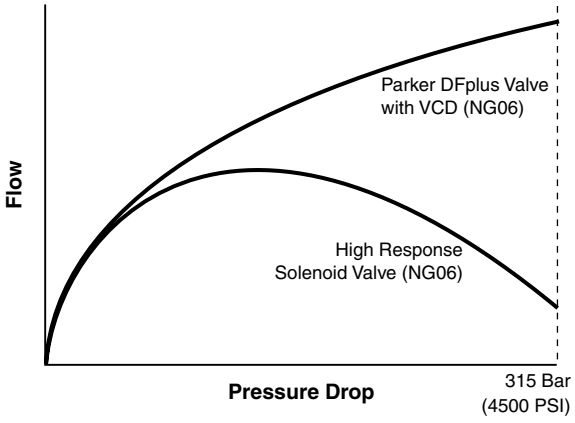
- **High Dynamics** — No active return spring required.
- **High Forces** — High force density provided by electromechanical drive.
- **Low Operation Expenses** — Maintenance free, no pilot supply oil required.



Frequency Response
±5% Command Signal
All Valves $Q_{Nom.}$=40 LPM (10.6 GPM)



Flow Limit
Schematics
All Valves $Q_{Nom.}$=40 LPM (10.6 GPM)



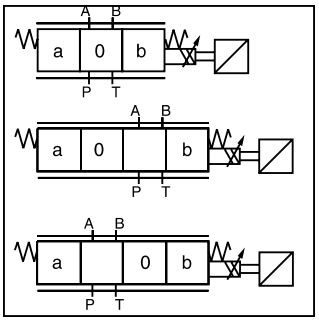
A

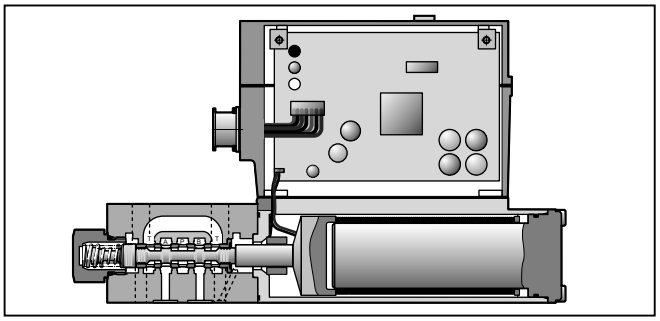
General Description

Series D1FP direct operated control valve features extremely high dynamics combined with maximum flow. It is used for high accuracy positioning of a hydraulic axis, and for controlling force and velocity.

Driven by the new patented VCD® actuator, the D1FP reaches the frequency response of servovalves. Compared with solenoid driven valves, the D1FP can also be used in applications with pressure drops up to 315 Bar (4500 PSI) across the valve.

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





Features

- Servovalve dynamics (-90°/250Hz at ±5% input signal).
- Full flow capacity up to 315 Bar (4500 PSI) pressure drop through the valve.
- Maximum tank pressure 315 Bar (4500 PSI) with external drain Y-port.
- High flow.
- Defined spool positioning in case of loss of electric power supply.
- On-board electronics.

CE

Specifications

General

Design	Direct-operated, proportional directional control valve
Actuation	VCD® actuator
Size	NG6 (CETOP 3) / D03
Mounting Interface	DIN 24340, ISO 10372 Size 4, CETOP RP121, NFPA D03
Mounting Position	Any
Ambient Temp.	-20°C to +50°C (-4°F to +122°F)
Vibration Resist.	25g acc. DIN IEC68, part 2-6

Static/Dynamic

Step Response[3]	<9 ms @ 100% step with rise and settling, <3.5 ms rise only
Frequency Response (±5% signal)[3]	300 (amplitude ratio -3dB), 250 (phase lag -90°)
Hysteresis	<0.05%
Sensitivity	<0.03%
Temperature Drift	<0.025%/°C

[1] For applications with P_T>35 Bar (500 PSI) the Y-port has to be used. Remove the plug in the Y-port of the valve and connect the Y-port to unpressurized tank.

[2] Flow rate for different Δp per control edge: $Q_x = Q_{Nom.} \cdot \sqrt{\frac{\Delta P_x}{\Delta P_{Nom.}}}$

Hydraulic

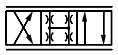
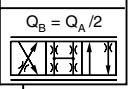
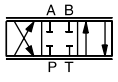
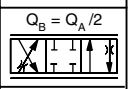
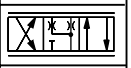
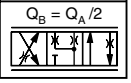
Maximum Operating Pressure	Ports P, A, B 315 Bar (4500 PSI); Port T 35 Bar (500 PSI); rated 315 Bar (4500 PSI) if external drain is used[1]
Fluid	Hydraulic oil as per DIN 51524 to 51535, other on request
Fluid Temp.	-20°C to +50°C (-4°F to +122°F)
Viscosity Permitted	20 mm²/s to 380 mm²/s (90 to 1750 SSU)
Viscosity Recommended	30 mm²/s to 80 mm²/s (135 to 370 SSU)
Minimum Fluid Cleanliness	ISO 4406 (1999), 18/16/13 (acc. NAS 1683: 7)
Recommended Fluid Cleanliness	ISO 4406 (1999), 15/12/10
Flow (Nominal at ΔP=35 Bar (500 PSI) per control edge [2]	3 LPM (0.8 GPM), 6 (1.6 GPM), 12 LPM (3.2 GPM), 25 LPM (6.6 GPM), 40 LPM (10.6 GPM)
Flow Maximum	90 LPM (21.2 GPM) at Δp=315 Bar (4500 PSI) over two control edges)
Internal Leakage at 100 Bar (1450 PSI)	<400 ml/min (zero lapped spool); <50 ml/min (over lapped spool)

[3] Measured with load. 100 Bar (1450 PSI) pressures drop/two control edges.

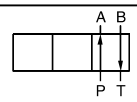
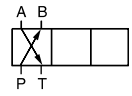
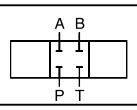
A

D	1	F	P	□	□	9	N	□	□	0	□
Directional Control Valve				Spool Type	Spool Position on Power Down [1]		Seal	Command Signal	Accessories		Design Series

NOTE: Not required when ordering.

Code	Flow LPM (GPM) at Δp 35 Bar (507 PSI) per Metering Edge	Spool
Zerolap		
E50M	40 LPM (10.6 GPM)	
E50H	25 LPM (6.6 GPM)	
E50F	12 LPM (3.2 GPM)	
E50C	6 LPM (1.6 GPM)	
E50B	3 LPM (0.8 GPM)	
B60M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
Overlap 25%		
E01M	40 LPM (10.6 GPM)	
E01H	25 LPM (6.6 GPM)	
E01F	12 LPM (3.2 GPM)	
E01C	6 LPM (1.6 GPM)	
E01B	3 LPM (0.8 GPM)	
B31M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
E02M	40 LPM (10.6 GPM)	
E02H	25 LPM (6.6 GPM)	
B32M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	

Code	Description
N	Nitrile Others available on request

Code	Spool Position on Power Down
A [2]	
B [2]	
C [3]	

Code	Signal	Flow Direction [4]
B	±10V	0 to +10V → P-A
E	±20 mA	0 to +20mA → P-A
S	4 to 20 mA	12 to +20mA → P-A

Code	Connection Type
0	6 + PE acc. DIN 43563
5	11 + PE acc. DIN 41651

1) On power down the spool moves to a defined position. In case of single flow path on the control edge A→ T resp. B→T with pressure drops above 120 Bar (1740 PSI) or contamination in the hydraulic fluid, this cannot be guaranteed.

2) Approximately 25% opening, only zero lapped spools.

3) Only for overlapped spools.

4) Flow direction P→ A with Pin D > Pin E.

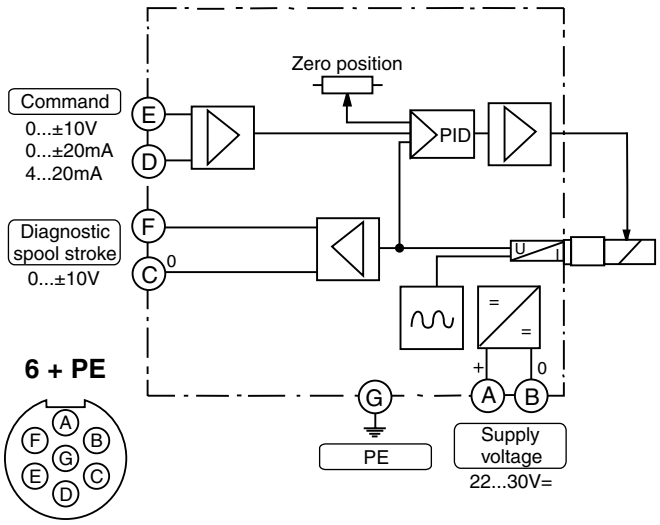
Weight: 4.5 kg (9.9 lbs.)

Please order mating connector separately.
See Accessories section.

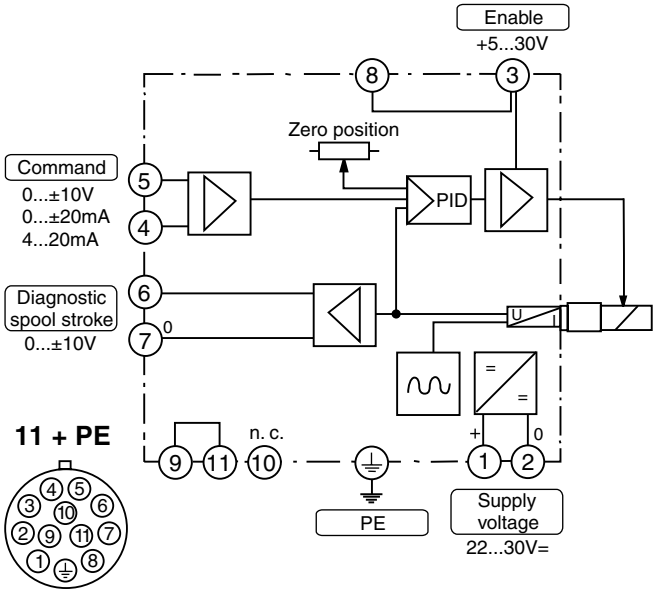
A

Block Diagrams

Code 0



Code 5



Note: When replacing another valve, verify Pin C is 0 V and not wired as an enable.

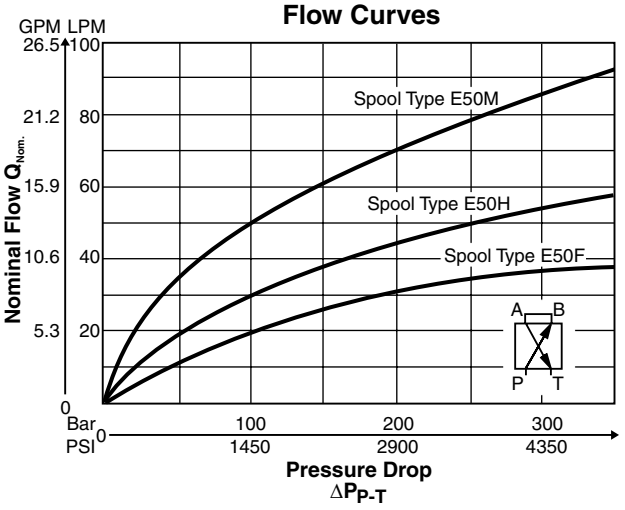
Electrical Characteristics

Duty Ratio	100%
Protection Class	IP65
Supply Voltage/ Ripple	22V to 30V, ripple <5% eff.
Current Consumption Max.	3.5A
Switch-on Current Typical	22A for 0.2 ms
Input Signal	(Flow with Pin D > Pin E)
Voltage	10V to 0V to -10V, ripple <0.01% eff., surge free, 0V to +10V P->A
Impedance	100K ohm
Current	20 mA to 0 mA to -20 mA, ripple <0.01% eff., surge free, 0 to +20 mA P->A
Impedance	250 ohm
Current	4 mA to 12 mA to 20 mA, ripple <0.01% eff., surge free, 12 to 20 mA P->A
Impedance	250 ohm

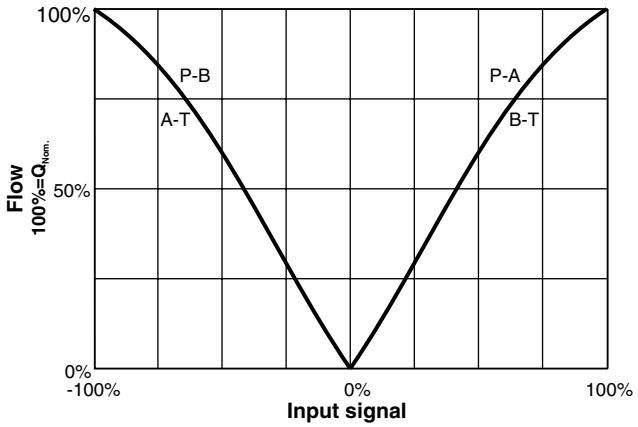
Differential Input Maximum	30V for terminal D and E against PE
Enable Signal (only code 5)	5V to 30V, 9K ohm input impedance
Diagnostic Signal	+10V to 0V to -10V rated max. 5 mA
Pre-fusing	4.0A medium lag
EMC	EN 50081-2, EN50082-2
Electrical Connection	
Code 0	6 + PE acc. DIN 43563
Code 5	11 + PE acc. DIN 41651
Wiring Minimum	
Code 0	7x1.0 mm² (AWG 18) overall braid shield
Code 5	12x1.0 mm² (AWG 18) overall braid shield
Wiring Length Maximum	50m (164 ft.)

A

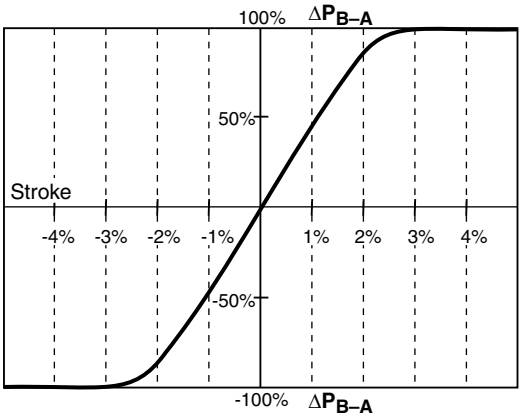
Flow Curves



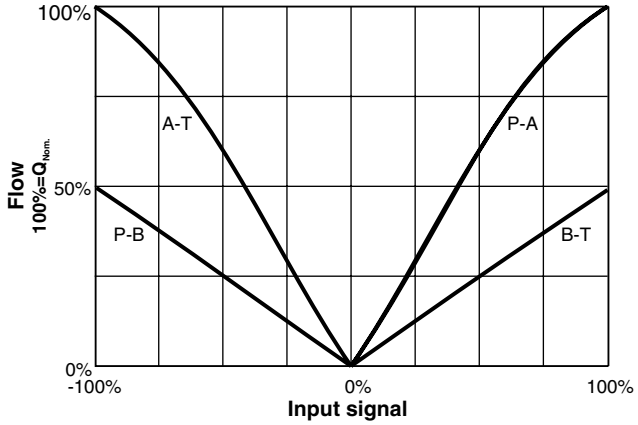
Spool Type E50



Pressure Gain

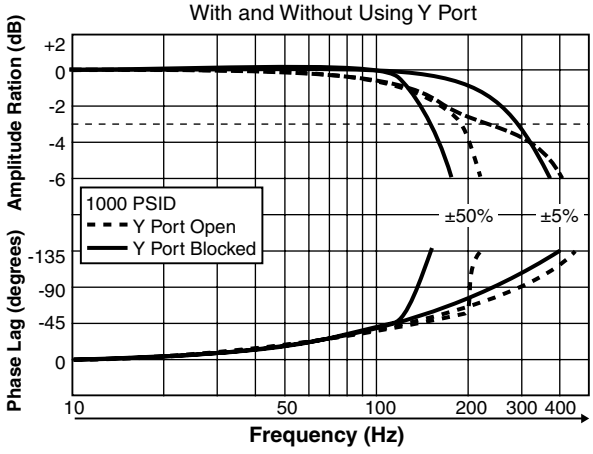


Spool Type B60



Frequency Response

With and Without Using Y Port



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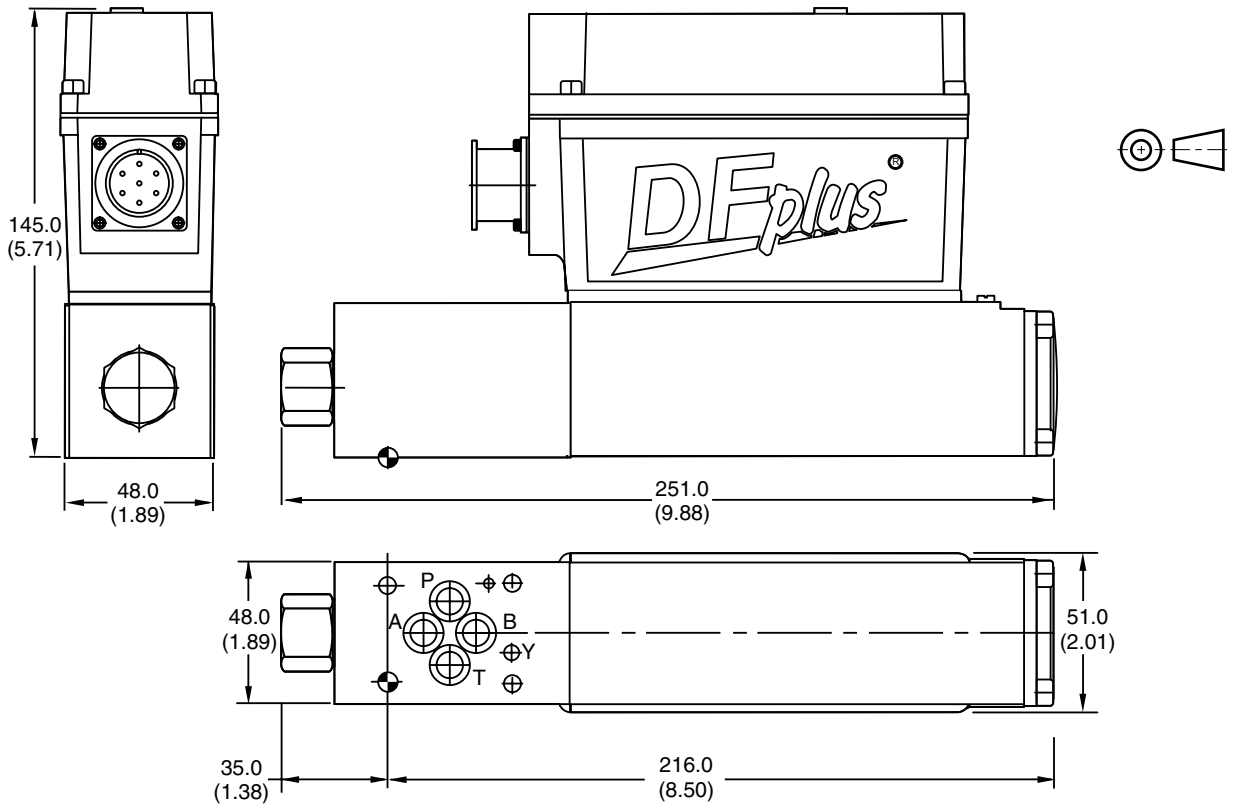
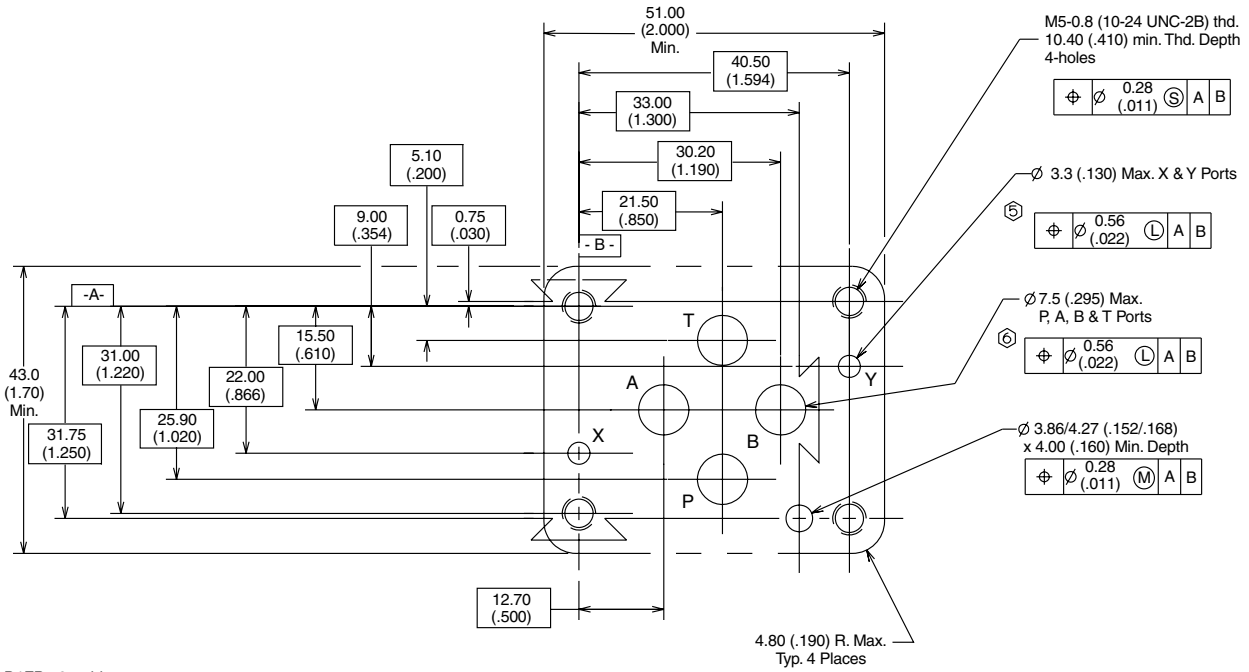
Inch equivalents for millimeter dimensions are shown in (**)



Surface Finish	Kit		
R_{max} 6.3 ⏥ 0.01/100	BK375	4 x M5x30 DIN 912 12.9	6.8 Nm (5.0 lb. ft.) ±15%
	BK209	4x10-24x1.25"	6.8 Nm (5.0 lb.-ft.)

DIN 24340-A6, size NG6 / CETOP 3 / D03



D1FP.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

A

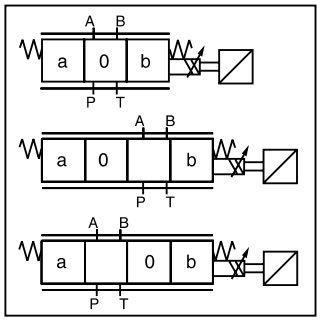
General Description

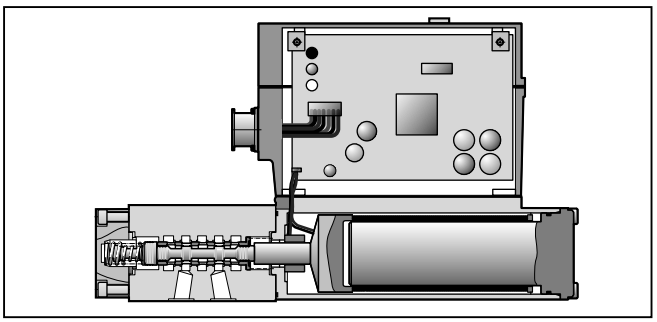
Series D1FP*S direct operated control valve of the nominal size 04 (ISO 10372) shows extremly high dynamics combined with maximum flow. The valve mounting pattern is designed to replace servovalves of size 04 (ISO 10372) with the D1FP*S.

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 315 Bar† (4500 PSI). Additional features are low leakage and a defined spool position in case of loss of power supply.

Maintenance and contamination restrictions correspond to common solenoid driven valves and pilot supply is not required.

† Flow over two control edges.





Features

- Servovalve size 04 (ISO 10372) mounting pattern (22.23 mm (0.875 in.) port circle.)
- Servovalve dynamics (-3db/300Hz with ±5% input signal).
- Low internal leakage.
- No flow limit up to 315 Bar (4500 PSI) pressure drop through the valve (flow over two control edges).
- Maximum tank pressure 315 Bar (4500 PSI) with external drain Y-port.
- High flow.
- Defined spool positioning in case of loss of electric power supply.
- On-board electronics.

CE

Specifications

General

Design	Direct-operated, proportional directional control valve
Actuation	VCD® actuator
Size	ISO 10372 size 04
Mounting Interface	ISO 10372-04-04-0-92 (X Port used as Y unpressurized tank)
Mounting Position	Any
Ambient Temp.	-20°C to +50°C (-4°F to +122°F)
Vibration Resist.	25g acc. DIN IEC68, part 2-6

Static/Dynamic

Step Response[3]	<9 ms @ 100% step with rise and settling, <3.5 ms rise only
Frequency Response (±5% signal)[3]	300 (amplitude ratio -3dB), 250 (phase lag -90°)
Hysteresis	<0.05%
Sensitivity	<0.03%
Temperature Drift	<0.025%/°C

[1] For applications with P_T>35 Bar (500 PSI) the Y-port has to be used. Remove the plug in the Y-port of the valve and connect the Y-port to unpressurized tank.

Hydraulic

Maximum Operating Pressure	Ports P, A, B 315 Bar (4500 PSI); Port T 35 Bar (500 PSI); rated 315 Bar (4500 PSI) if external drain is used[1]
Fluid	Hydraulic oil as per DIN 51524 to 51535, other on request
Fluid Temp.	-20°C to +50°C (-4°F to +122°F)
Viscosity Permitted	20 mm²/s to 380 mm²/s (90 to 1750 SSU)
Viscosity Recommended	30 mm²/s to 80 mm²/s (135 to 370 SSU)
Minimum Fluid Cleanliness	ISO 4406 (1999), 18/16/13 (acc. NAS 1683: 7)
Recommended Fluid Cleanliness	ISO 4406 (1999), 15/12/10
Flow (Nominal at ΔP=35 Bar (500 PSI) per control edge [2]	3 LPM (0.8 GPM), 6 (1.6 GPM), 12 LPM (3.2 GPM), 25 LPM (6.6 GPM), 40 LPM (10.6 GPM)
Flow Maximum	90 LPM (21.2 GPM) at Δp=315 Bar (4500 PSI) over two control edges)
Internal Leakage at 100 Bar (1450 PSI)	<400 ml/min (zero lapped spool); <50 ml/min (over lapped spool)

[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 (1450 PSI) pressures drop/two control edges.

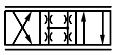
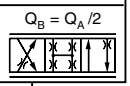
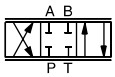
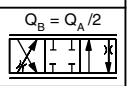
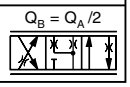
D1FP.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

A

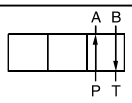
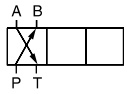
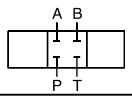
D	1	F	P	□	□	9	N	□	□	S	□
Directional Control Valve				Spool Type	Spool Position on Power Down [1]		Seal	Command Signal	Accessories	Mounting	Design Series

NOTE: Not required when ordering.

Code	Flow LPM (GPM) at Δp 35 Bar (507 PSI) per Metering Edge	Spool
Zerolap		
E50M	40 LPM (10.6 GPM)	
E50H	25 LPM (6.6 GPM)	
E50F	12 LPM (3.2 GPM)	
E50C	6 LPM (1.6 GPM)	
E50B	3 LPM (0.8 GPM)	
B60M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
Overlap 25%		
E01M	40 LPM (10.6 GPM)	
E01H	25 LPM (6.6 GPM)	
E01F	12 LPM (3.2 GPM)	
E01C	6 LPM (1.6 GPM)	
E01B	3 LPM (0.8 GPM)	
B31M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
E02M	40 LPM (10.6 GPM)	
E02H	25 LPM (6.6 GPM)	
B32M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	

Code	Description
N	Nitrile Others available on request

Code	Description
S	ISO 10372 Size 04 (0.875" Port Circle)

Code	Spool Position on Power Down
A[2]	
B[2]	
C[3]	

Code	Connection
0	6 + PE acc. DIN 43563
5	11 + PE acc. DIN 41651

Code	Signal	Flow Direction[4]
B	±10V	0 to +10V → P-A
E	±20 mA	0 to +20mA → P-A
S	4 to 20 mA	12 to +20mA → P-A

1) On power down the spool moves to a defined position. In case of single flow path on the control edge A→T resp. B→T with pressure drops above 120 Bar (1740 PSI) or contamination in the hydraulic fluid, this cannot be guaranteed.

2) Approximately 25% opening, only zero lapped spools.

3) Only for overlapped spools.

4) Flow direction P→ A with Pin D > Pin E.

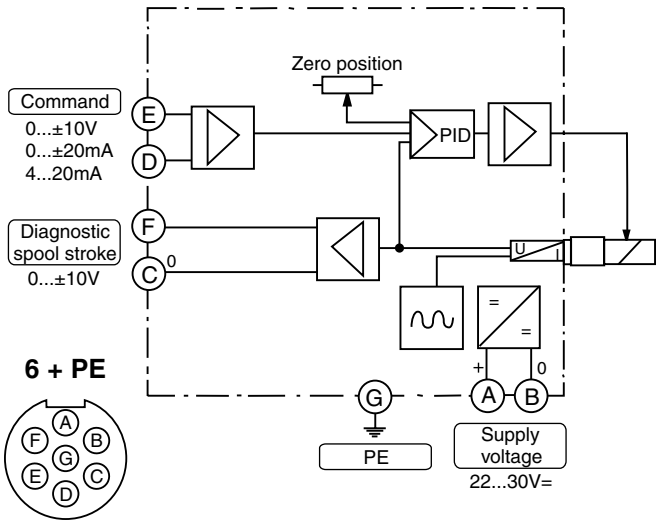
Weight: 4.5 kg (9.9 lbs.)

Please order mating connector separately.
See Accessories section.

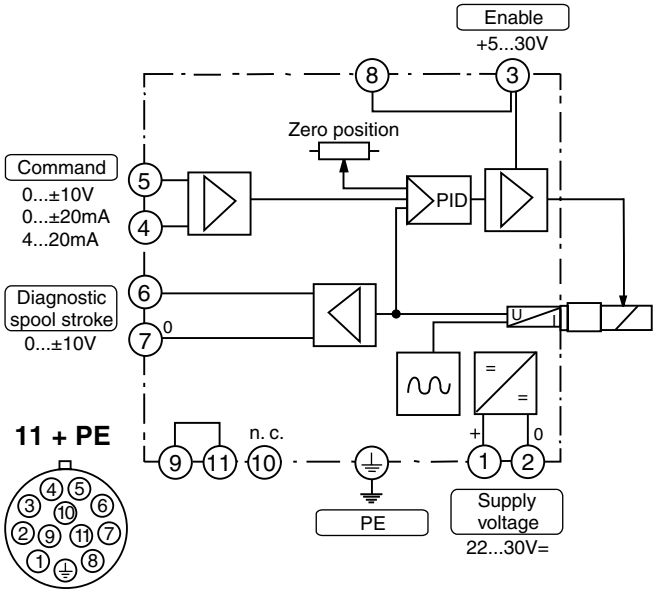
A

Block Diagrams

Code 0



Code 5



Note: When replacing another valve, verify Pin C is 0 V and not wired as an enable.

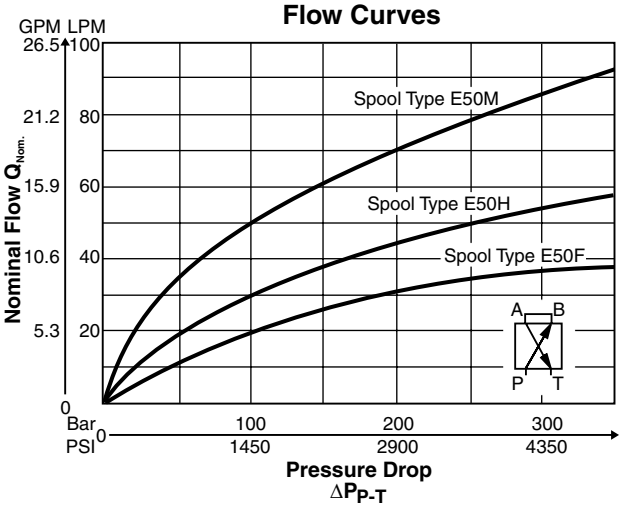
Electrical Characteristics

Duty Ratio	100%
Protection Class	IP65
Supply Voltage/ Ripple	22V to 30V, ripple <5% eff.
Current Consumption Max.	3.5A
Switch-on Current Typical	22A for 0.2 ms
Input Signal	(Flow with Pin D > Pin E)
Voltage	10V to 0V to -10V, ripple <0.01% eff., surge free, 0V to +10V P->A
Impedance	100K ohm
Current	20 mA to 0 mA to -20 mA, ripple <0.01% eff., surge free, 0 to +20 mA P->A
Impedance	250 ohm
Current	4 mA to 12 mA to 20 mA, ripple <0.01% eff., surge free, 12 to 20 mA P->A
Impedance	250 ohm

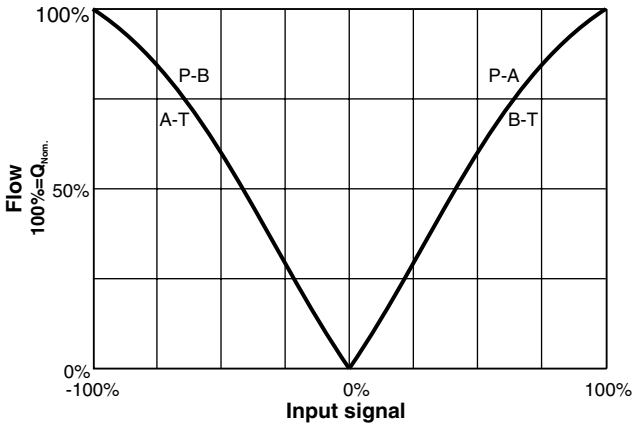
Differential Input Maximum	30V for terminal D and E against PE
Enable Signal (only code 5)	5V to 30V, 9K ohm input impedance
Diagnostic Signal	+10V to 0V to -10V, rated max. 5 mA
Pre-fusing	4.0A medium lag
EMC	EN 50081-2, EN50082-2
Electrical Connection	
Code 0	6 + PE acc. DIN 43563
Code 5	11 + PE acc. DIN 41651
Wiring Minimum	
Code 0	7x1.0 mm² (AWG 18) overall braid shield
Code 5	12x1.0 mm² (AWG 18) overall braid shield
Wiring Length Maximum	50m (164 ft.)

A

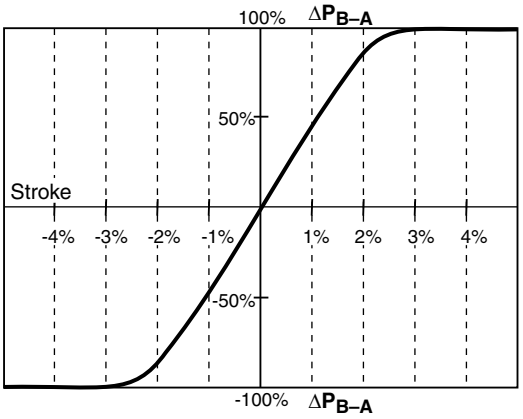
Flow Curves



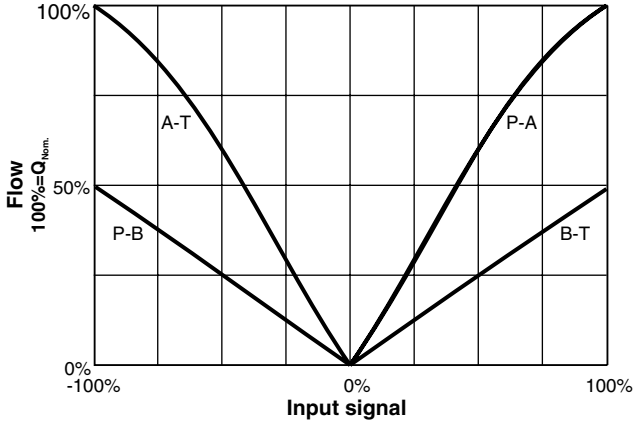
Spool Type E50



Pressure Gain

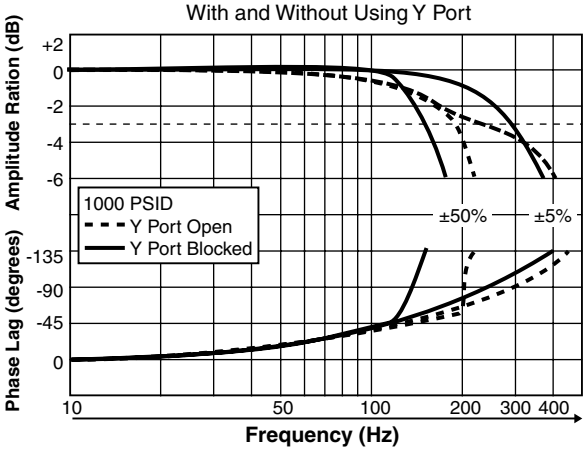


Spool Type B60



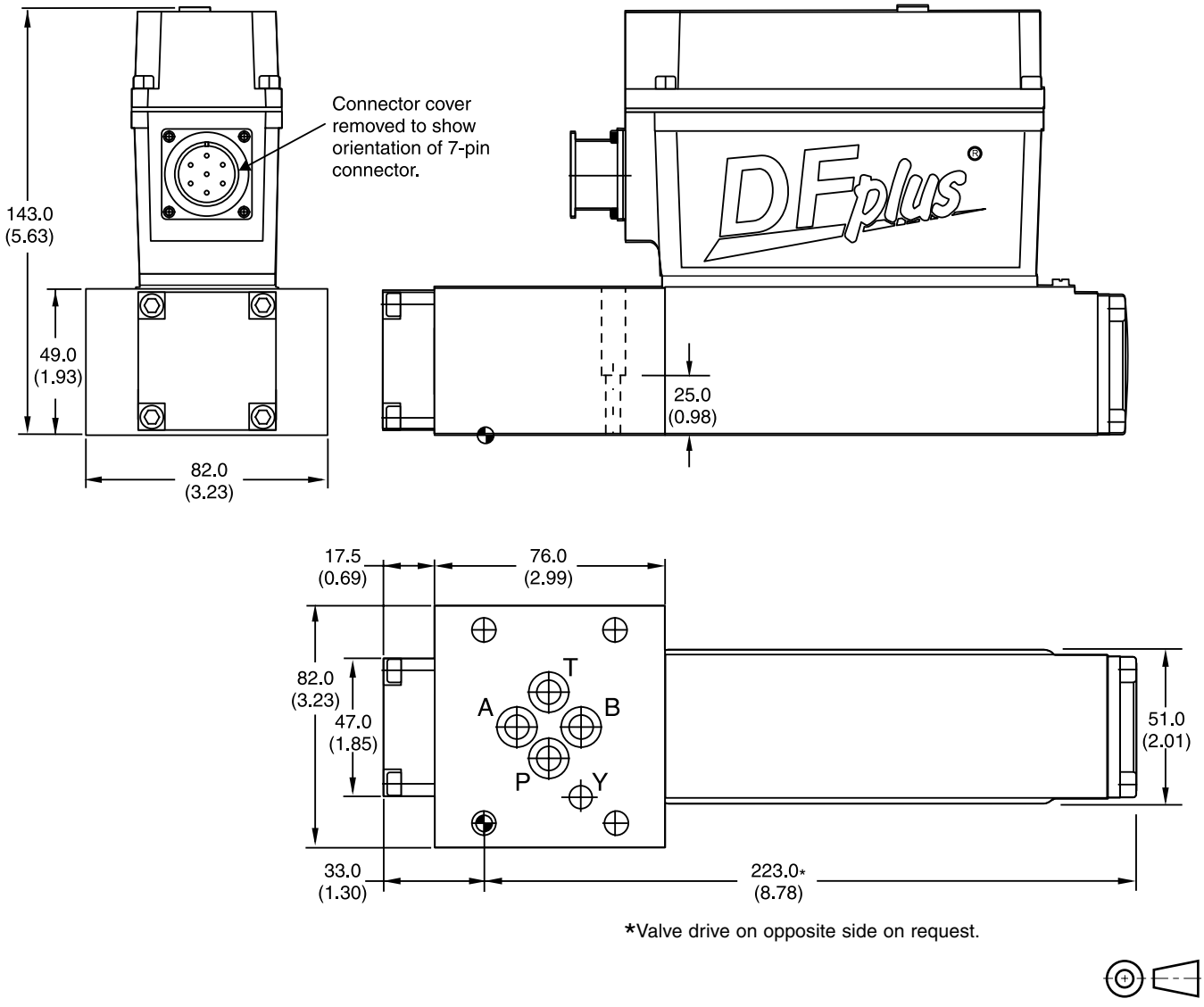
Frequency Response

With and Without Using Y Port



A

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



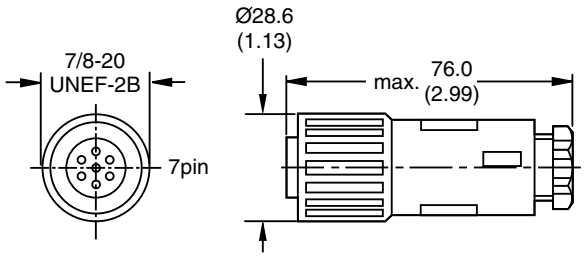
***Valve drive on opposite side on request.**

Warning: External drain port is in ISO external pilot location. Do not apply external pilot.

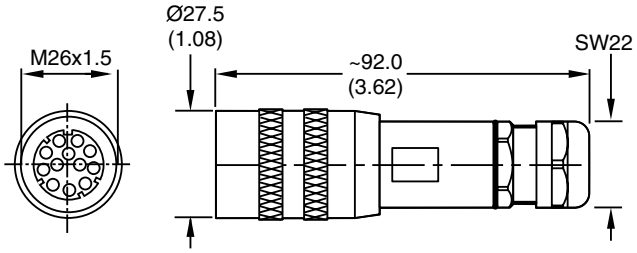
Surface Finish	Kit		
R_{max} 6.3 ⏥ 0.01/100	BK414	4 x M8x40 DIN 912 12.9	33 Nm ±15%
	BK116	4 x 5/16-18 x 1 3/4 long	24.3 lb.-ft.

A

Electrical Connectors



DIN 43563 6 + PE: Part Number 5004072

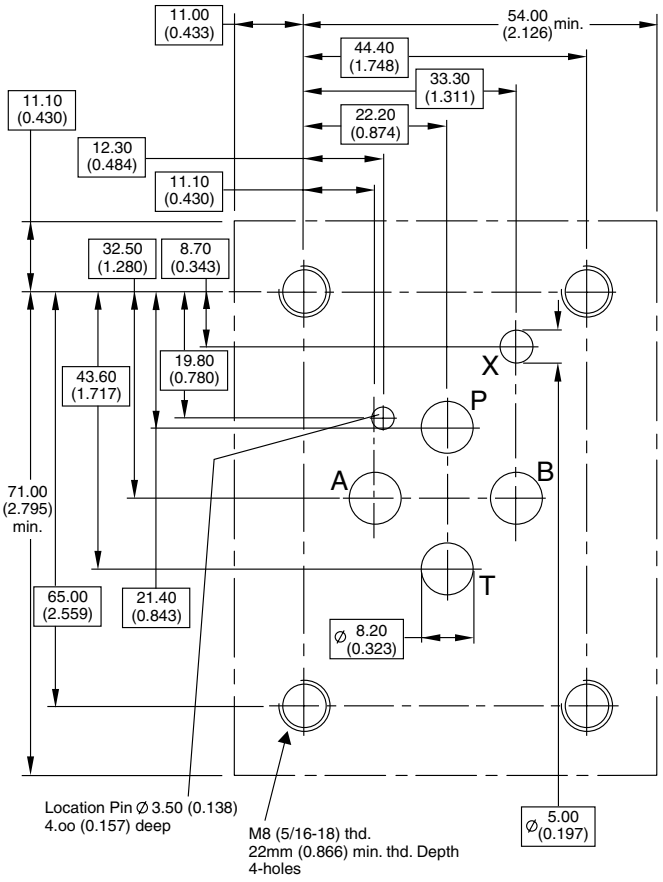


DIN 41651 11 + PE: Part Number 5004711

NOTE: The servovalve X-port is for external pilot pressure. The D1FP can use this port as a Y-port for external drain if T-port pressure will exceed 35 Bar (500 PSI).

IMPORTANT: If replacing a servovalve, make certain pressure is not applied to X-port.

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



A

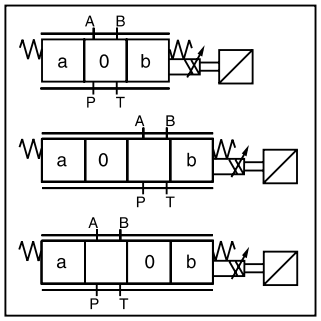
General Description

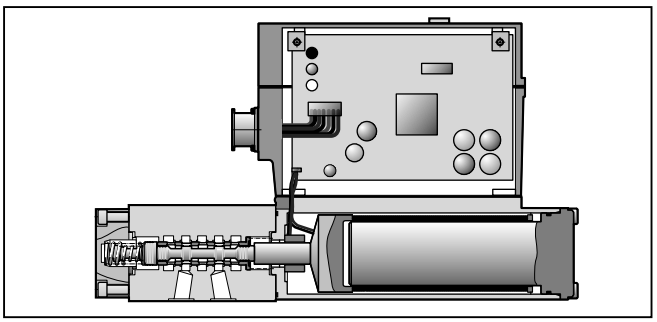
Series D1FP*S direct operated control valve of the nominal size 04 (ISO 10372) shows extremly high dynamics combined with maximum flow. The valve mounting pattern is designed to replace servovalves of size 04 (ISO 10372) with the D1FP*S.

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 315 Bar† (4500 PSI). Additional features are low leakage and a defined spool position in case of loss of power supply.

Maintenance and contamination restrictions correspond to common solenoid driven valves and pilot supply is not required.

† Flow over two control edges.





Features

- Servovalve size 04 (ISO 10372) mounting pattern (22.23 mm (0.875 in.) port circle.)
- Servovalve dynamics (-3db/300Hz with ±5% input signal).
- Low internal leakage.
- No flow limit up to 315 Bar (4500 PSI) pressure drop through the valve (flow over two control edges).
- Maximum tank pressure 315 Bar (4500 PSI) with external drain Y-port.
- High flow.
- Defined spool positioning in case of loss of electric power supply.
- On-board electronics.

CE

Specifications

General

Design	Direct-operated, proportional directional control valve
Actuation	VCD® actuator
Size	ISO 10372 size 04
Mounting Interface	ISO 10372-04-04-0-92 (X Port used as Y unpressurized tank)
Mounting Position	Any
Ambient Temp.	-20°C to +50°C (-4°F to +122°F)
Vibration Resist.	25g acc. DIN IEC68, part 2-6

Static/Dynamic

Step Response[3]	<9 ms @ 100% step with rise and settling, <3.5 ms rise only
Frequency Response (±5% signal)[3]	300 (amplitude ratio -3dB), 250 (phase lag -90°)
Hysteresis	<0.05%
Sensitivity	<0.03%
Temperature Drift	<0.025%/°C

[1] For applications with P_T>35 Bar (500 PSI) the Y-port has to be used. Remove the plug in the Y-port of the valve and connect the Y-port to unpressurized tank.

Hydraulic

Maximum Operating Pressure	Ports P, A, B 315 Bar (4500 PSI); Port T 35 Bar (500 PSI); rated 315 Bar (4500 PSI) if external drain is used[1]
Fluid	Hydraulic oil as per DIN 51524 to 51535, other on request
Fluid Temp.	-20°C to +50°C (-4°F to +122°F)
Viscosity Permitted	20 mm²/s to 380 mm²/s (90 to 1750 SSU)
Viscosity Recommended	30 mm²/s to 80 mm²/s (135 to 370 SSU)
Minimum Fluid Cleanliness	ISO 4406 (1999), 18/16/13 (acc. NAS 1683: 7)
Recommended Fluid Cleanliness	ISO 4406 (1999), 15/12/10
Flow (Nominal at ΔP=35 Bar (500 PSI) per control edge [2]	3 LPM (0.8 GPM), 6 (1.6 GPM), 12 LPM (3.2 GPM), 25 LPM (6.6 GPM), 40 LPM (10.6 GPM)
Flow Maximum	90 LPM (21.2 GPM) at Δp=315 Bar (4500 PSI) over two control edges)
Internal Leakage at 100 Bar (1450 PSI)	<400 ml/min (zero lapped spool); <50 ml/min (over lapped spool)

[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 (1450 PSI) pressures drop/two control edges.

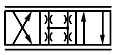
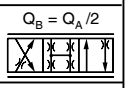
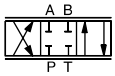
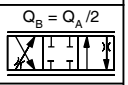
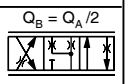
D1FP.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

A

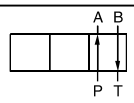
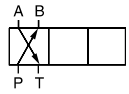
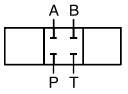
D	1	F	P	□	□	9	N	□	□	S	□
Directional Control Valve				Spool Type	Spool Position on Power Down [1]		Seal	Command Signal	Accessories	Mounting	Design Series

NOTE: Not required when ordering.

Code	Flow LPM (GPM) at Δp 35 Bar (507 PSI) per Metering Edge	Spool
Zerolap		
E50M	40 LPM (10.6 GPM)	
E50H	25 LPM (6.6 GPM)	
E50F	12 LPM (3.2 GPM)	
E50C	6 LPM (1.6 GPM)	
E50B	3 LPM (0.8 GPM)	
B60M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
Overlap 25%		
E01M	40 LPM (10.6 GPM)	
E01H	25 LPM (6.6 GPM)	
E01F	12 LPM (3.2 GPM)	
E01C	6 LPM (1.6 GPM)	
E01B	3 LPM (0.8 GPM)	
B31M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	
E02M	40 LPM (10.6 GPM)	
E02H	25 LPM (6.6 GPM)	
B32M	40 LPM (10.6 GPM)	
	20 LPM (5.3 GPM)	

Code	Description
N	Nitrile Others available on request

Code	Description
S	ISO 10372 Size 04 (0.875" Port Circle)

Code	Spool Position on Power Down
A[2]	
B[2]	
C[3]	

Code	Connection
0	6 + PE acc. DIN 43563
5	11 + PE acc. DIN 41651

Code	Signal	Flow Direction[4]
B	±10V	0 to +10V → P-A
E	±20 mA	0 to +20mA → P-A
S	4 to 20 mA	12 to +20mA → P-A

1) On power down the spool moves to a defined position. In case of single flow path on the control edge A→T resp. B→T with pressure drops above 120 Bar (1740 PSI) or contamination in the hydraulic fluid, this cannot be guaranteed.

2) Approximately 25% opening, only zero lapped spools.

3) Only for overlapped spools.

4) Flow direction P→ A with Pin D > Pin E.

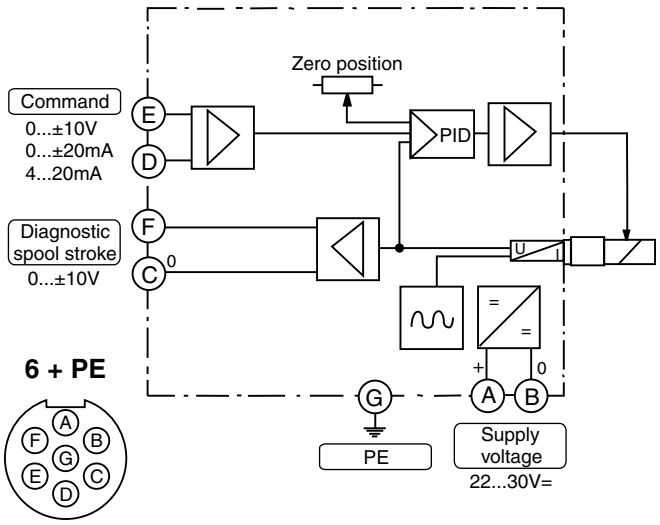
Weight: 4.5 kg (9.9 lbs.)

Please order mating connector separately.
See Accessories section.

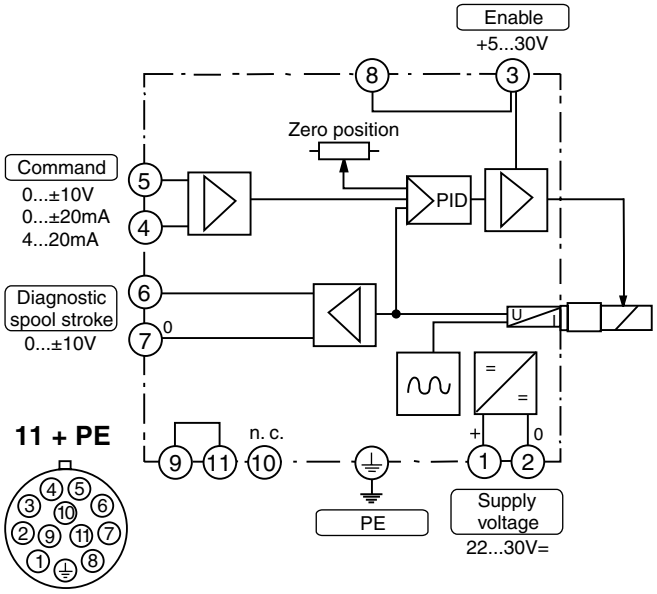
A

Block Diagrams

Code 0



Code 5



Note: When replacing another valve, verify Pin C is 0 V and not wired as an enable.

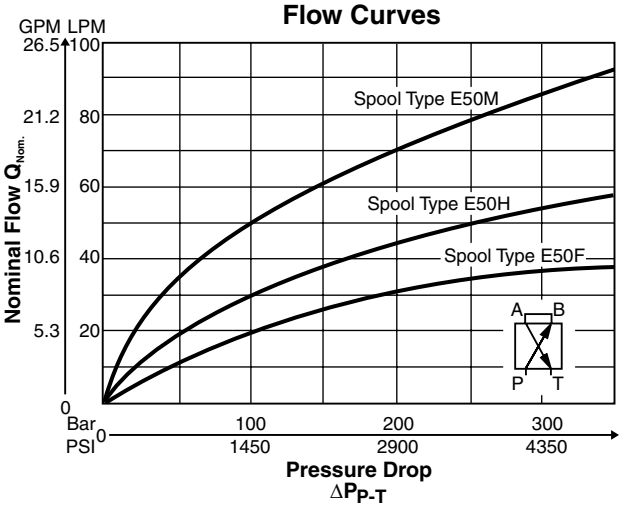
Electrical Characteristics

Duty Ratio	100%
Protection Class	IP65
Supply Voltage/ Ripple	22V to 30V, ripple <5% eff.
Current Consumption Max.	3.5A
Switch-on Current Typical	22A for 0.2 ms
Input Signal	(Flow with Pin D > Pin E)
Voltage	10V to 0V to -10V, ripple <0.01% eff., surge free, 0V to +10V P->A
Impedance	100K ohm
Current	20 mA to 0 mA to -20 mA, ripple <0.01% eff., surge free, 0 to +20 mA P->A
Impedance	250 ohm
Current	4 mA to 12 mA to 20 mA, ripple <0.01% eff., surge free, 12 to 20 mA P->A
Impedance	250 ohm

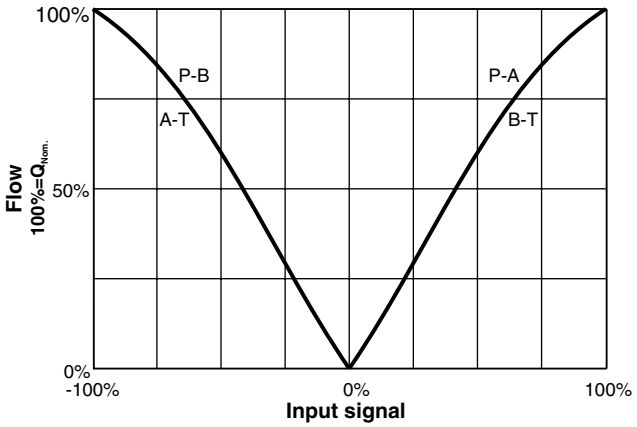
Differential Input Maximum	30V for terminal D and E against PE
Enable Signal (only code 5)	5V to 30V, 9K ohm input impedance
Diagnostic Signal	+10V to 0V to -10V, rated max. 5 mA
Pre-fusing	4.0A medium lag
EMC	EN 50081-2, EN50082-2
Electrical Connection	
Code 0	6 + PE acc. DIN 43563
Code 5	11 + PE acc. DIN 41651
Wiring Minimum	
Code 0	7x1.0 mm² (AWG 18) overall braid shield
Code 5	12x1.0 mm² (AWG 18) overall braid shield
Wiring Length Maximum	50m (164 ft.)

A

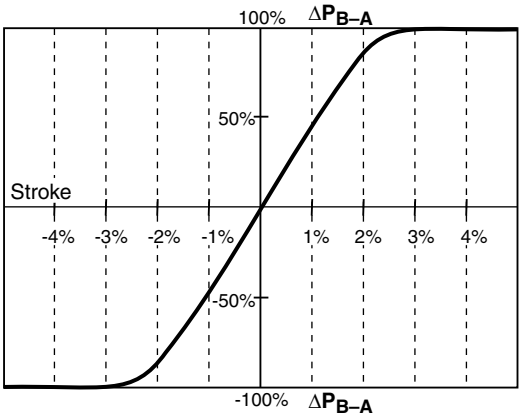
Flow Curves



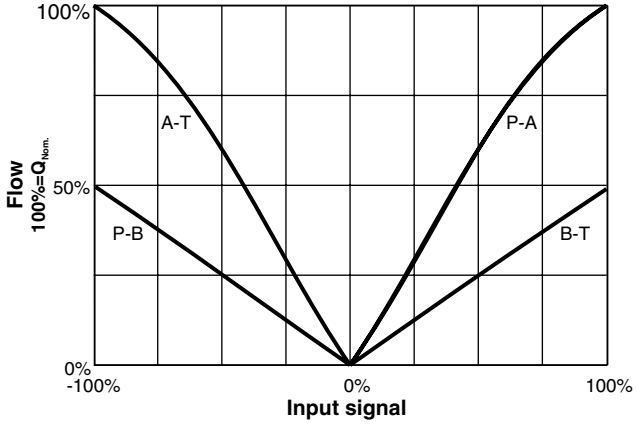
Spool Type E50



Pressure Gain

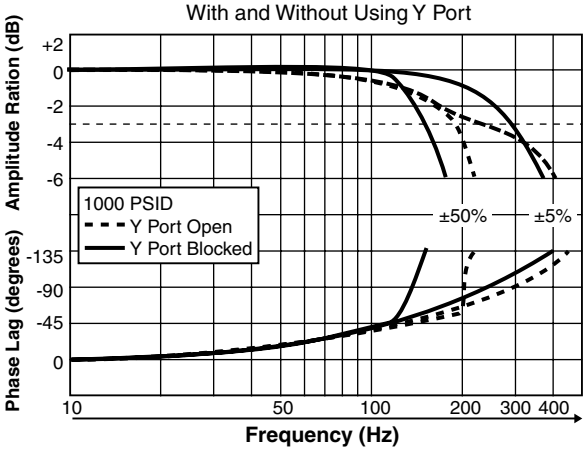


Spool Type B60



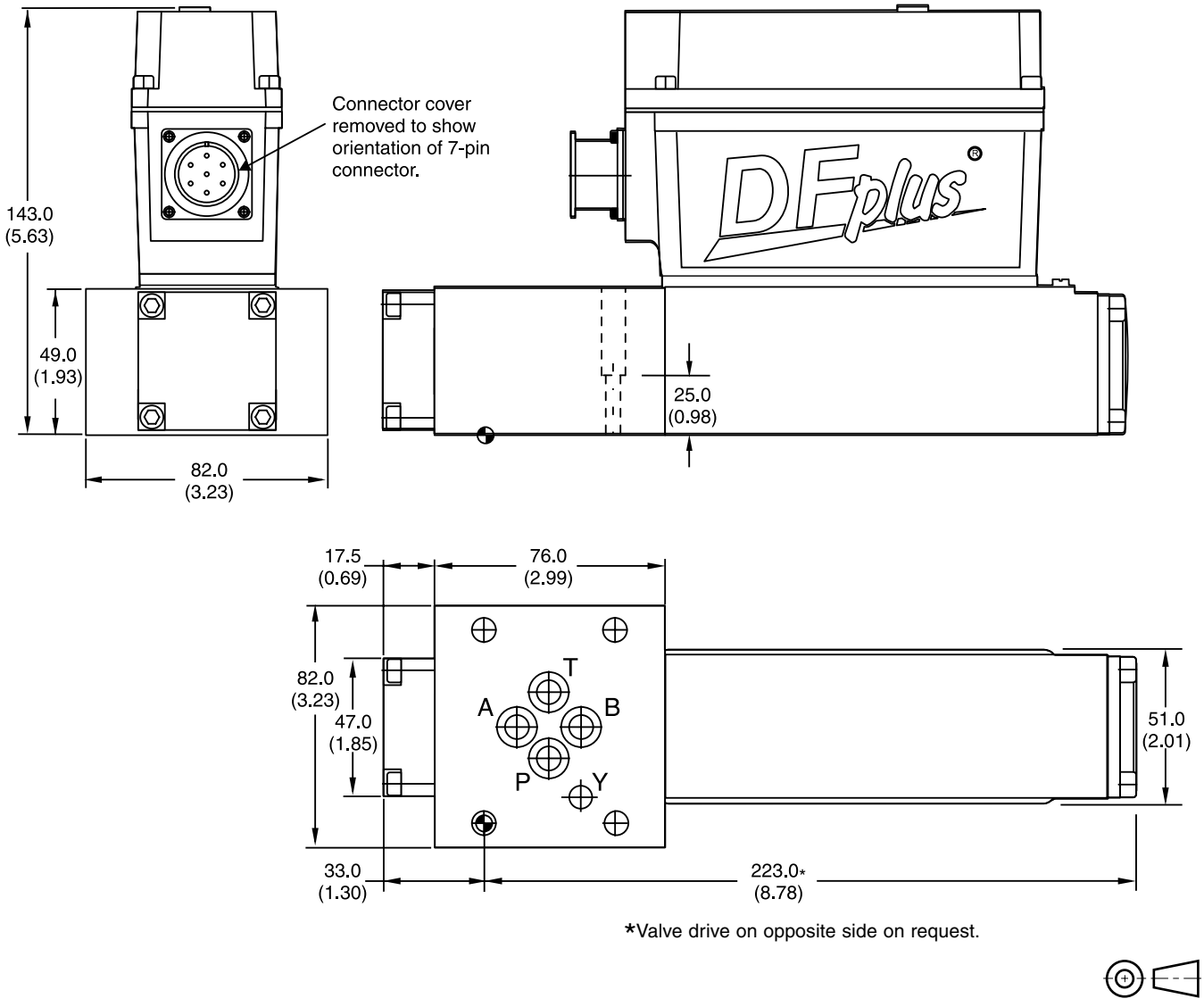
Frequency Response

With and Without Using Y Port



A

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



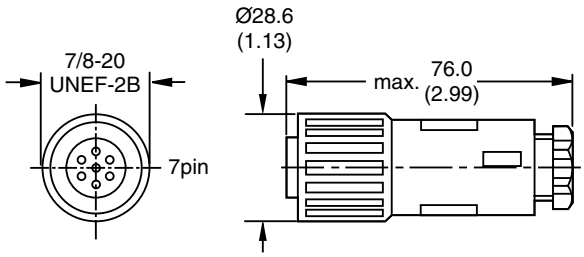
***Valve drive on opposite side on request.**

Warning: External drain port is in ISO external pilot location. Do not apply external pilot.

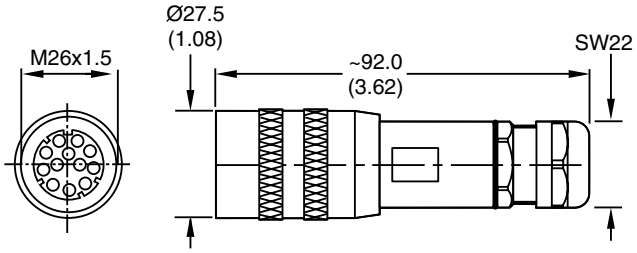
Surface Finish	Kit		
R_{max} 6.3 ⏥ 0.01/100	BK414	4 x M8x40 DIN 912 12.9	33 Nm ±15%
	BK116	4 x 5/16-18 x 1 3/4 long	24.3 lb.-ft.

A

Electrical Connectors



DIN 43563 6 + PE: Part Number 5004072

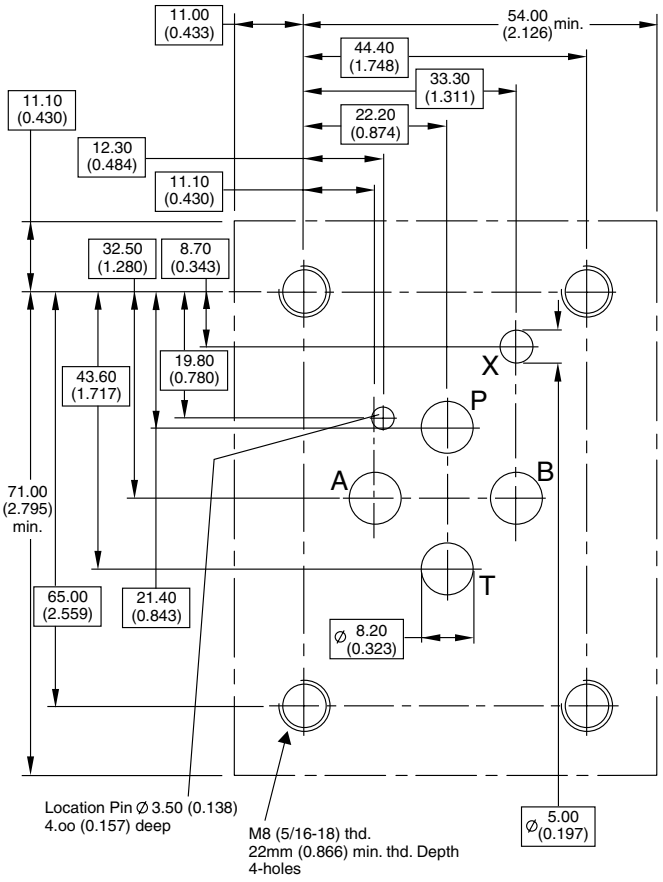


DIN 41651 11 + PE: Part Number 5004711

NOTE: The servovalve X-port is for external pilot pressure. The D1FP can use this port as a Y-port for external drain if T-port pressure will exceed 35 Bar (500 PSI).

IMPORTANT: If replacing a servovalve, make certain pressure is not applied to X-port.

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



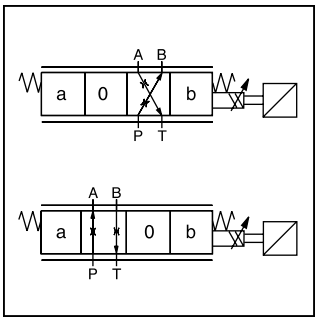
A

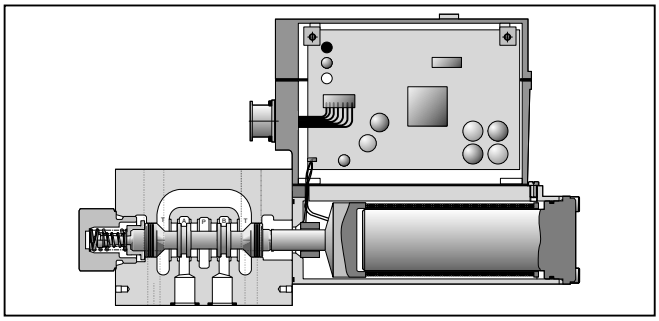
General Description

Series D3FP direct-operated control valve size NG10 (CETOP 5) shows extremely high dynamics combined with high flow. 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.



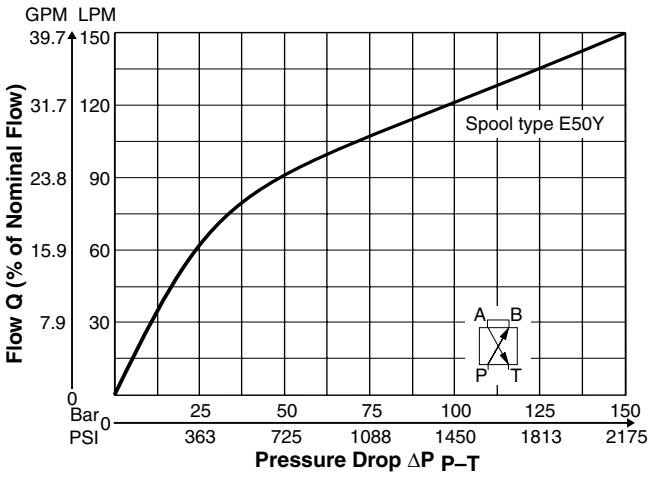


Features

- Extremely high dynamics.
- Max. tank pressure 350 Bar (5075 PSI) (with external leakage port Y).
- Defined spool positioning in case of power supply breakdown.
- On-board electronics.
- Precision spool/sleeve design.

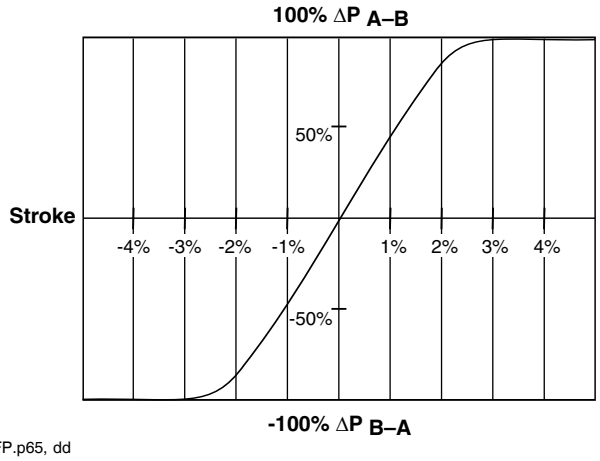
Performance Curves

Operating Limit

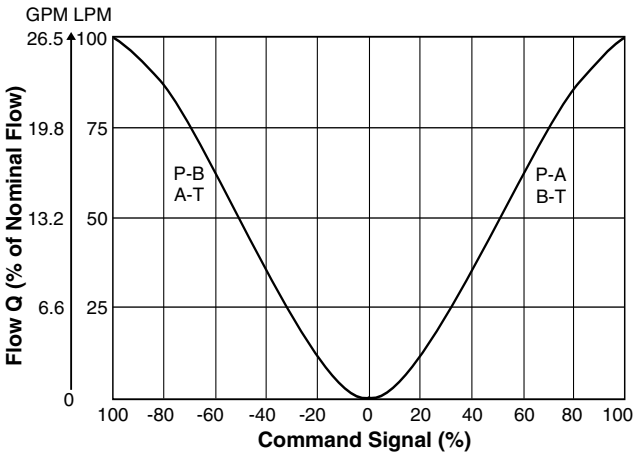


*** When exceeding the operating limits, the valve will shut down in a defined position (Code A, B concerning ordering code). Switch power supply off/on to re-enable the valve within the operating limits.**

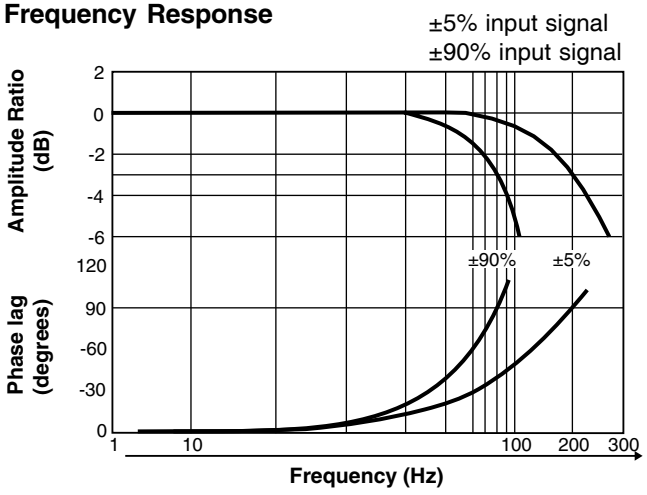
Pressure Gain



Spool Type E50/E55



Frequency Response



A

General			
Design	Direct operated proportional Directional control valve	**Mounting Position**	Any
Actuation	VCD® actuator	**Ambient Temperature Range**	-20°C to +50°C (-4°F to +122°F)
Size	NG10 (CETOP 5)	**Vibration Resistance**	25 g acc. DIN IEC68, part 2-6
Mounting Interface	DIN 24340 / ISO 4401 / CETOP RP121 / NFPA	**Protection Class**	IP65
Hydraulic			
Operating Pressure Maximum	Ports P, A, B: 350 Bar (5075 PSI) Port T: 35 Bar (507.5 PSI) 350 Bar (5075 PSI) discharged at Port Y)[1]	**Filtration**	ISO 4406 (1999) 18/16/13 (acc. NAS 1683: 7)
Fluid	Hydraulic oil as per DIN 51524 to 535, other on request	**Flow**	nominal at Δp=35 Bar (507.5 PSI) per control edge[2] 50 / 100 LPM (13.2 / 26.5 GPM)
Fluid Temperature	-20°C to +50°C (-4°F to +122°F)	**Flow Maximum**	100 LPM (26.5 GPM) at Δp=70 Bar (1015 PSI) over two control edges
Viscosity Permitted	20 to 380 SSU	**Leakage**	at 100 Bar (1450 PSI) <400 ml/min (49 in³/min.)
Viscosity Recommended	30 to 80 SSU		
Static / Dynamic			
Step Response @ 100%[3]	<16 ms@ 100% step with rise and settling, <6 ms rise only	**Hysteresis**	<0.5%
		Sensitivity	<0.3%
Frequency Response (±5% signal[3]	200 Hz (amplitude ratio -3dB), 200 Hz (phase lag -90°)	**Temperature Drift**	<0.025%/°C
Electrical			
Duty Ratio	100%	**Differential Input Maximum**	30 VDC for Terminal D and E against PE
Supply Voltage/ Ripple	22 VDC to 30 VDC, ripple <5% eff.	**Enable Signal (Code 5 Only)**	5 VDC to 30 VDC, R=9K ohm
Current Consumption	3.5A	**Diagnostic Signal**	+10...0...-10 VDC, rated max. 5 mA
Switch-on Current Typical	22A for 0.2 ms	**Prefusing**	4.0A medium lag
		EMC	EN 50081-1 / EN50082-2
Input Signal **Voltage**	Flow with Pin D > Pin E 10...0...-10, ripple <0.01% eff., surge free, 0...+10V P->A	**Interface**	Code 0: 6+PE acc. DIN 43563 Code 5: 11+PE acc. DIN 41651
Impedance	100K ohm	**Cable Specification**	Code 0: 7x1.0 (AWG 18) overall braid shield Code 5: 12x1.0 (AWG 18) overall braid shield
Current	20...0...-20 mA, ripple <0.01% eff., surge free, 0...+20 mA P->A		
Impedance	250 ohm	**Cable Length**	50m (164 ft.)
Current	4...12...20 mA, ripple <0.01% eff., surge free, 12...20 mA P->A		
Impedance	250 ohm		

[1] For applications with p_T>35 bar the Y-port has to be used. Remove the plug in the Y-port of the valve and connect the Y-port to unpressurized tank.

[2] Flow rate for different Δp per control edge: $Q_x = Q_{Nom.} \cdot \sqrt{\frac{\Delta p_x}{\Delta p_{Nom.}}}$ **Note:** Equation with Δp ≤35 Bar/edge

[3] Measured with load (70 Bar (1015 PSI) pressure drop/two control edges)

D	3	F	P	□	□	9	N	□	□	0	[ ]
Directional Control Valves	Size	Flow Control		Spool	Spool Position on Power Down		Seals	Command Signal	Accessories	Sleeve/ Spool	Design Series

NOTE: Not required when ordering.

Code	Description
3	NG10/CETOP 5

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

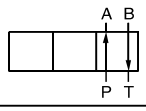
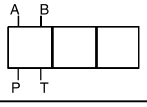
Code	Description
N	Nitrile
	Others available on request

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

Code	Spool	Flow LPM (GPM) at Δp 35 Bar (507.5 PSI) per metering edge
Zerolap 0 to +1%		
E50Y		100 (26.5)
E50P		50 (13.2)
Underlap approx. -0.5%		
E55Y		100 (26.5)
E55P		50 (13.2)

Please order plugs separately. See Accessories.

Weight: 6.5 kg (14.3 lbs.)

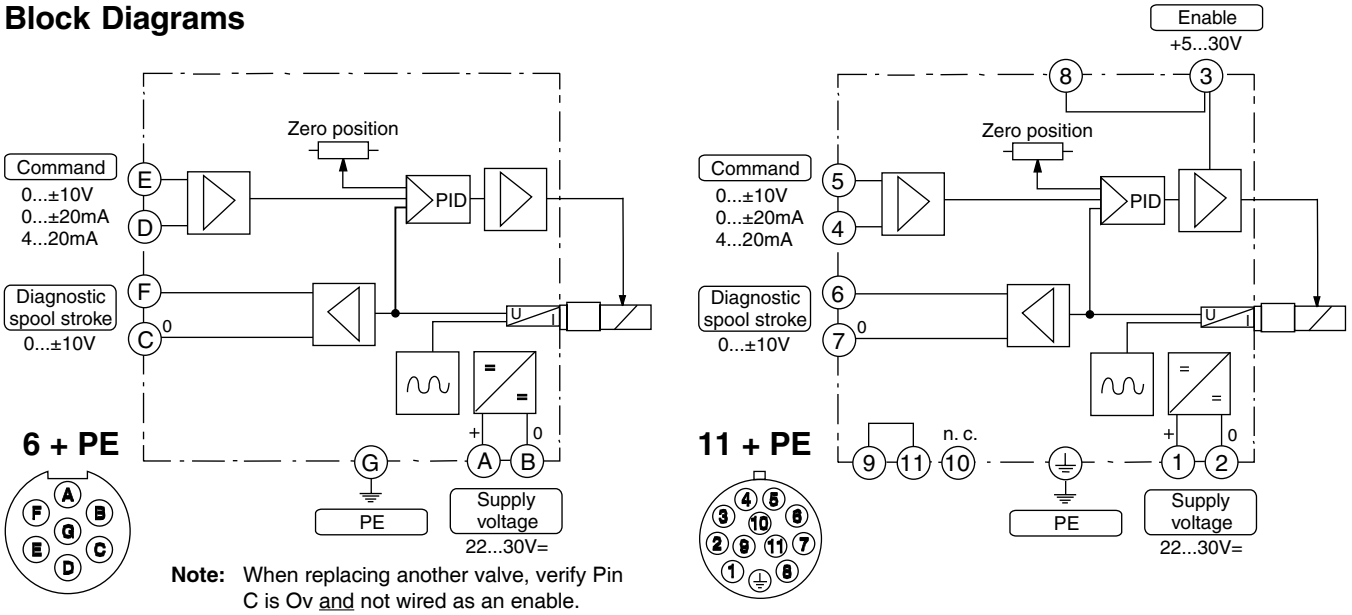
Code	Spool Position on Power Down[1]
A[2]	
B[2]	

[1] On power down the spool moves in a defined position. In case of contamination in the hydraulic fluid, this cannot be guaranteed.

[2] approx. 25% opening.

A

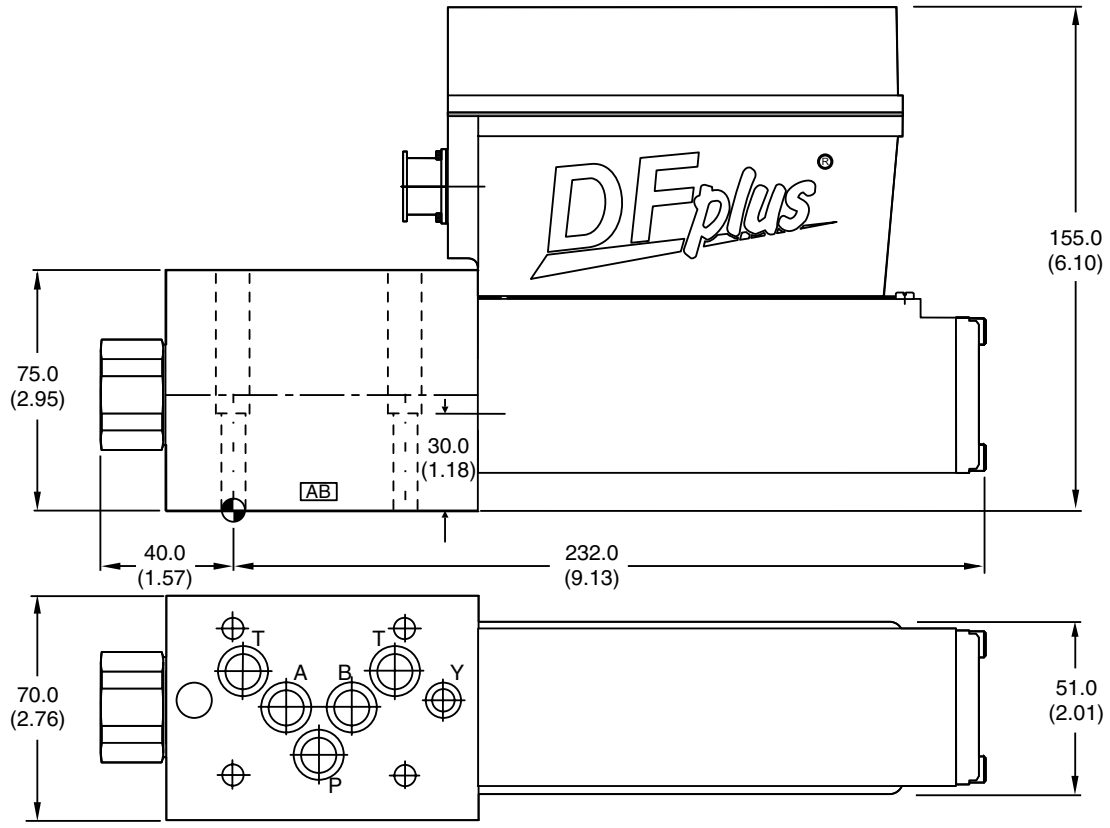
Block Diagrams



Note: When replacing another valve, verify Pin C is Ov and not wired as an enable.

Dimensions

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



Surface finish	Kit		
R_{max}6.3 ⏥ 0.01/100	BK360	4x M6x40 DIN 912 12.9	11 Nm (8.1 lb.-ft.) ±15 %
	BK98	4x1/4-20x1.625"	11 Nm (8.1 lb.-ft.)

D3FP.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

A

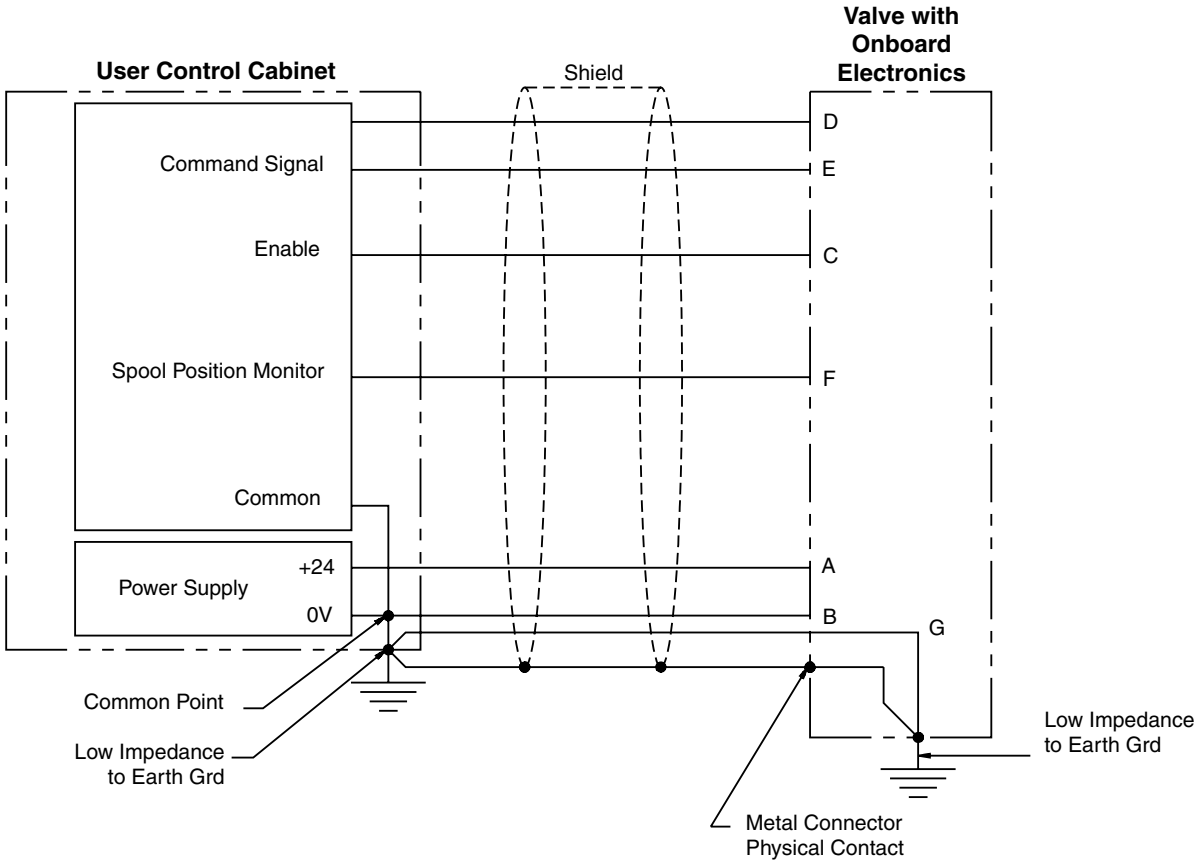
RFI/EMC Immunity for valves with integrated electronics

Conformance to the CE RFI/EMC susceptibility and emissions regulations require valves with integrated electronics be properly wired and grounded. The wiring diagram below suggests proper practices, and should be used as a guide for wiring any new application. In some retrofit applications it may be necessary to significantly alter an existing wiring layout and grounding methods to achieve the desired RFI/EMC immunity and avoid ground loops. Note that an improperly wired application can render a system unusable.

Valves should be wired to the user control cabinet by shielded cable where the shield is grounded at both ends. These ground points must be very low impedance earth grounds, and proper wiring practices are required to avoid system ground loops. In some applications it may be necessary to install a low impedance ground strap between the valve or manifold and earth to achieve a proper ground.

Note that when assembling cable/connector assemblies, the shield must be in electrical contact with the connector shell to complete the shield circuit through the valve mating receptacle. (Refer to the Accessories section of this catalog for pre-assembled 'EHC' cable assemblies)

To minimize the exposure to RFI/EMC radiation, electronic equipment should be isolated from sources of high-energy electromagnetic radiation such as cables carrying high currents, radio transmitters, electrical load control centers and contactors.

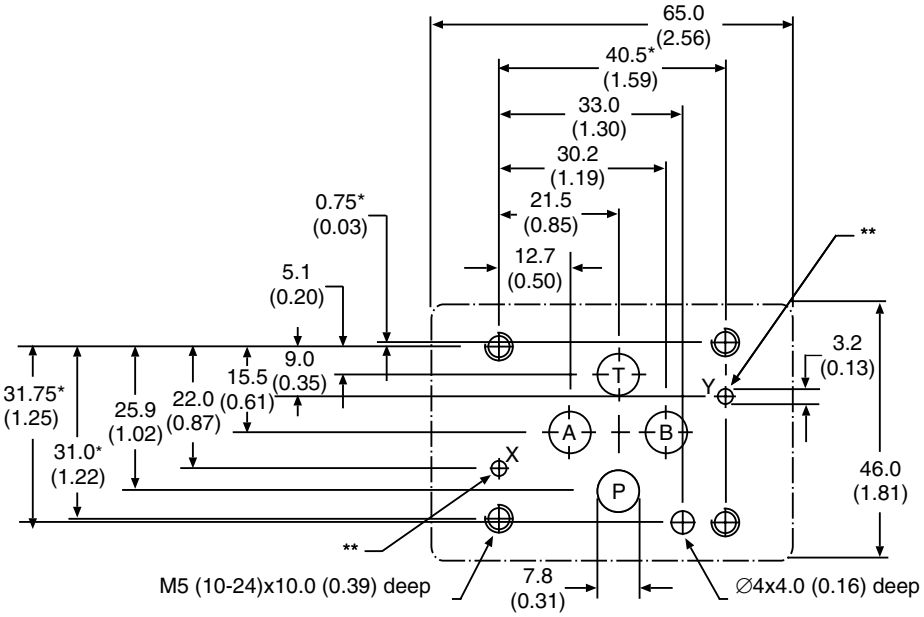


Note: PE on Functional Block Diagrams refers to "Potential Earth".

A

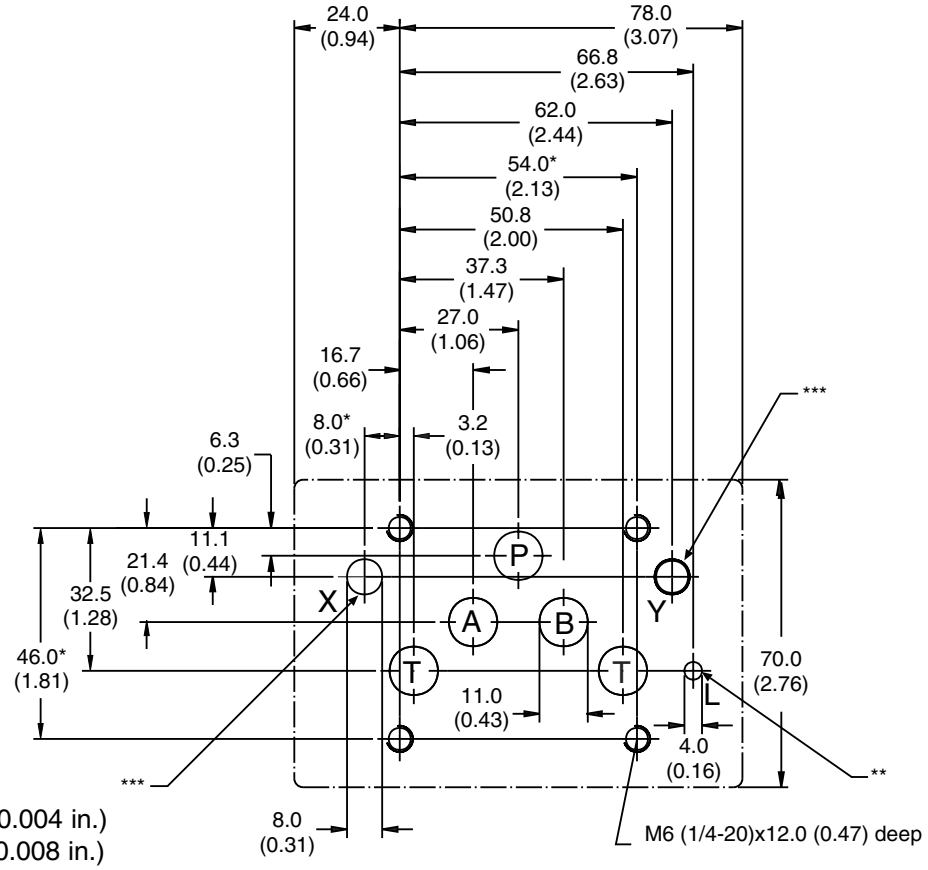
Size NG6 (NFPA/ISO/CETOP 3)

mounting pattern per DIN 24340-A6



Size NG10 (NFPA/ISO/CETOP 5HE)

mounting pattern per DIN 24340-A6



* Dimension tolerance ±0.1 mm (0.004 in.)
All other dimensions ±0.2 mm (0.008 in.)

** Port not used with valves in this catalog

*** Ports only used for pilot operated valves

D_techinfo.p65, dd

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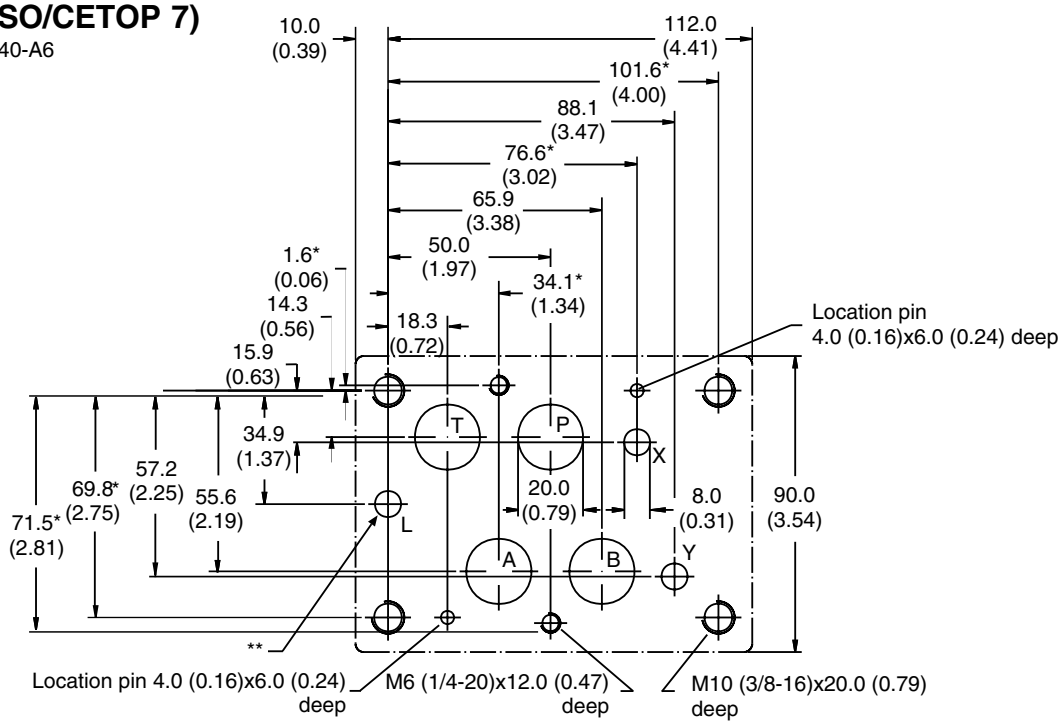
Hydraulic Valve Division
Elyria, Ohio, USA

A

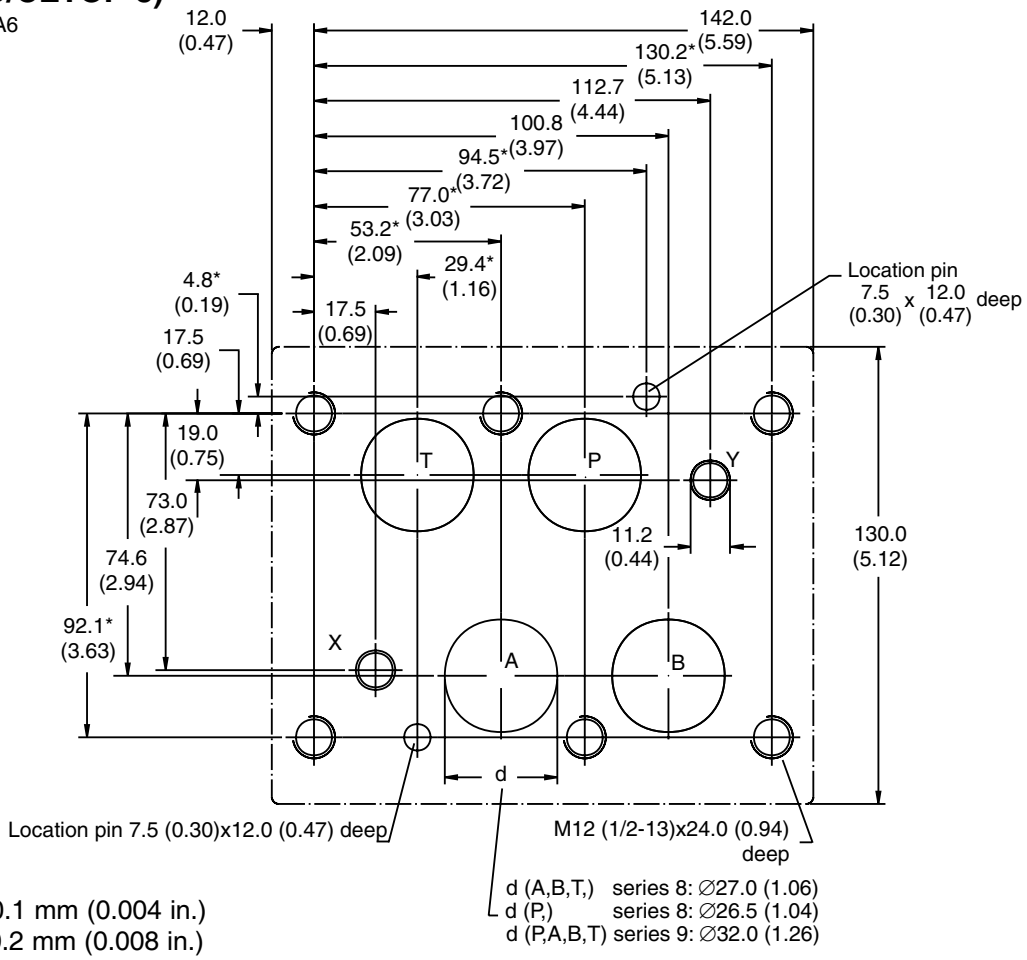
Size NG16 (NFPA/ISO/CETOP 7)

mounting pattern per DIN 24340-A6



Size NG25 (NFPA/ISO/CETOP 8)

mounting pattern per DIN 24340-A6



* Dimension tolerance ±0.1 mm (0.004 in.)
All other dimensions ±0.2 mm (0.008 in.)

** Port not used with valves in this catalog

D_techinfo.p65, dd

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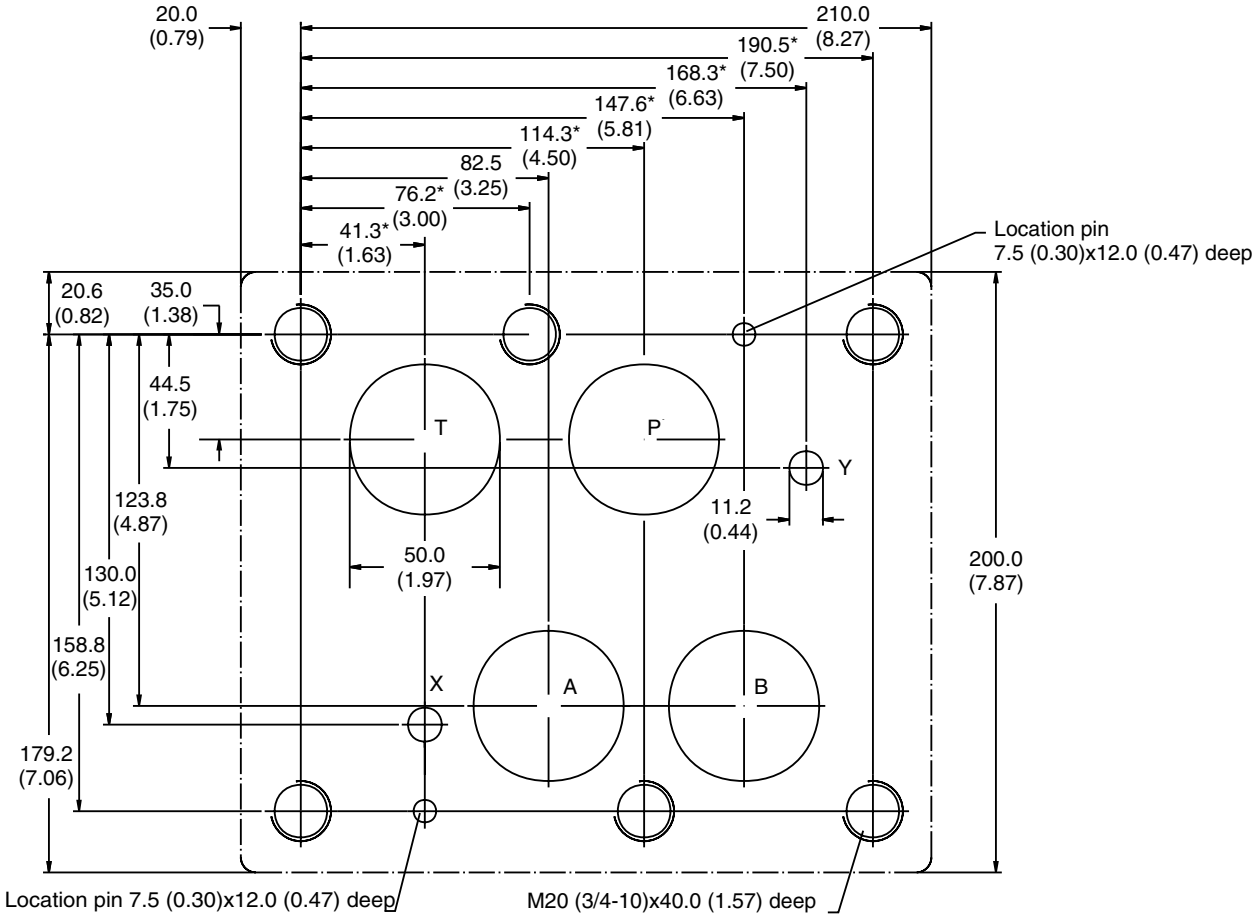
Elyria, Ohio, USA

Size NG32 (NFPA/ISO/CETOP 10)

mounting pattern per DIN 24340-A6

A



* Dimension tolerance ±0.1 mm (0.004 in.)
All other dimensions ±0.2 mm (0.008 in.)

Contents

Series	Description	Direct Operated	Pilot Operated	Page
	[size: NG] [size: ISO/CETOP]	6 3	6 10 25 32 3 5 8 10	
	with Integrated Electronics			
RE06M*T	Proportional Relief Valve	•		B2
RE*T	Proportional Relief Valve		• • •	B6
PE*T	Proportional Reducing Valve	PHASE OUT *	• • •	B13
PC*T	Proportional Reducing with Check Valve	PHASE OUT	• • •	B13
	without Integrated Electronics			
RE06M*W	Proportional Relief Valve	•		B18
RE*W	Proportional Relief Valve		• • •	B22
PE*W	Proportional Reducing Valve		• • •	B28
DWE	Proportional Reducing Valve	PHASE OUT *	• • •	B32
DWU	Proportional Reducing with Check Valve	PHASE OUT	• • •	B32
VBY*K	Pilot Operated Sequence Valve		• •	B37
VMY*06	Pilot Operated Pressure Reducing Valve		•	B43

* Refer to PE*W

B

B

General Description

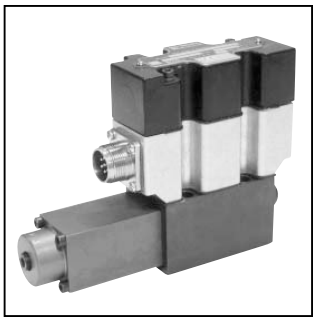
Series RE06*T proportional pressure relief valves are direct operated proportional solenoid valves with integral control electronics.

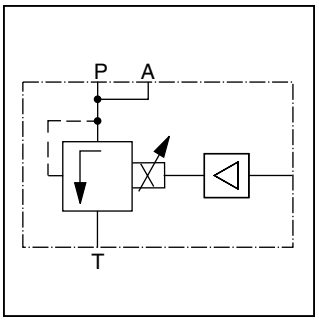
The power supply voltage and the input command signals are connected via a single seven-pin electrical plug connector. Input command signals can be in the range 0 to 10V or 0 to 20 mA, selected in the valve ordering code. Ramp times for increasing pressure and decreasing pressure can be independently set by two potentiometers.

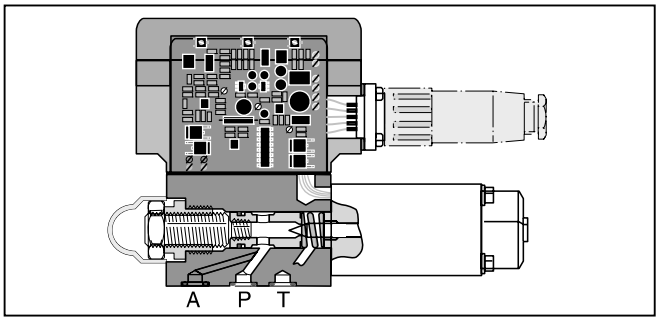
MIN and MAX potentiometers allow the setting of the minimum pressure value and the maximum pressure value. These can be adjusted to scale the pressure range to correspond to the full range of the command input signal. Control chokes are fitted in the pilot valve for the different pressure ranges.

Features

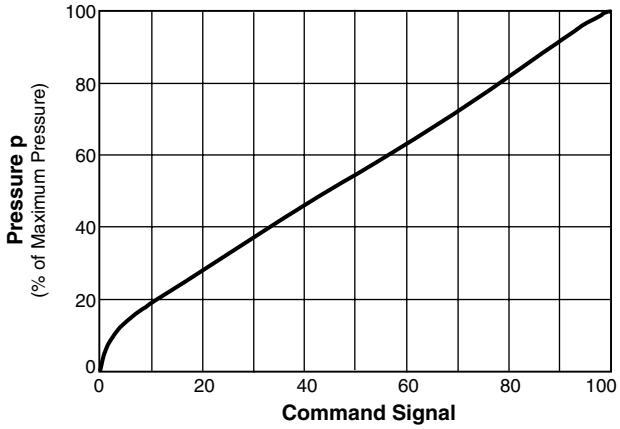
- Standard DIN/ISO interfaces.
- Integrated valve electronics.
- Adjustable electronic ramp control.



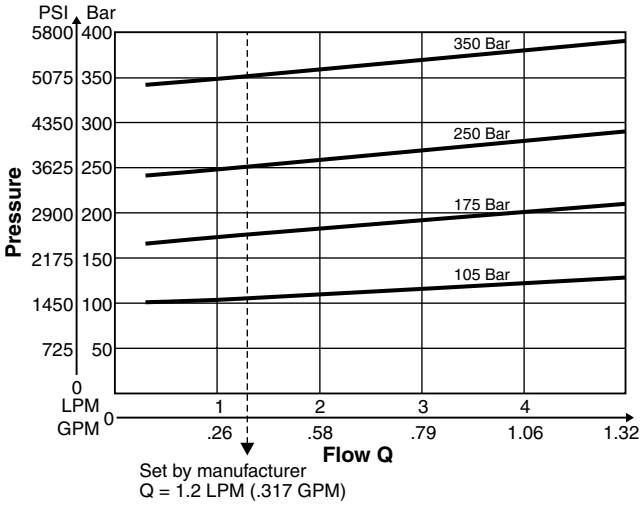




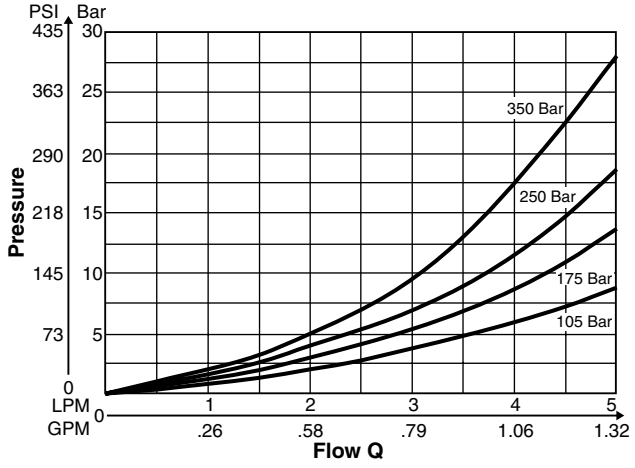
Command/Pressure Curve



P/Q Curves



p_{min}/Q Curves



RE06M_T.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Specifications

Interface	DIN ISO/CETOP	NG6 3
Nominal Flow Q	LPM (GPM)	Up to 3 (0.8)
Weight	kg (lbs.)	2.3 (5.1)
Maximum Operating Pressure	Bar (PSI)	Ports P, A; 350 (5075) Tank connection T: not pressurized
Adjustment Range	Bar (PSI)	5 to 350 (72.5 to 5075)
Mounting Pattern		DIN 24340 Form D ISO 5781 and ISO 6264
Mounting Orientation		Any
Supply Voltage Range	VDC	14.5 to 30
Ripple in the Supply Voltage	%	5 maximum

Current Consumption	Amps	2.8 maximum
Command Signal (Impedence) (Select by ordering code)		0 to 10V (10K ohm) 0 to +20mA (500 ohm)
Reference Output		+10V, 10 mA max.
Adjustment Range of the Ramp Time		0 to 5s
Ambient Temperature Range		-40°C to +70°C (-40°F to +158°F)
Recommended Cable		18 gauge, shielded, up to 15m (50 ft.)
Protection Class		IP54 (NEMA 1)
7-Pin Plug (Main Connection)		5004072

B

Ordering Information

RE06M | [ ] | **T** | **2** | [ ] | **1** | [ ] | **0** | [ ]

- **RE06M**: Direct Acting Proportional Relief Valve
- [ ] Pressure Range
- **T**: Integrated Electronics
- **2**
- [ ] Seal
- **1**: Valve Open at Zero Command
- [ ] Electronic Design
- **0**: Electronic Options
- [ ] Design Series
  NOTE: Not required when ordering.

Size
NG6 (CETOP 3)

Code	Pressure Range	
10	105 Bar	(1522 PSI)
17	175 Bar	(2537 PSI)
25	250 Bar	(3625 PSI)
35	350 Bar	(5075 PSI)

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
F	**Voltage Input 0 ... +10V with reference output +10V**
G	Current Input 0 ... 20 mA

Bolt Kits:
BK387 (M5x45)
BK210 (10-24x1-7/8)

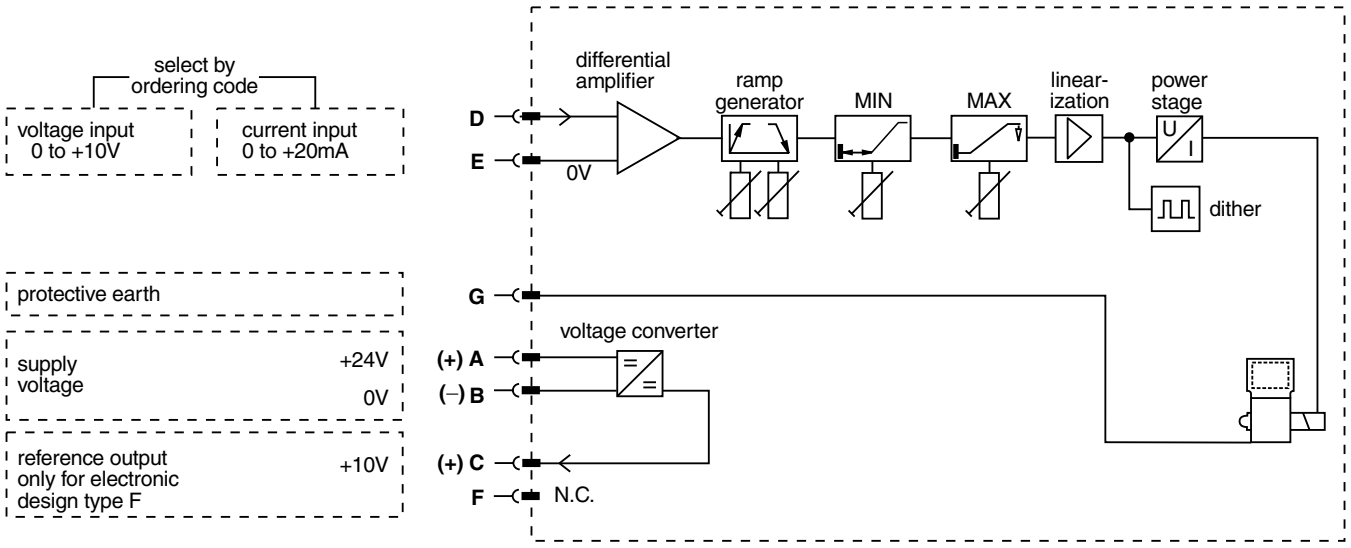
Weight: NG6 5.1 kg (11.2 lbs.)

Bold: Designates Tier I products and options.

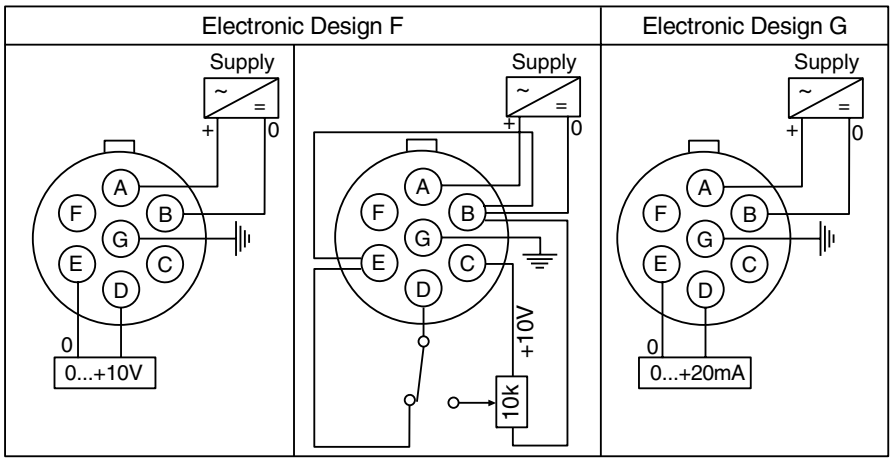
Non-Bold: Designates Tier II products and options.
These products will have longer lead times.

B

Electronics Block Diagram



Connector Wiring Diagram

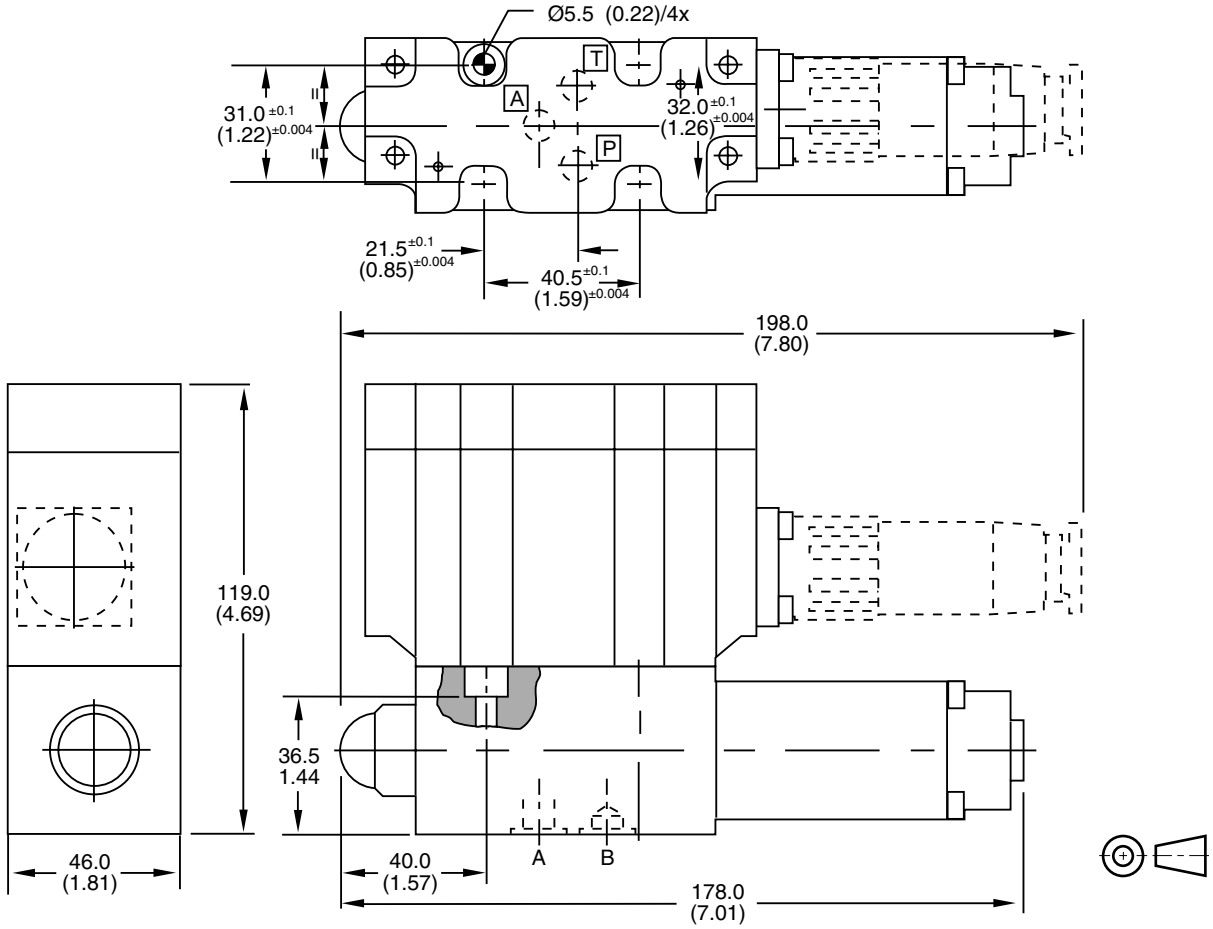


Note: As viewed when facing the connector assembled to valve.

B

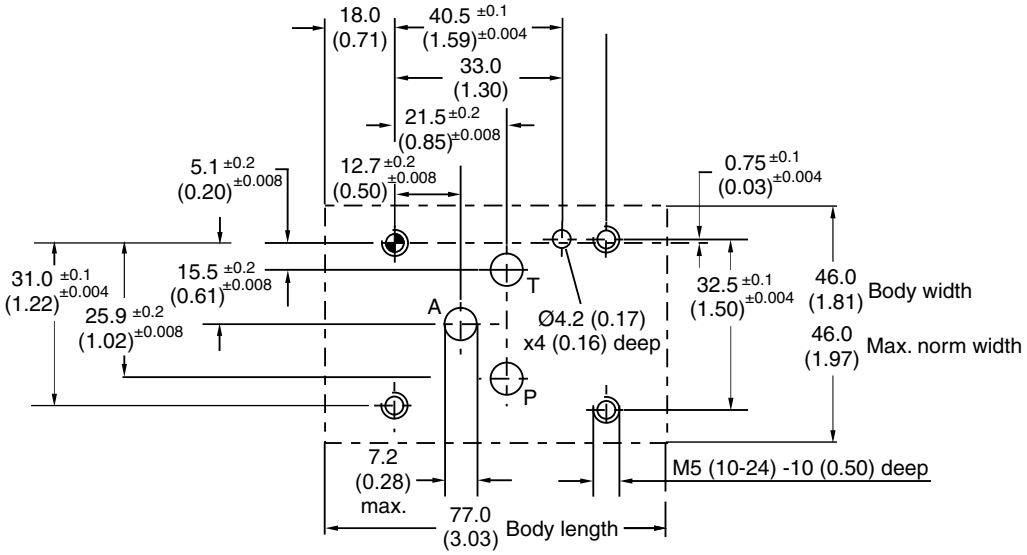
Dimensions

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



Surface finish	Bolt kit DIN912 12.9		Kit NBR	Kit FPM
R_{max}6.3 ▱ 0.01/100	BK387 4xM5x45 BK210 4x10-24x1.875	8.1 Nm	SK-RE06MNT	SK-RE06MVT

Mounting Pattern ISO 6264-03-04-*-97



RE06M_T.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

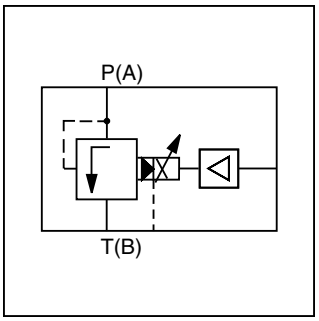
B

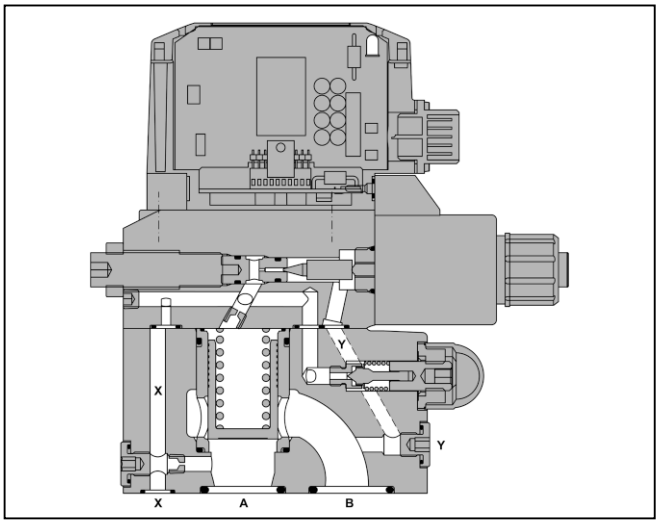
General Description

Series RE*T proportional pressure relief valves have a proportional solenoid operated pilot stage with integral control electronics and a DIN NG25 cartridge insert as the main stage.

The power supply voltage and the input command signals are connected via a single seven-pin electrical plug connector. Input command signals can be in the range 0 to 10V or 0 to 20 mA, selected in the valve ordering code. Ramp times for increasing pressure and decreasing pressure can be independently set by two potentiomenters.

MIN and MAX potentiometers allow the setting of the minimum pressure value and the maximum pressure value to correspond to the full range of the command input signal. Control chokes are fitted in the pilot valve for the different pressure ranges.





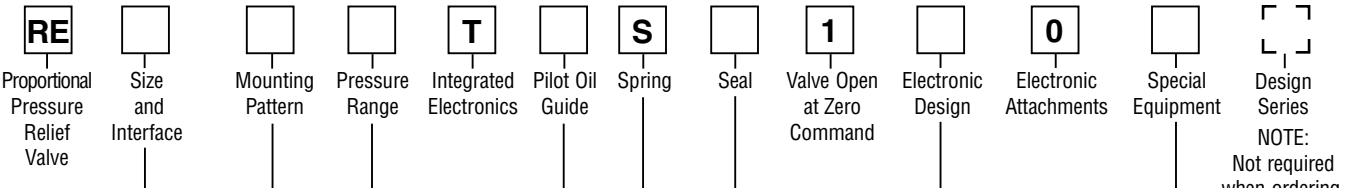
Features

- Standard DIN/ISO interfaces.
- Mechanical maximum pressure adjustment.

Specifications

Interface	DIN CETOP	NG10 5	NG25 8	NG32 10
Nominal Flow LPM (GPM)	RE*RT	Up to 250 (66)	Up to 500 (132)	Up to 650 (171)
	RE*MT	Up to 150 (39.6)	Up to 350 (92)	Up to 650 (171)

Adjustment Range Bar (PSI)	10 to 350 (145 to 5075)		**Reference Output**	+10V, 10 mA max.
Max. Operating Pressure Port P, A, X Bar (PSI) T, Y	350 (5075) Not pressurized		**Adjustment Range of the Ramp Times**	0 to 5 S
Mounting Orientation	Any		**Ambient Temperature Range**	-20°C to +80°C (-4°F to +176°F)
Supply Voltage Range VDC	14.5 to 30		**Recommended Cable**	18 Gauge, Shielded, up to 15M (50 ft.)
Ripple in the Supply Voltage %	5 maximum			
Current Consumption A	2.8 maximum		**Protection Class**	IP54 (NEMA 1)
Command Signal (Impedence) (Select by ordering code)	0 to 10V (10K ohm) 0 to +20 mA (500 ohm)		**7-pin plug (main connection)**	5004072



B

Code	Description
10	NG10/CETOP 5
25	NG25/CETOP 8
32	NG32/CETOP 10

Code	Description
M	DIN 24340 Form D
R	DIN 24340 Form E

Code	Pressure Range
10	105 Bar (1522 PSI)
17	175 Bar (2537 PSI)
25	250 Bar (3625 PSI)
35	350 Bar (5075 PSI)

Code	Supply	Drain
1	Internal	External
4*	Internal	Internal

* Standard

Code	Description
S	1.6 Bar (23 PSI)

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
F	Voltage Input 0 ... +10V with reference output +10V
G	Current Input 0 ... 20 mA

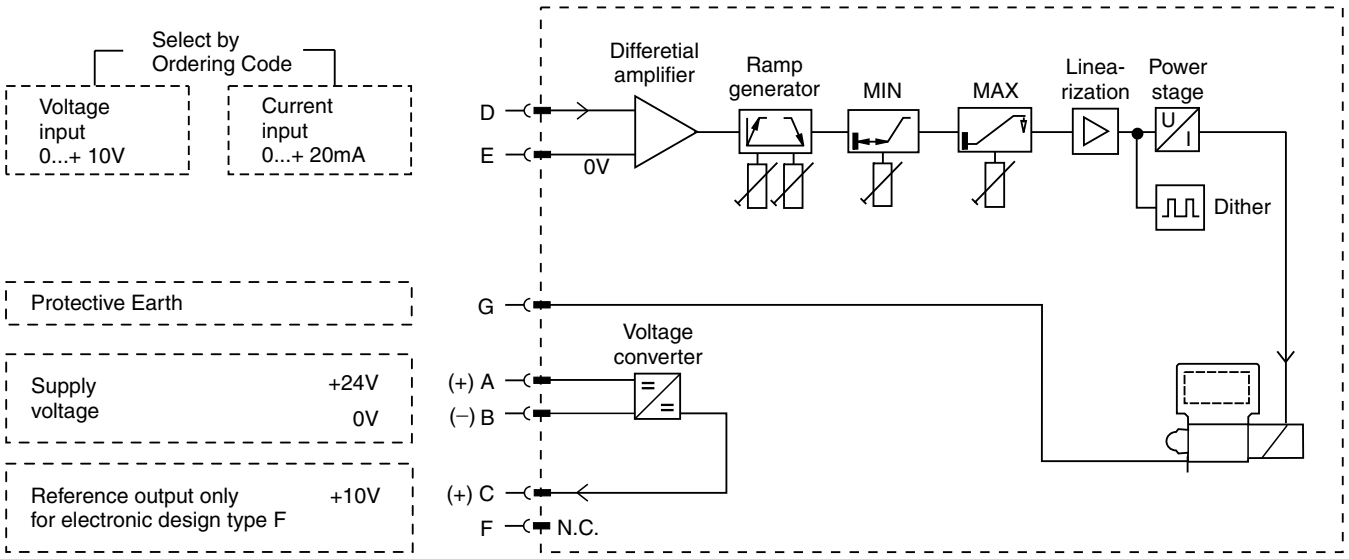
Code	Description
Omit	No Mechanical Maximum Pressure Adjustment
M	Mechanical Maximum Pressure Adjustment

Weight:

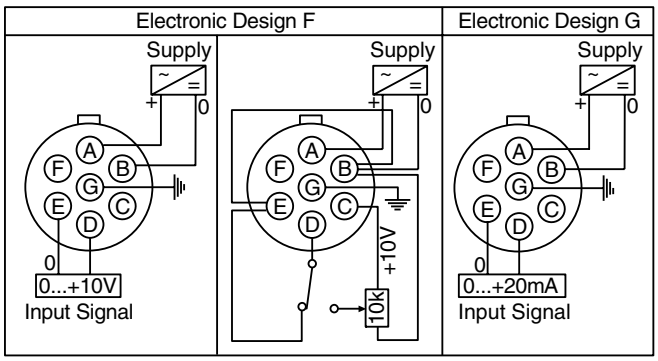
RE*RT	
NG10	5.4 kg (11.9 lbs.)
NG25	6.6 kg (14.6 lbs.)
NG32	8.6 kg (19.0 lbs.)
RE*MT	
NG10	4.5 kg (9.9 lbs.)
NG25	6.3 kg (13.9 lbs.)
NG32	7.86 kg (17.2 lbs.)

B

Electronics Block Diagram

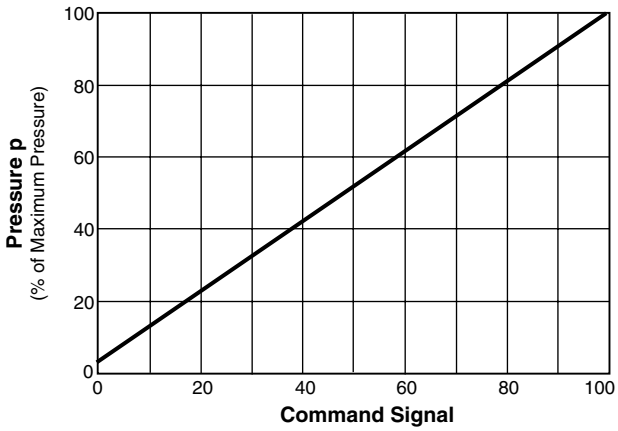


Connector Wiring Diagram

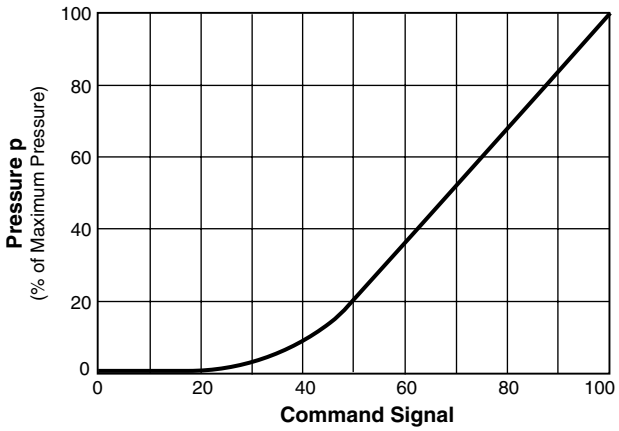


Performance Curves

Command/Pressure Curve RE*R*T

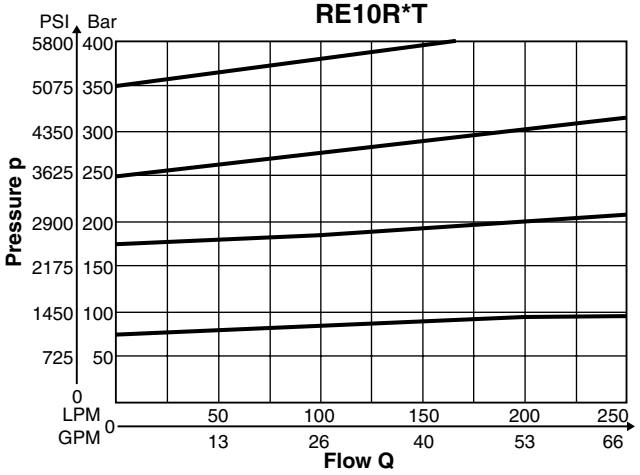


Command/Pressure Curve RE*M*T

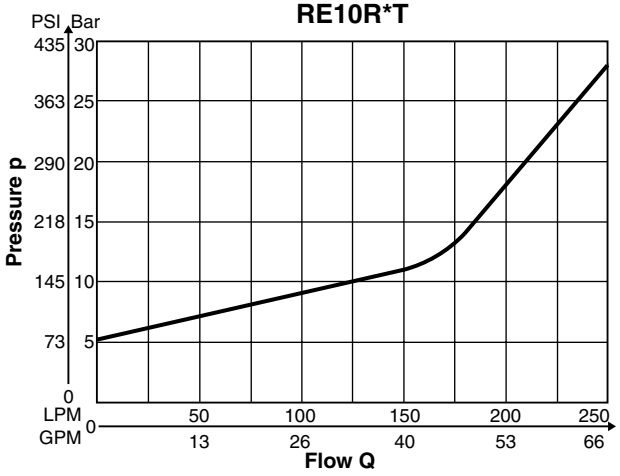


B

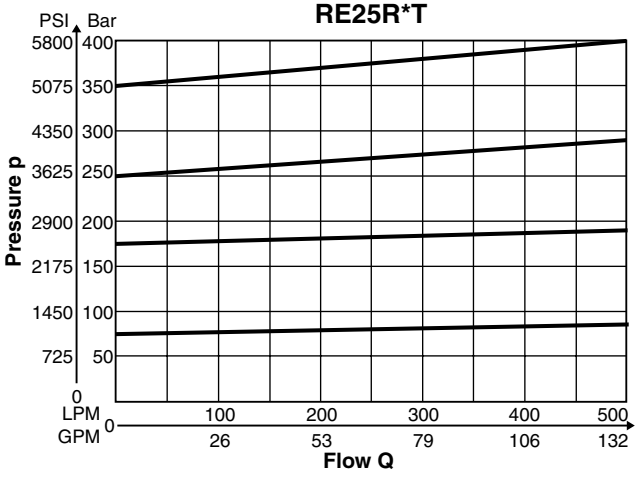
p/Q Performance Curve RE*R*T [1)]



Minimum Pressure Curve RE*R*T [1)]



p/Q Performance Curve RE*R*T [1)]



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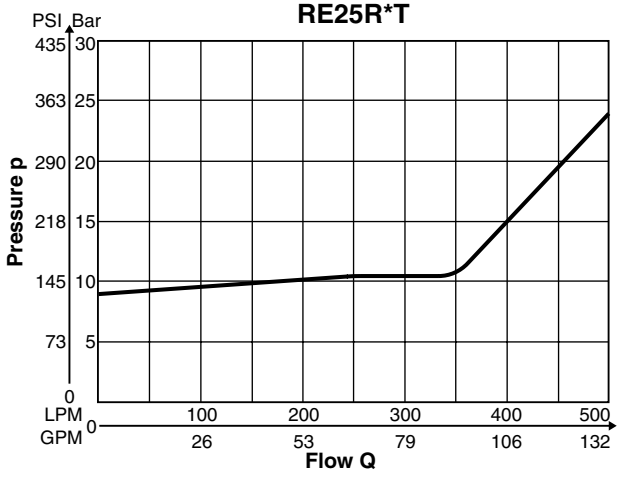
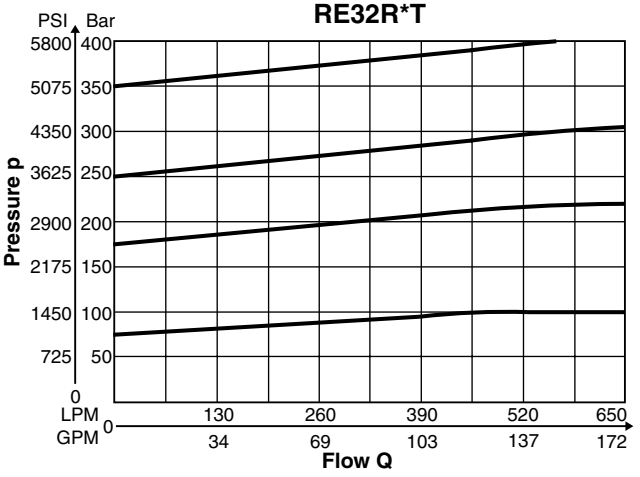
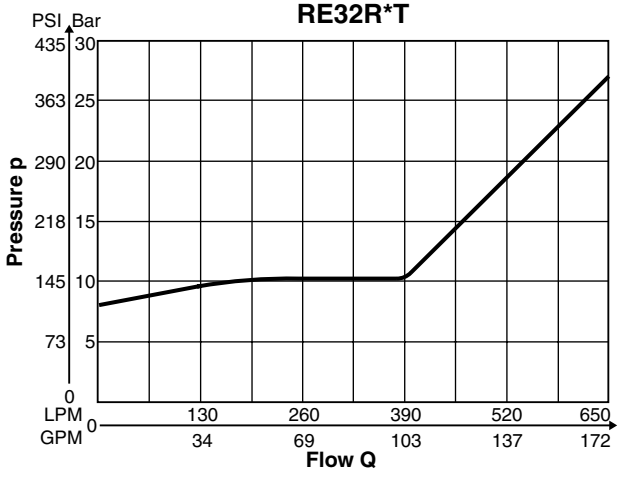


p/Q Performance Curve RE*R*T [1)]



Minimum Pressure Curve RE*R*T [1)]

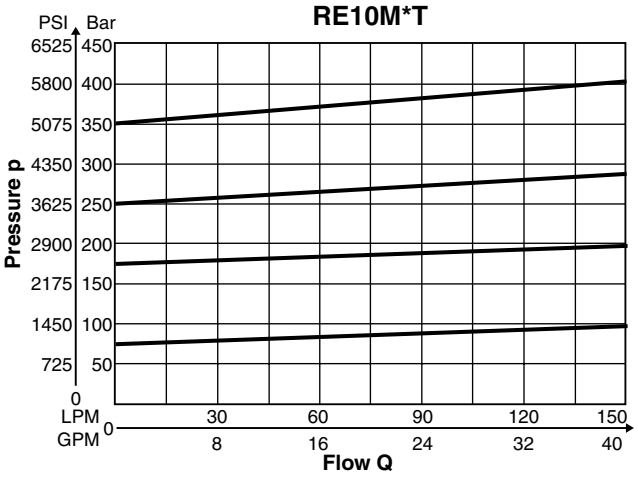


[1)] The performance curves are measured with external drain.
For internal drain the tank pressure has to be added to curve.

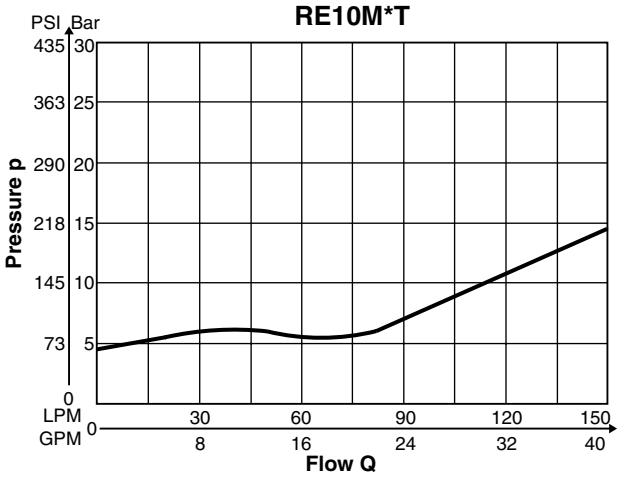
RE_T.p65, dd

B

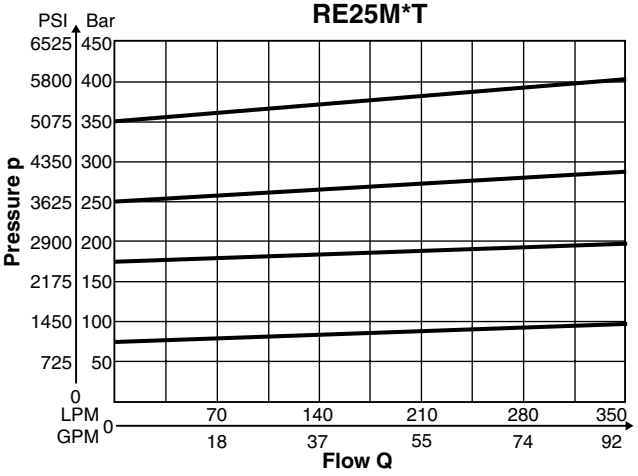
p/Q Performance Curve RE*M*T [1)]



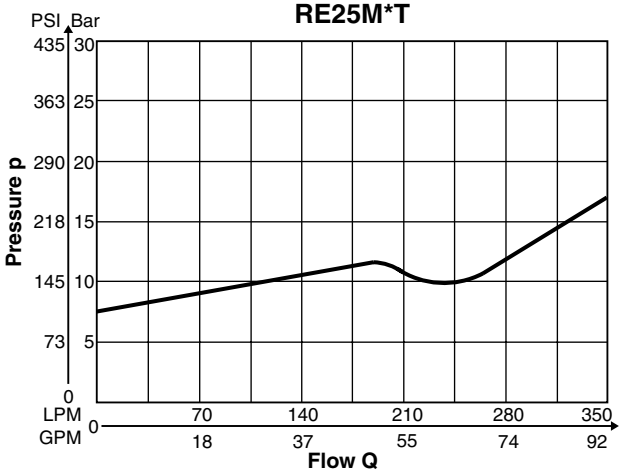
Minimum Pressure Curve RE*M*T [1)]



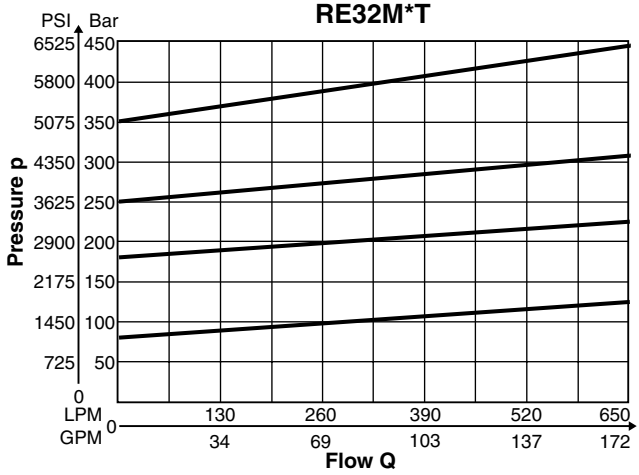
p/Q Performance Curve RE*M*T [1)]



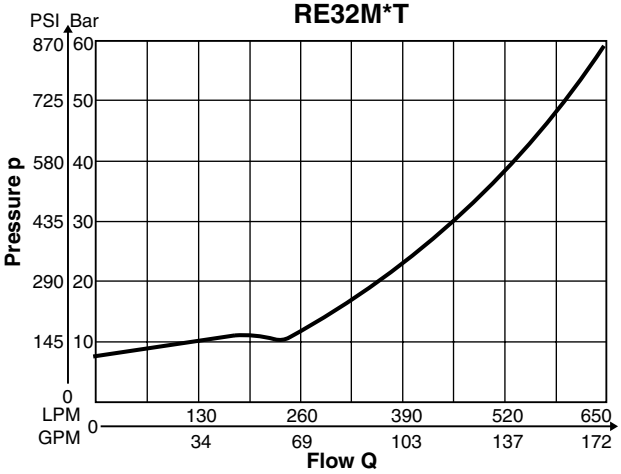
Minimum Pressure Curve RE*M*T [1)]



p/Q Performance Curve RE*M*T [1)]



Minimum Pressure Curve RE*M*T [1)]



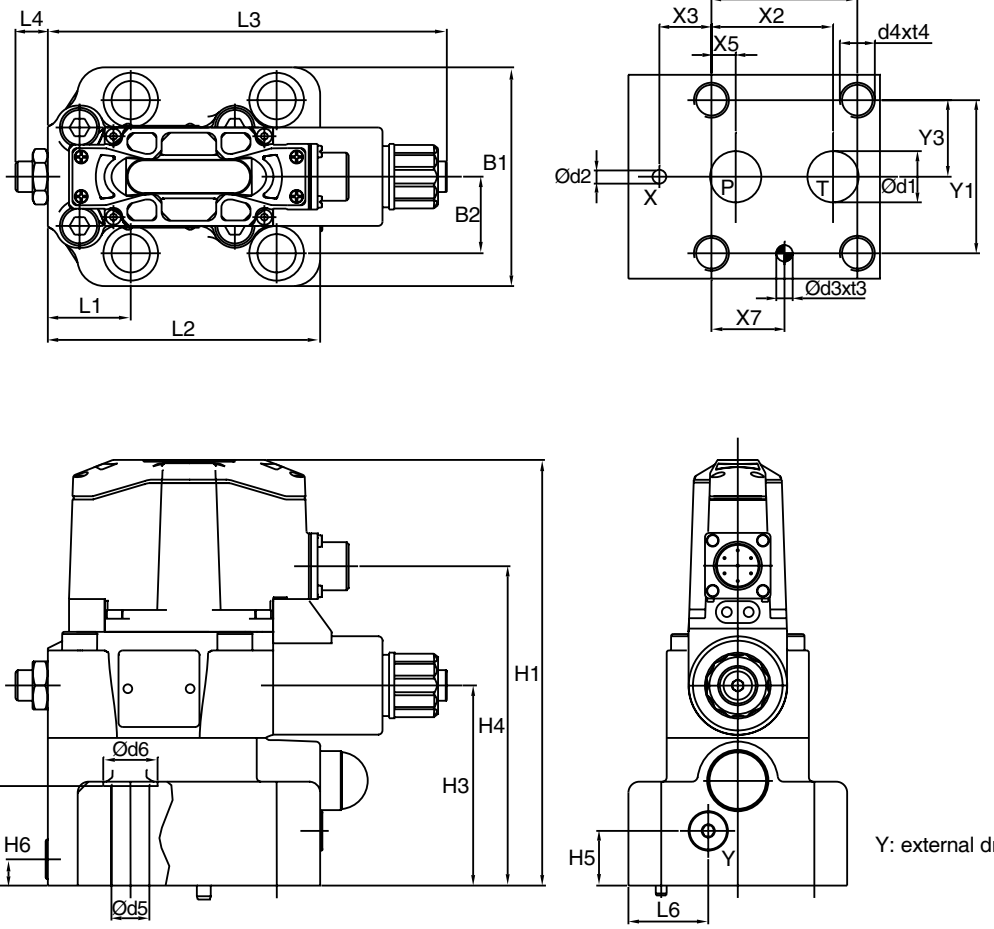
[1)] The performance curves are measured with external drain.
For internal drain the tank pressure has to be added to curve.

RE_T.p65, dd

B

RE*R*T

Dimensions are shown in millimeters.



Y: external drain port G 1/8“

NG	ISO-code	x1	x2	x3	x4	x5	x6	x7	y1	y2	y3	y4	y5	y6
10	6264-06-09-*-97	53.8	47.5	0	-	22.1	-	22.1	53.8	-	26.9	-	-	-
25	6264-08-13-*-97	66.7	55.6	23.8	-	11.1	-	33.4	70	-	35	-	-	-
32	6264-10-17-*-97	88.9	76.2	31.8	-	12.7	-	44.5	82.6	-	41.3	-	-	-

Tolerance at X and Y pin holes and screw holes ±0.1, at port holes ±0.2.

NG	ISO-code	B1	B2	H1	H2	H3	H4	H5	H6	L1	L2	L3	L4	L5	L6
10	6264-06-09-*-97	80	26.9	189.6	27	88	142.5	25	12	52.5	118.5	182.3	14.4	-	36.5
25	6264-08-13-*-97	100	35	193.1	45.5	91.5	146	25	12	37.9	124.5	182.3	14.4	-	36.5
32	6264-10-17-*-97	120	41.3	198.6	52	97	151.5	25	12	45	153	182.3	14.4	-	36.5

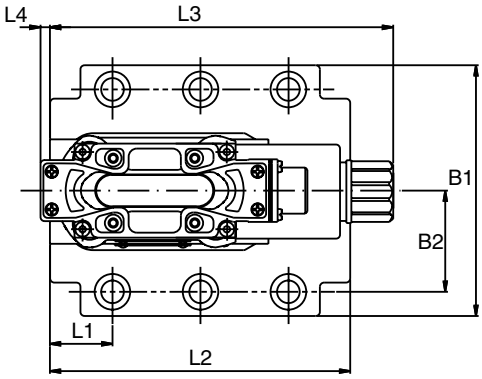
NG	ISO-code	d1max	d2max	d3	t3	d4	t4	d5	d6
10	6264-06-09-*-97	14.7	4.8	7.5	10	M12	20	13.5	20
25	6264-08-13-*-97	23.4	6.3	7.5	10	M16	27	17.5	25
32	6264-10-17-*-97	32	6.3	7.5	10	M18	28	20	30

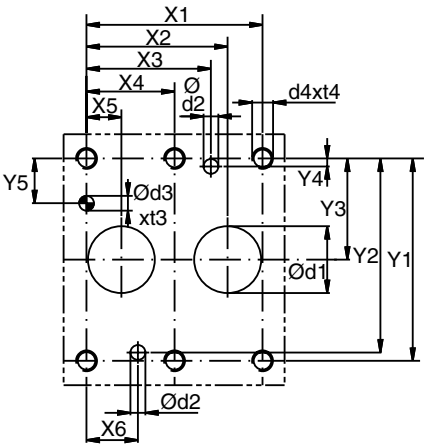
NG	ISO-code	Bolt kit DIN912 12.9		Kit NBR	Kit FPM	Surface finish
10	6264-06-09-*-97	BK-M12 x 45-4pcs	115 Nm ±15%	SK-RE10RN50	SK-RE10RV50	$\sqrt{R_{max}}6.3$ ⏥ 0.01/100
25	6264-08-13-*-97	BK-M16 x 70-4pcs	281 Nm ±15%	SK-RE25RN50	SK-RE25RV50	
32	6264-10-17-*-97	BK-M18 x 75-4pcs	398 Nm ±15%	SK-RE32RN50	SK-RE32RV50	

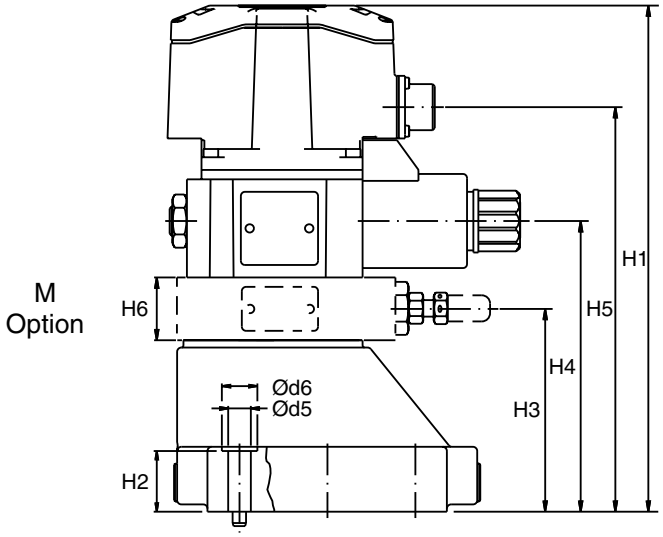
B

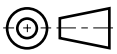
RE*M*T

Dimensions are shown in millimeters.









NG	ISO-code	x1	x2	x3	x4	x5	x6	x7	y1	y2	y3	y4	y5	y6
10	6264-06-09-*-97	42.9	35.8	21.5	-	7.2	21.5	0	66.7	58.8	33.4	7.9	14.3	-
25	6264-08-13-*-97	60.3	49.2	39.7	-	11.1	20.6	0	79.4	73	39.7	6.4	15.9	-
32	6264-10-17-*-97	84.2	67.5	59.5	42.1	16.7	24.6	0	96.8	92.8	48.4	3.8	21.4	-

Tolerance at X and Y pin holes and screw holes ±0.1, at port holes ±0.2.

NG	ISO-code	B1	B2	H1	H2	H3	H4	H5	H6	L1	L2	L3	L4	L5	L6
10	6264-06-09-*-97	87.3	33.35	204.8	21	60	102	156.5	30	28.3	94.1	164.2	4.5	-	-
25	6264-08-13-*-97	105	39.7	231.3	29	86.5	128.5	183	30	34	126.1	164.2	4.5	-	-
32	6264-10-17-*-97	120	48.4	241.8	29	97	139	193.5	30	29.9	143.6	164.2	4.5	-	-

NG	ISO-code	d1max	d2max	d3	t3	d4	t4	d5	d6
10	6264-06-09-*-97	15	7	7.1	8	M10	16	10.8	17
25	6264-08-13-*-97	23.4	7.1	7.1	8	M10	18	10.8	17
32	6264-10-17-*-97	32	7.1	7.1	8	M10	20	10.8	17

NG	ISO-code	Bolt kit DIN912 12.9		Kit NBR	Kit FPM	Surface finish
10	6264-06-09-*-97	BK-M10 x 35-4pcs	68 Nm	SK-RE10MN50	SK-RE10MV50	R_{max}6.3 ▱ 0.01/100
25	6264-08-13-*-97	BK-M10 x 45-4pcs	68 Nm	SK-RE25MN50	SK-RE25MV50	
32	6264-10-17-*-97	BK-M10 x 45-6pcs	68 Nm	SK-RE32MN50	SK-RE32MV50	

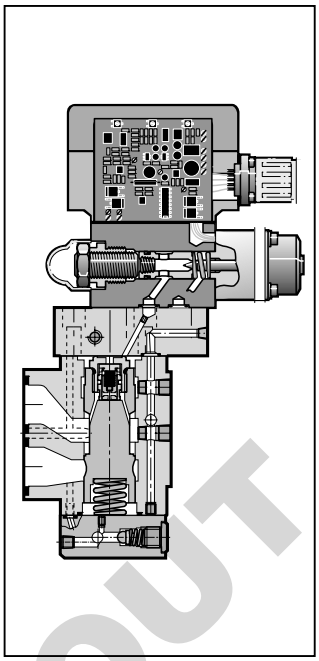
B

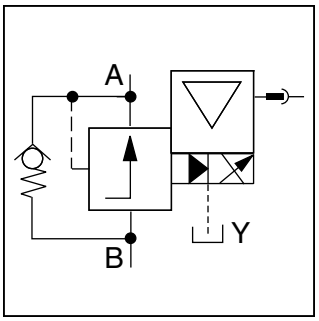
General Description

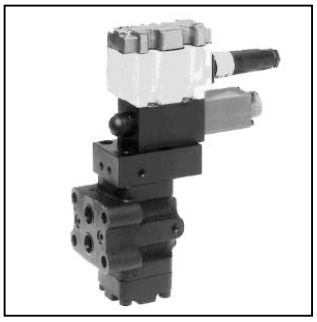
Series PE and PC proportional pressure reducing valves have a proportional solenoid operated pilot stage and sliding spool main stage.

The power supply voltage and input command signals are connected via a single seven-pin electrical plug connector. Input command signals can be in the range 0 to 10V or 0 to 20mA, selected in the valve ordering code. Ramp times for increasing and decreasing pressure can be independently set by two potentiometers.

MIN and MAX potentiometers allow the setting of the minimum pressure and the maximum pressure. These can be adjusted to scale the pressure range to correspond to the full range of the command input signal.







Features

- Standard DIN/ISO interfaces.
- Integrated valve electronics.
- Optional reverse flow check valve.

Specifications

Interface	**DIN ISO/CETOP**	**NG10 5**	**NG25 8**	**NG32 10**
Nominal Flow Q	LPM (GPM)	150 (40)	250 (66)	350 (92)
Weight	kg (lbs.)	5.5 (11.7)	6.5 (14.3)	11.0 (24.3)

Maximum Operating Pressure	Bar (PSI)	Pressure port A, B: 350 (5075); Tank connection Y: not pressurized	**Command Signal** (Impedence) (Select by ordering code)	0 to 10V (10K ohms) 0 to 20 mA (500 ohms)
			Reference Output	+10V/max. 10 mA
Adjustment Range	Bar (PSI)	10 to 350 (150 to 5075)	**Adjustment Range of the Ramp Time**	0 to 5 S
Mounting Pattern		DIN 24340 Form D ISO 5781 and ISO 6264	**Ambient Temperature Range**	-40°C to +70°C (-40°F to +158°F)
Mounting Orientation		Any	**Recommended Cable**	18 gauge, shielded, up to 15m (50 ft.)
Supply Voltage Range	VDC	14.5 to 30		
Ripple in the Supply Voltage	%	5 maximum	**Protection Class**	IP54 (NEMA 1)
Current Consumption	Amps	2.8 maximum	**7-Pin Plug** (Main Connection)	5004072

B

		M		T	1	R		9		0		
Valve Type	Size and Interface	Manifold Mount	Pressure Range	Integrated Electronics	Pilot Oil Guide	Spring 1 Bar	Seal	Normally Closed	Electronic Design	Electronic Attachments	Options	Design Series

NOTE: Not required when ordering.

Code	Description
10	NG10/CETOP 5
25	NG25/CETOP 8
32	NG32/CETOP 10

Code	Description
PE	Proportional Pressure Reducing Valve without check valve
PC	Proportional Pressure Reducing Valve with check valve

Code	Pressure Range Bar	(PSI)
10	105	(1522)
17	175	(2537)
25	250	(3625)
35	350	(5075)

Supply	Drain
Internal	External

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
F	Voltage Input 0 ... +10V (standard) with reference output +10V
G	Current Input 0 ... 20 mA

Code	Description
Omit	Standard
U	Quick Pressure Unloading

Weight:

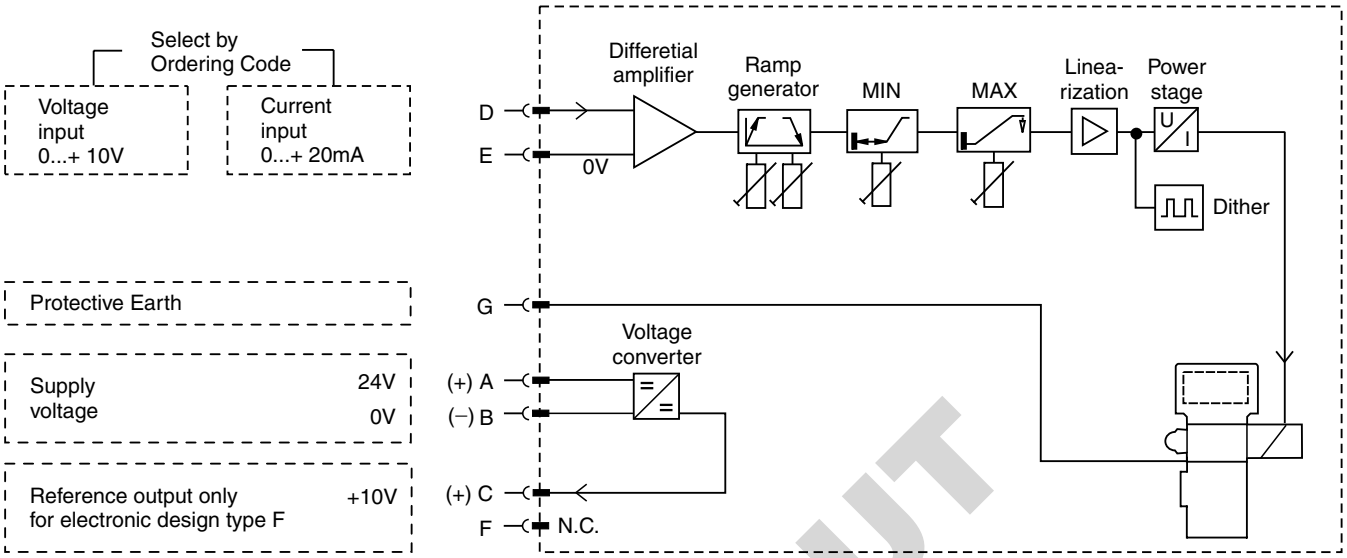
NG10	5.5 kg (11.7 lbs.)
NG25	6.5 kg (14.3 lbs.)
NG32	11.0 kg (24.3 lbs.)

Accessories

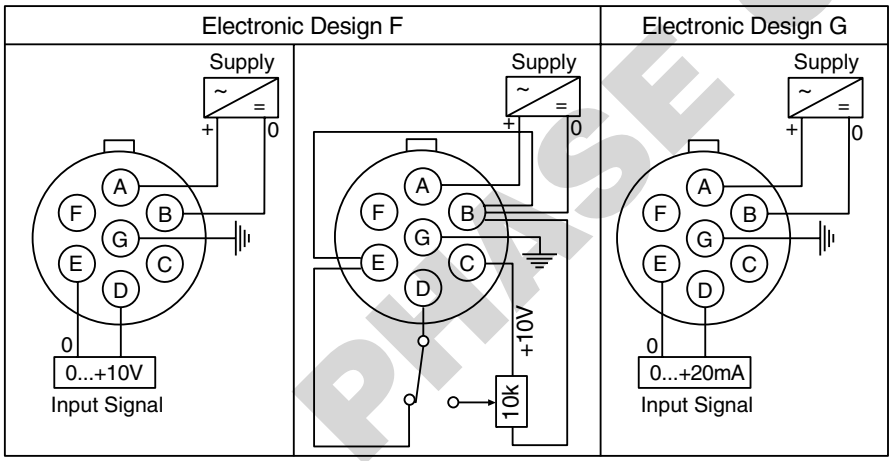
Nominal Size	Subplate	Bolt Kit	Bolt (Quantity) Size	Tightening Torque (Nm)	Sealing Kits	
					Nitrile	Fluorocarbon
NG10	SPP3M6B910	BK389	(4x) M10x50	65	SK-PE10MN10	SK-PE10MV10
NG25	SPP6M8B910	BK485	(4x) M10x45	65	SK-PE25MN10	SK-PE25MV10
NG32	SPP10M12B910	BK390	(6x) M10x50	65	SK-PE32MN10	SK-PE32MV10

For new applications:
PE*T: Refer to PE*W
PC*T: Consult Factory

Electronics Block Diagram

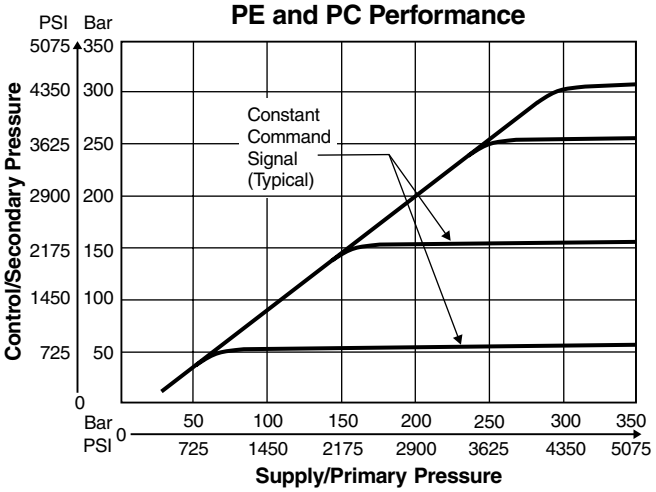


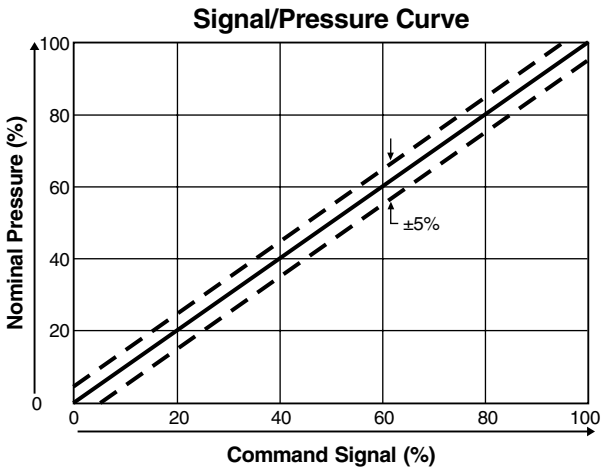
Connector Wiring Diagram



Note: As viewed when facing the connector assembled to valve.

Performance Curves





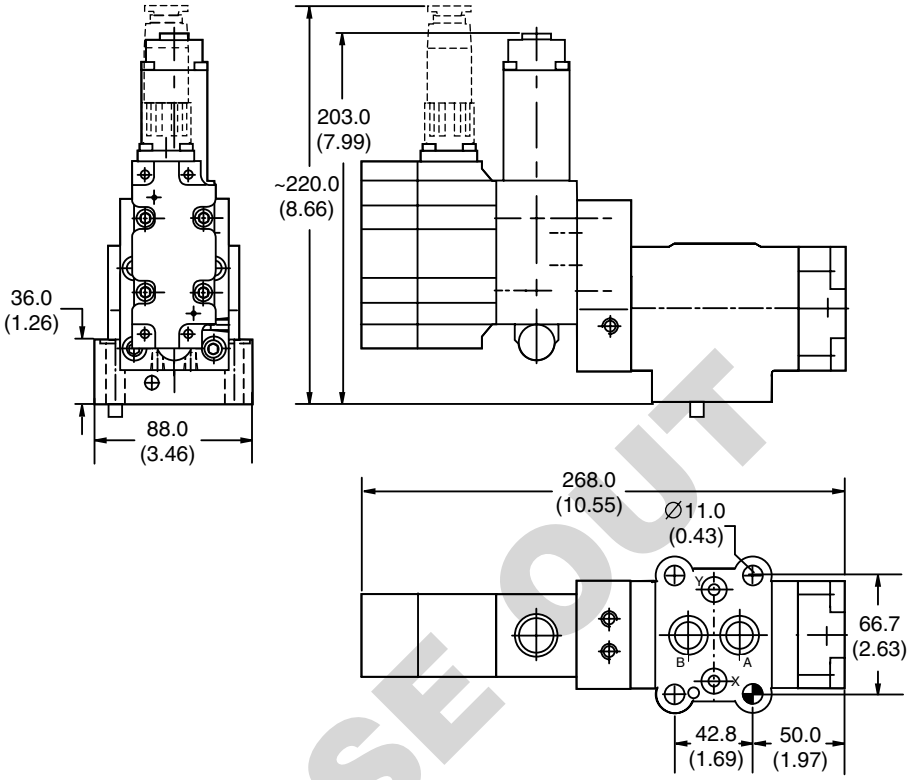
PE-PC.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

B

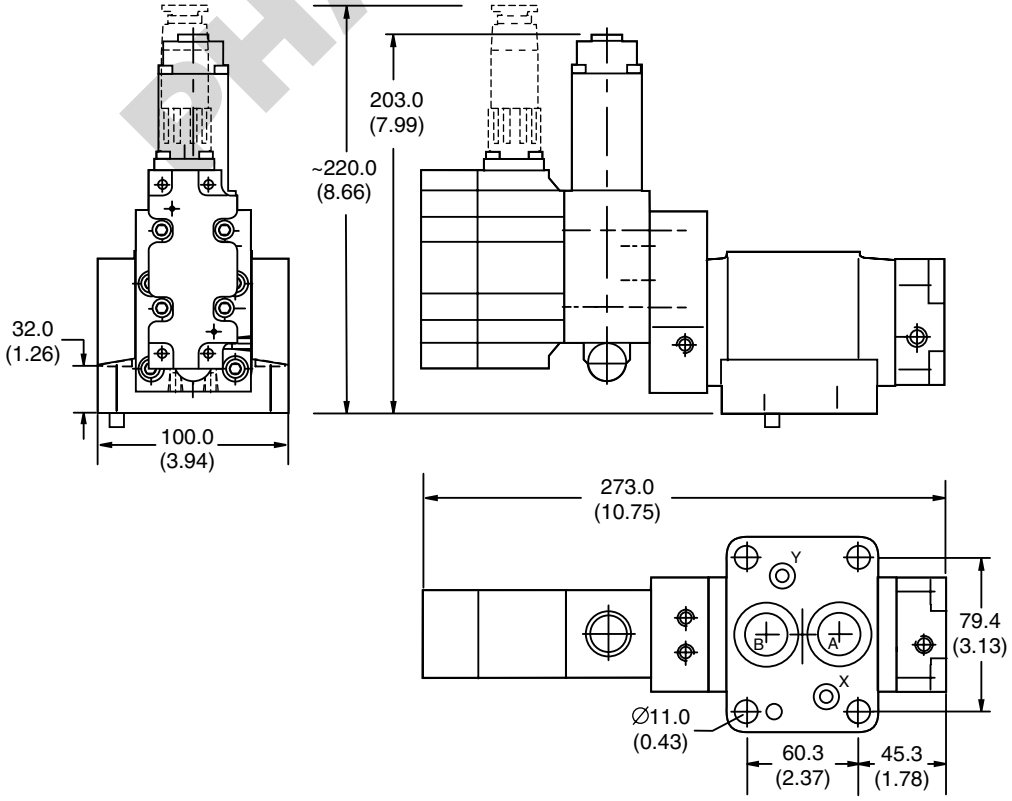
PE and PC10M

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



PE and PC25M

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



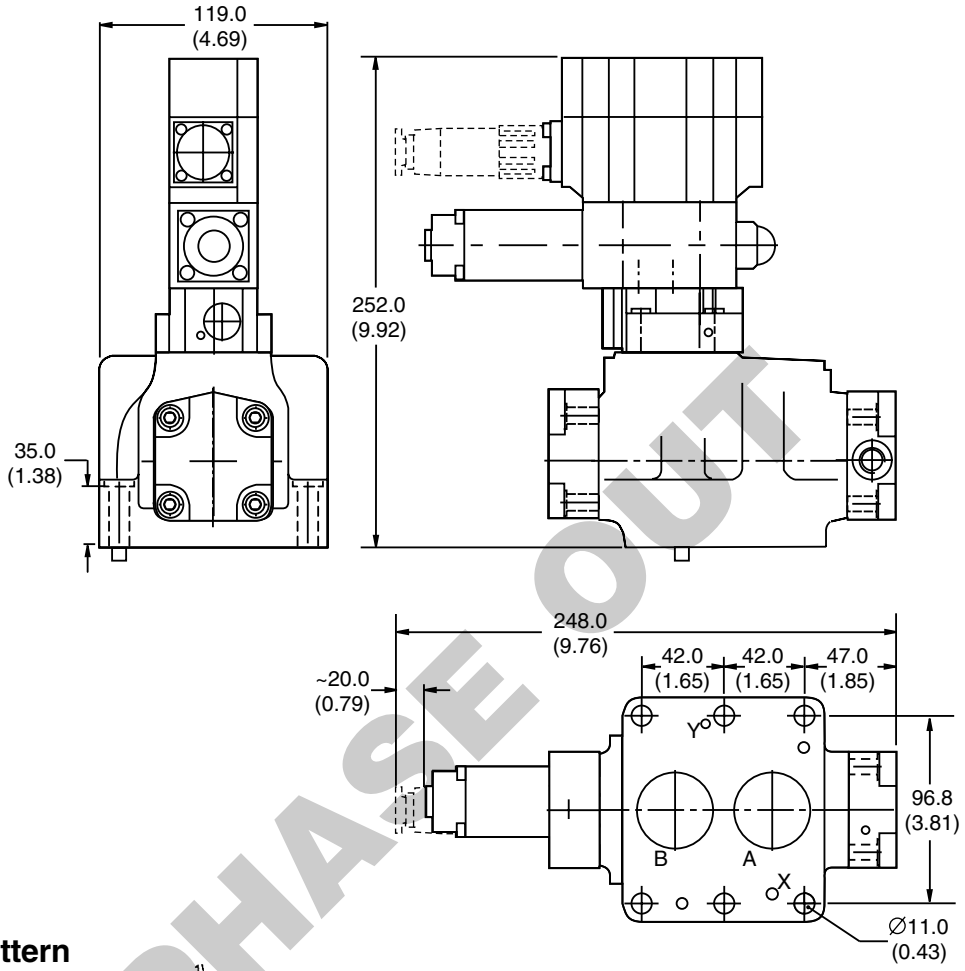
PE-PC.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

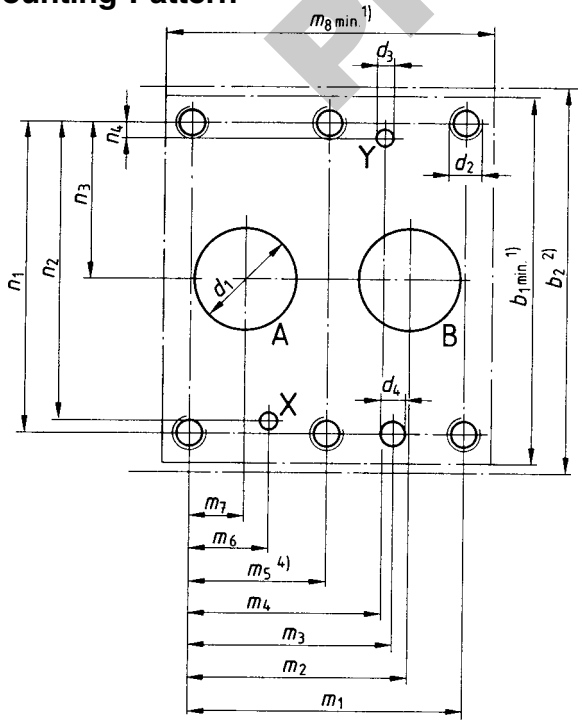
B

Dimensions

PE and PC32M Inch equivalents for millimeter dimensions are shown in (**)



Mounting Pattern



Nominal Size	d1 max.	d2	d3 ±0.2	d4 H12	b1 min.	b2 max.	m1 ±0.2	m2 ±0.2	m3 ±0.2
10	14.7 (0.92)	M10 M10	4.8 (0.19)	7.5 (0.30)	84.0 (3.31)	92.0 (3.62)	42.9 (1.69)	35.7 (1.41)	31.8 (1.25)
25	23.4 (0.92)	M10 M10	4.8 (0.19)	7.5 (0.30)	97.0 (3.82)	105.0 (4.31)	60.3 (2.37)	49.2 (1.94)	44.5 (1.75)
32	32.0 (0.92)	M10 M10	4.8 (0.19)	7.5 (0.30)	114.0 (4.49)	10.0 (0.39)	84.1 (3.31)	67.5 (2.66)	62.7 (2.47)

Nominal Size	m4 ±0.2	m5 ±0.2	m6 ±0.2	m7 min.	m8 min.	n1 ±0.2	n2 ±0.2	n3 ±0.2	n4 ±0.2
10	21.4 (0.84)	– –	21.4 (0.84)	7.1 (0.28)	61.0 (2.40)	66.7 (2.63)	58.7 (2.31)	33.3 (1.31)	7.9 (0.31)
25	39.7 (1.56)	– –	20.6 (0.81)	11.1 (0.44)	78.0 (3.07)	79.4 (3.13)	73.0 (2.87)	39.7 (1.56)	6.4 (0.25)
32	59.6 (2.35)	42.1 1.66	24.6 (0.97)	16.7 (0.66)	102.0 (4.02)	96.8 (3.81)	92.9 (3.66)	48.8 (1.92)	4.0 (0.16)

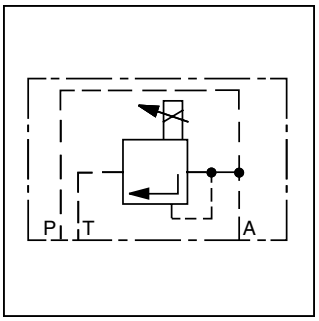
B

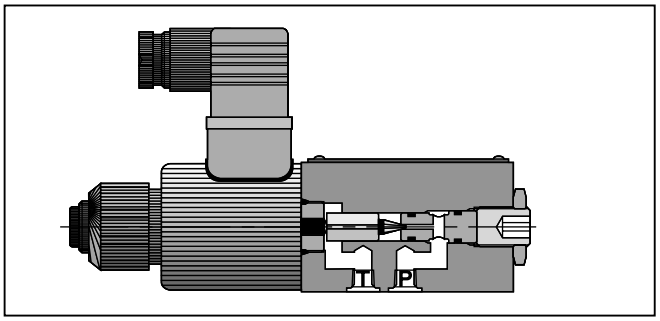
General Description

Series RE06M*W proportional relief valves are direct operated single solenoid valves. Control pressure is proportional to solenoid current when used in conjunction with a PCD00A-400 series or equivalent electronic driver card.

RE06*W valve performance is characterized by very low hysteresis and excellent repeatability. Typical applications include precise control of hydraulic pressure with relatively low flow requirements and as a pilot for larger pressure control valves or as a variable pump pressure control.

The RE06*W proportional relief valve supersedes and is a direct replacement for the DSA-P07 relief valve (select the “X” coil option). Note that a shorter bolt kit is required if field replacing a DSA-P07 valve (refer to ordering code page for appropriate Bolt kits).





Features

- Standard DIN/ISO/CETOP/NFPA interface.
- Very low hysteresis.
- Excellent repeatability.
- Very low minimum pressure capability.
- Flows up to 5 LPM (1.3 GPM).
- Four pressure ranges available.

Specifications

General	
Design	Seated Valve
Mounting Pattern	DIN 24340, form A, ISO 6264/CETOP 3
Mounting Position	As desired, horizontal mounting recommended
Mounting Style	Subplate
Ambient Temperature	-20°C to 70°C (-4°F to +158°F)
Electrical	
Voltage VDC	12 (Coil “K”), 16 (Coil “X”)
Nominal Operating Maximum Amps	2.5 (Coil “K”), 1.3 (Coil “X”)
Coil Resistance	4 Ohm at 20°C (68°F) (Coil K) 11.5 Ohm at 20°C (68°F) (Coil X)
Duty Cycle	100%
Electrical Connection	Plug connector 692915* according to DIN 43650/2 pole + PE/Pg11
Protection Class	IP65 (NEMA 4)
Amplifier Types	PCD00A-400 Series
Dither - Recommended	270Hz, 120 mA

Hydraulic	
Operating Pressure Bar (PSI)	Ports P and A: up to 350 (5075) Port T: up to 210 (3045)
Pressure Range Bar (PSI)	105, 175, 250, 350 (1522, 2538, 3625, 5075)
Fluid Temperature	Maximum 80°C (176°F)
Fluid Vicosity, Recommended	80-1000 SSU
Fluid Cleanliness Level	ISO Class 16/15
Flow Rate	see performance curves
Linearity	2.8%
Repeatability	< ±1%
Hysteresis	±1.5% of p_{max}

* Plug must be ordered separately

Ordering Information

RE06M	[ ]	W	2	V	1	[ ]	W	[ ]
Proportional Pressure Relief Valve	Pressure Range	Offboard Electronics		Seal	Valve Open at Zero Command	Solenoid Type	Electronic Connection	Design Series

NOTE: Not required when ordering.

Code	Pressure Range	
10	105 Bar	(1522 PSI)
17	**175 Bar**	**(2538 PSI)**
25	250 Bar	(3625 PSI)
35	**350 Bar**	**(5075 PSI)**

Code	Description
V	Fluorocarbon

Code	Description
K*	**12V; 2.5A**
X**	16V; 1.3A

* Use with "PCD" Series Driver cards

** Order if currently using "ED" card

Code	Description
W	Socket Connector DIN 43650 without plug

Bolt Kit	Qty	Size
BK209	4	10-24 X 1.25"
BK375	4	M5 x 30mm

Weight: 1.8 kg (4.0 lbs.)

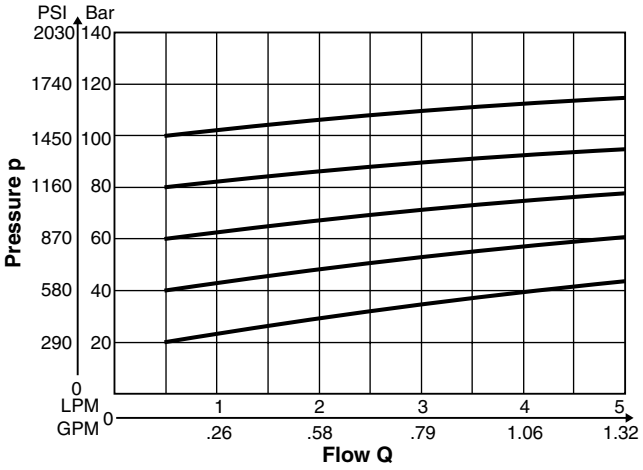
Bold: Designates Tier I products and options.

Non-Bold: Designates Tier II products and options.
These products will have longer lead times.

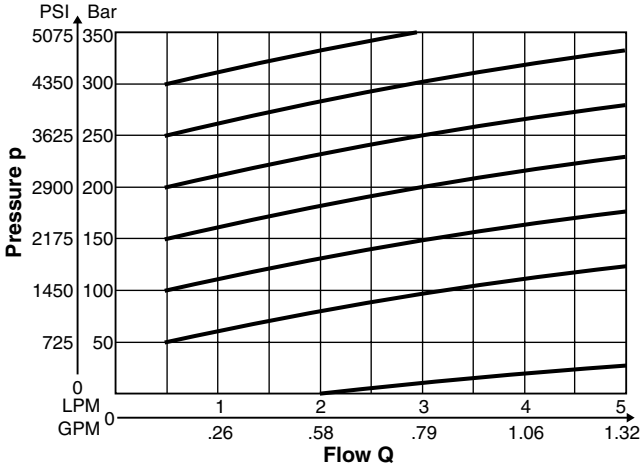
Performance Curves

p/Q Curves

Pressure Stage 105 Bar

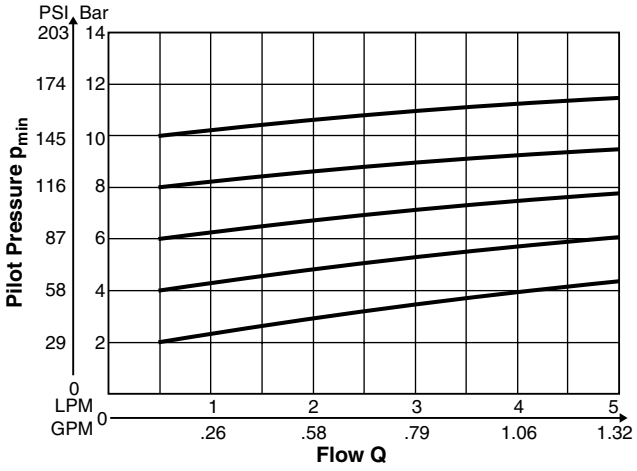


Pressure Stage 350 Bar

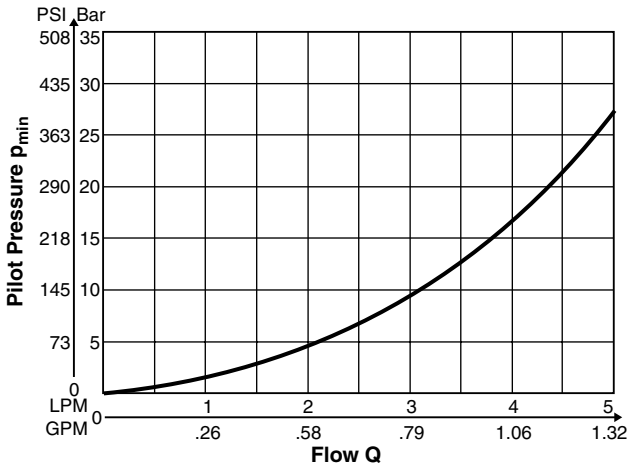


B

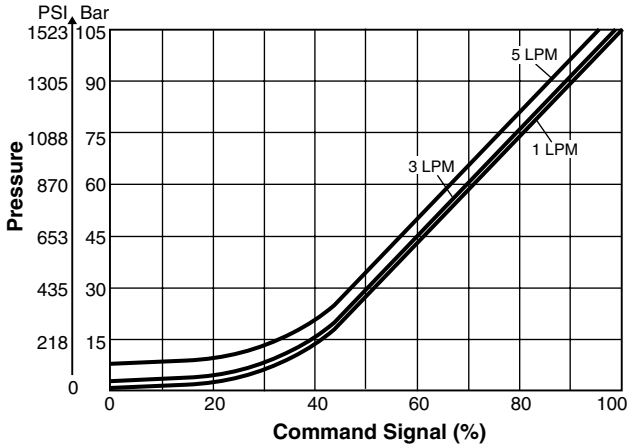
p_{min}/Q curves
Pressure Stage 105 Bar



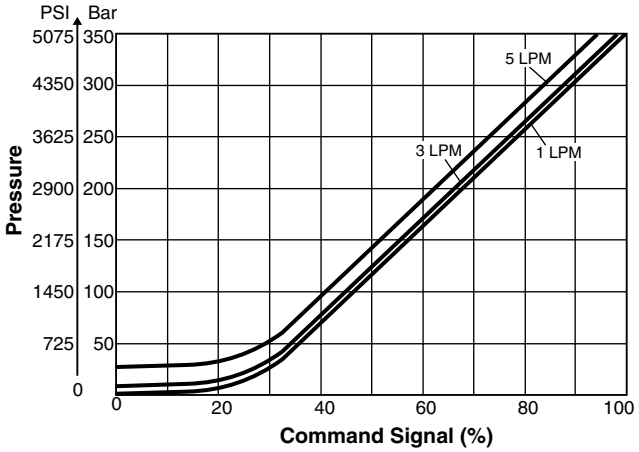
Pressure Stage 350 Bar



$p_{set\text{-}voltage}$ Curves
Pressure Stage 105 Bar



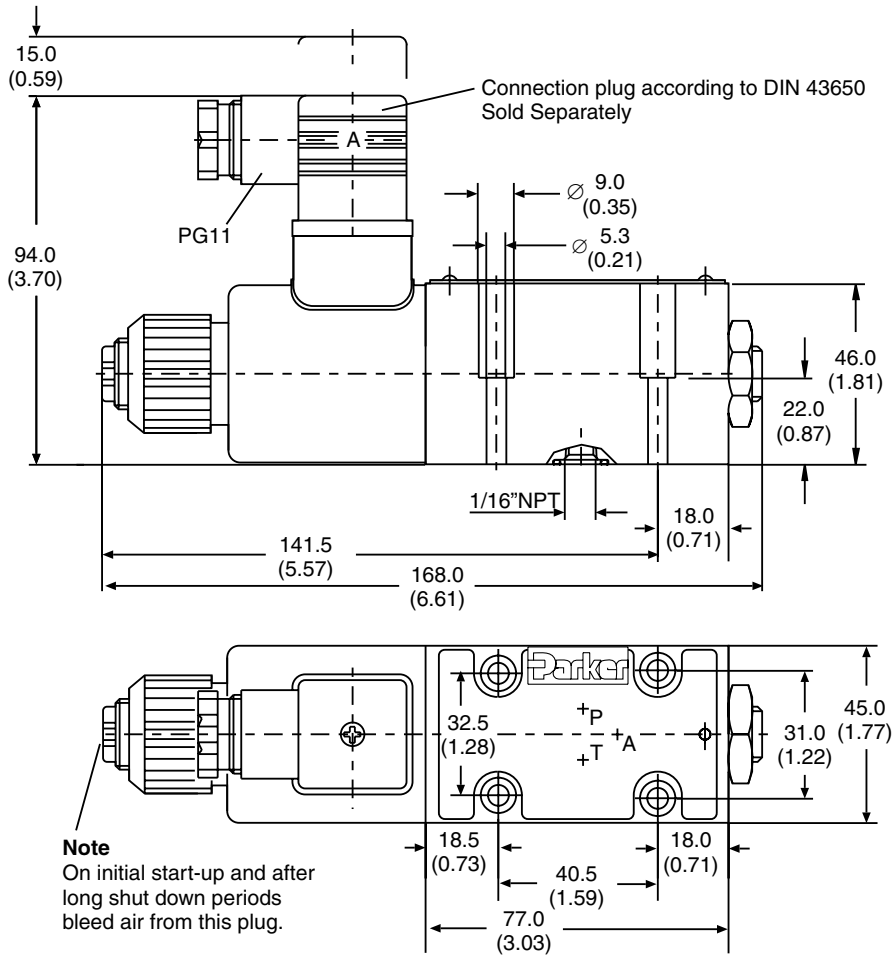
Pressure Stage 350 Bar



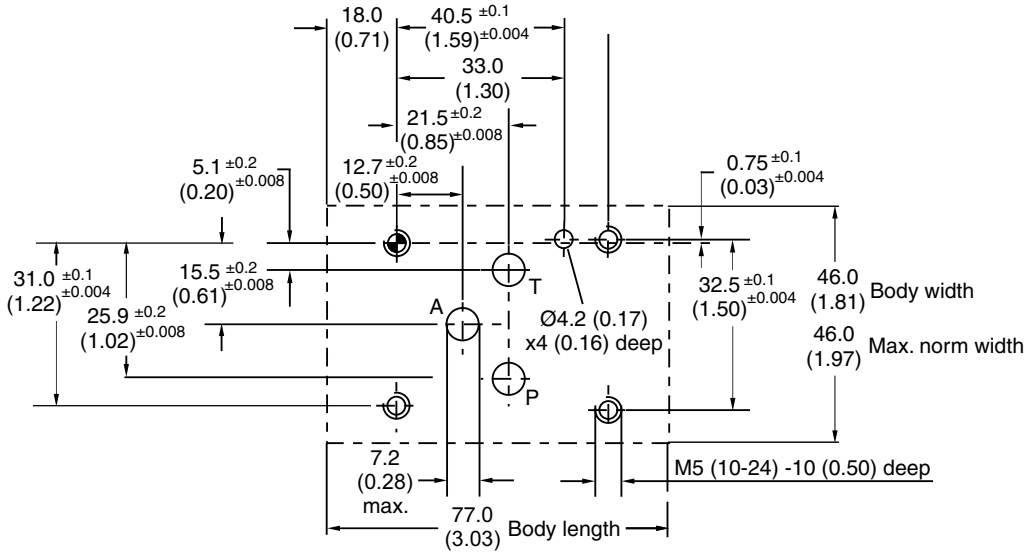
B

Dimensions

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



Mounting Pattern ISO 6264-03-04-*-97



RE06_W.p65, dd

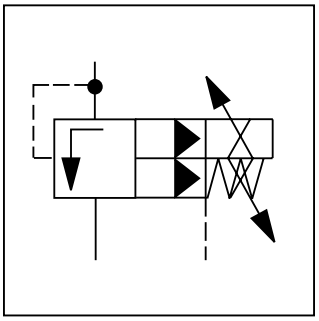
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

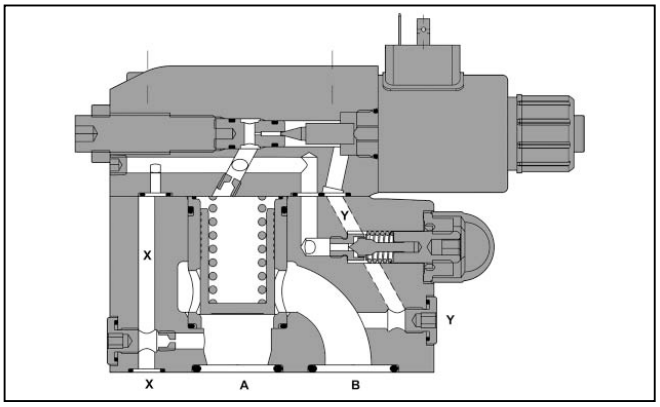
B

General Description

Series RE*W proportional pressure relief valves have a proportional solenoid operated pilot stage and DIN cartridge main stage.

Valves are controlled by off-board electronic driver modules. Refer to the electronics section for optional PCD00A-400 driver configuations.





Features

- Standard DIN/ISO interfaces.
- Mechanical maximum pressure adjustment.

Electronics Modules

Refer to the Electronics Section for information on electronic driver modules.

Specifications

Interface		**DIN** **CETOP**	**NG10** **5**	**NG25** **8**	**NG32** **10**
Nominal Flow	LPM (GPM)	RE*R	up to 250 (66)	up to 500 (132)	up to 650 (172)
		RE*M	up to 150 (40)	up to 350 (92)	up to 650 (172)
Maximum Operating Pressure		Bar (PSI)	Pressure port P, A, X: 350 (5075); T, Y: not pressurized		
Adjustment Range		Bar (PSI)	10 to 350 (145 to 5075)		
Mounting Pattern			DIN 24340 Form D or E, ISO 5781 and ISO 6264		
Mounting Orientation			Any		

Ordering Information

RE				W		S		1		W		
Proportional Pressure Limiting Valve	Size and Interface	Mounting Pattern	Pressure Range	Off-Board Electronics	Pilot Oil Guide	Spring	Seal	Valve Open at Zero Command	Solenoid Voltage	Solenoid Connection	Special Equipment	Design Series

NOTE: Not required when ordering.

B

Code	Description
10	NG10/CETOP 5
25	NG25/CETOP 8
32	NG32/CETOP 10

Code	Description
M	DIN 24340 Form D
R	DIN 24340 Form E

Code	Description
10	105 Bar (1522 PSI)
17	175 Bar (2537 PSI)
25	250 Bar (3625 PSI)
35	350 Bar (5075 PSI)

Code	Description	
	Supply	Drain
1**	Internal	External
4*	Internal	Internal

* Standard
** Not for Interface Form E

Code	Description
S	1.6 Bar(23 PSI)

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Description
K	12V, 2.3 A
X	16V, 1.3 A

Code	Description
W	DIN Socket Connector without plug

Code	Description
Omit	No Mechanical Maximum Pressure Adjustment
M	Mechanical Maximum Pressure Adjustment

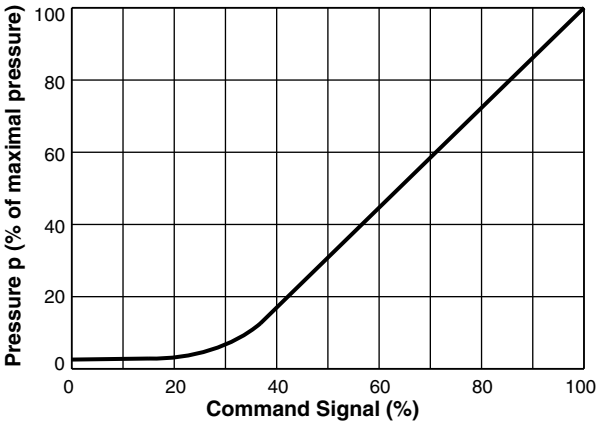
Weight:

RE*R	
NG10	5.2 kg (11.5 lbs.)
NG25	6.4 kg (14.0 lbs.)
NG32	8.3 kg (18.3 lbs.)
RE*M	
NG10	4.5 kg (9.9 lbs.)
NG25	6.3 kg (14.0 lbs.)
NG32	7.8 kg (17.2 lbs.)

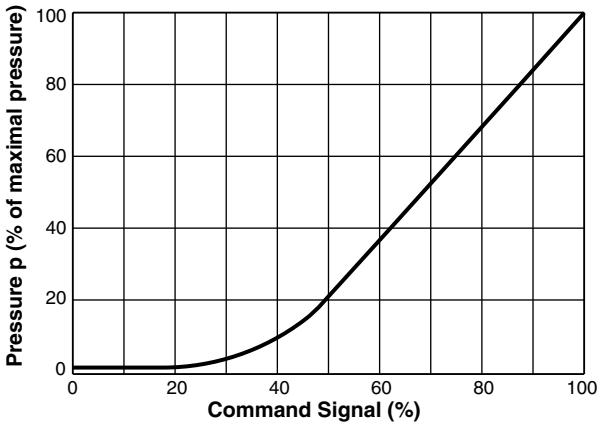
Driver Electronics – PCD00A-400

Performance Curves

Signal/Pressure Curve – RE*R*W

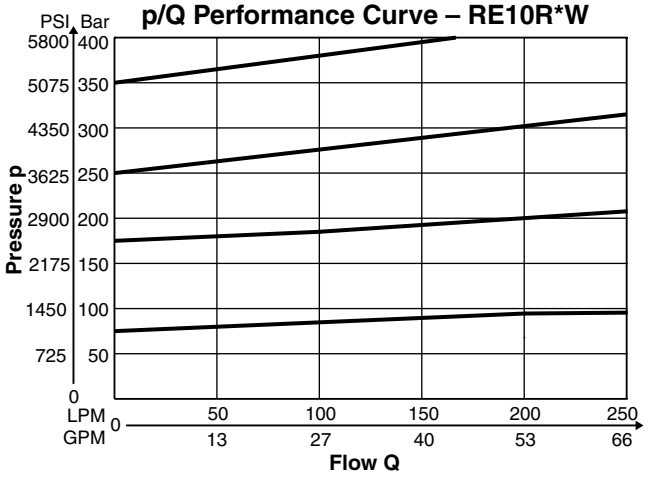


Signal/Pressure Curve – RE*M*W

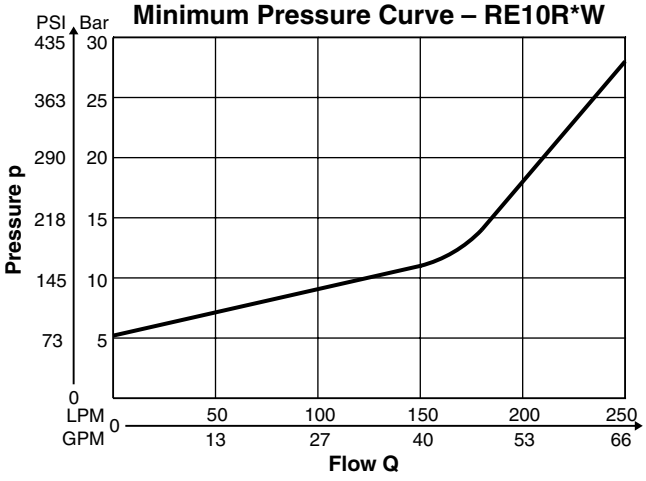


B

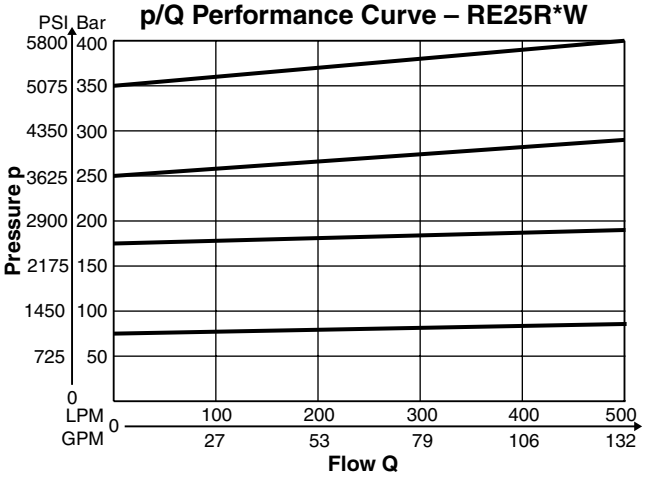
p/Q Performance Curve – RE10R*W



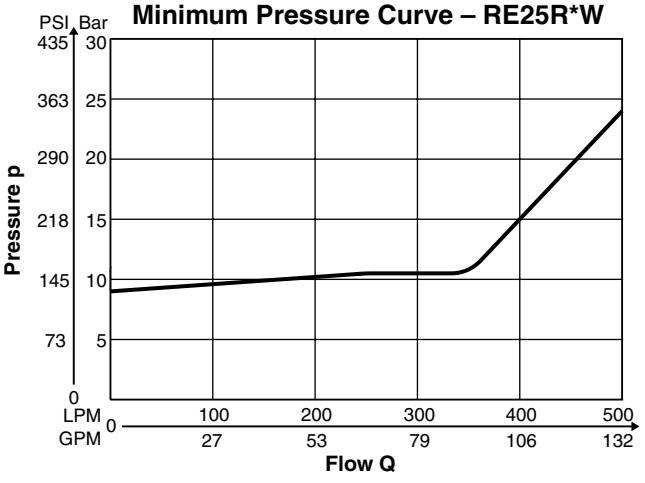
Minimum Pressure Curve – RE10R*W



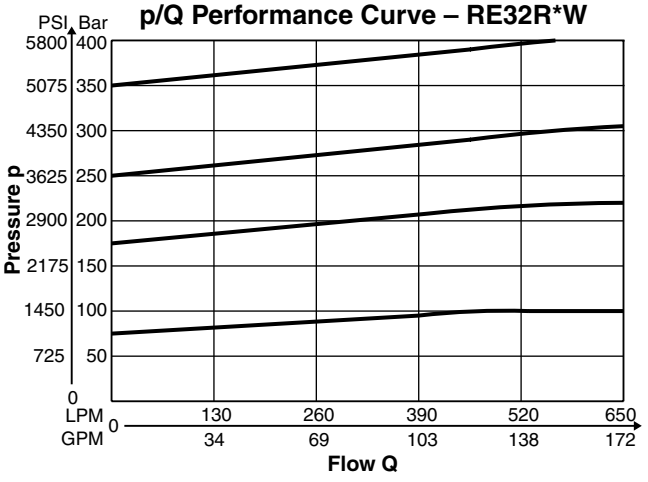
p/Q Performance Curve – RE25R*W



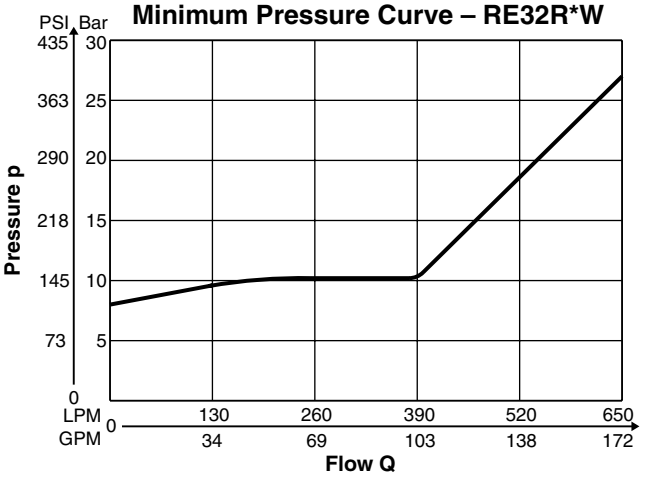
Minimum Pressure Curve – RE25R*W



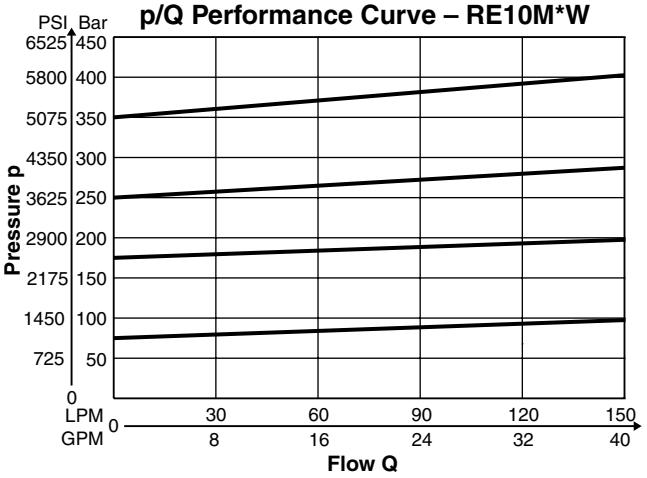
p/Q Performance Curve – RE32R*W



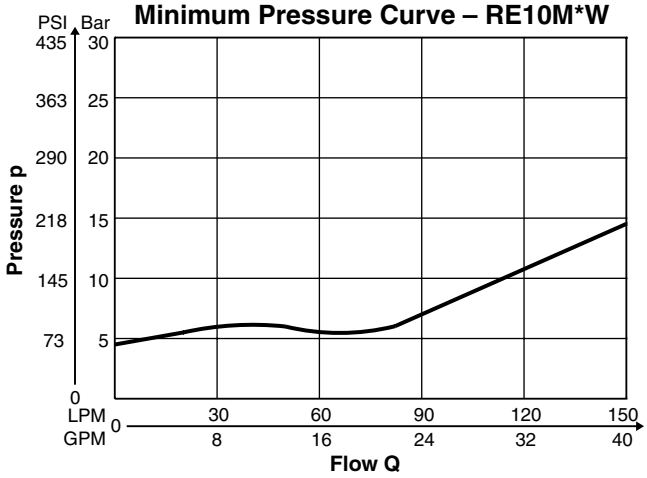
Minimum Pressure Curve – RE32R*W



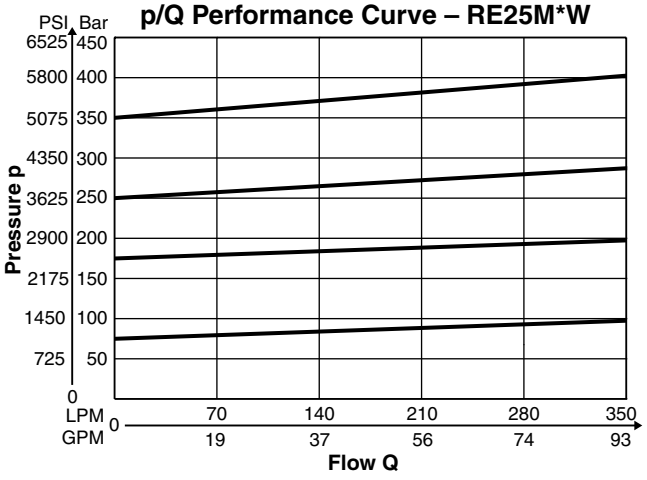
p/Q Performance Curve – RE10M*W



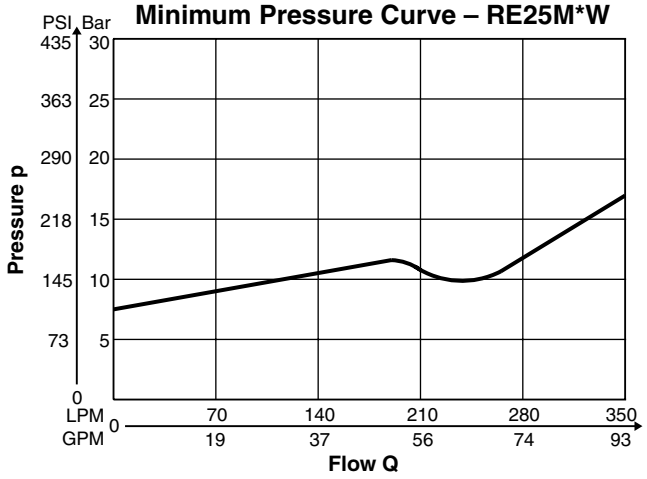
Minimum Pressure Curve – RE10M*W



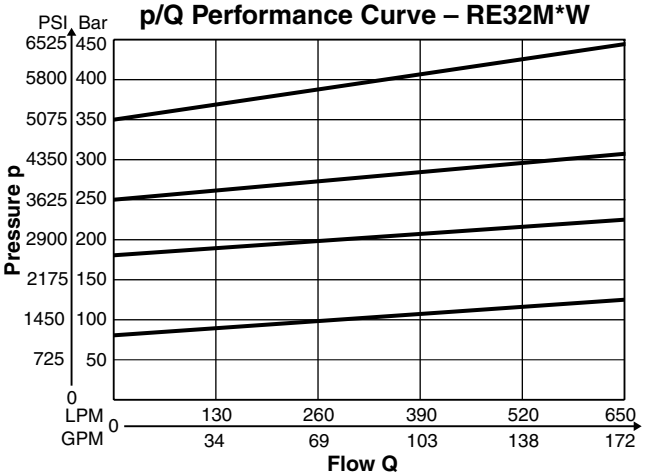
p/Q Performance Curve – RE25M*W



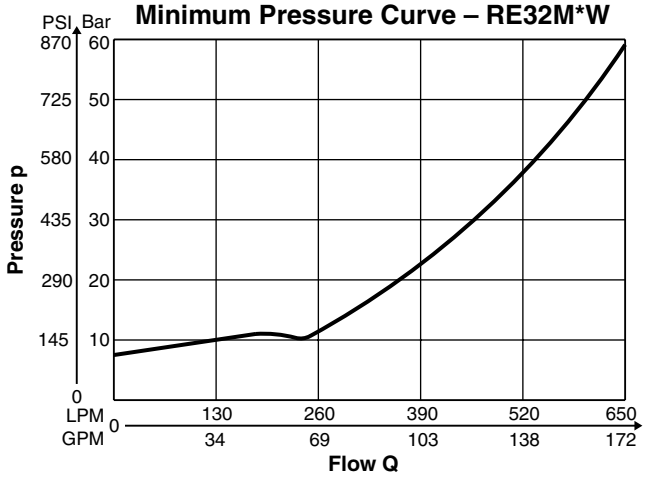
Minimum Pressure Curve – RE25M*W



p/Q Performance Curve – RE32M*W



Minimum Pressure Curve – RE32M*W

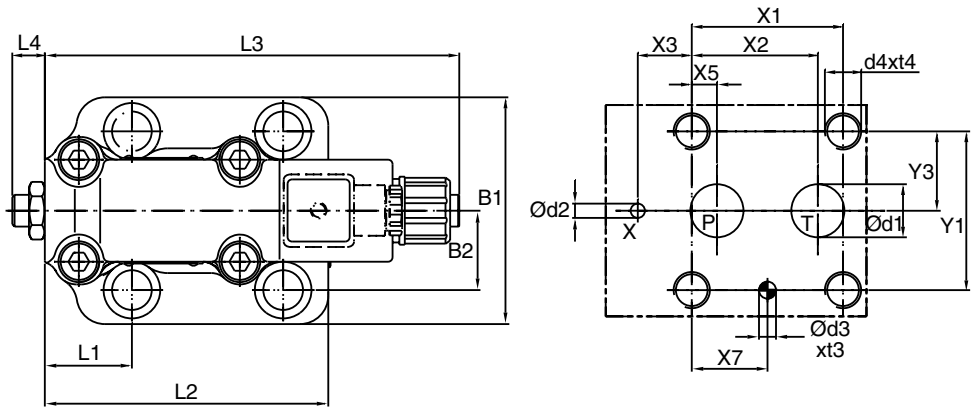


B

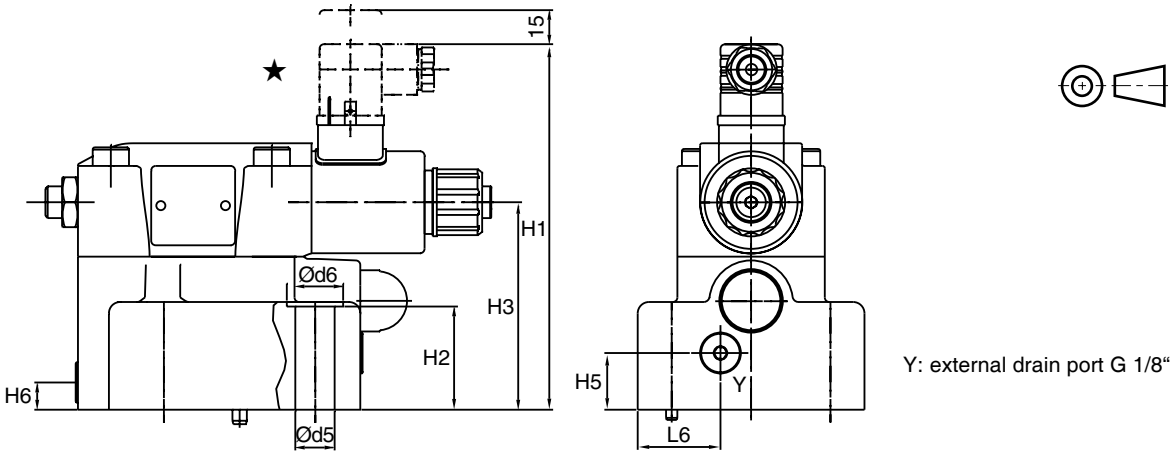
B

RE*R*W

Dimensions are shown in millimeters.



★ Order plugs separately.



Y: external drain port G 1/8“

NG	ISO-code	x1	x2	x3	x4	x5	x6	x7	y1	y2	y3	y4	y5	y6
10	6264-06-09-*-97	53.8	47.5	0	-	22.1	-	22.1	53.8	-	26.9	-	-	-
25	6264-08-13-*-97	66.7	55.6	23.8	-	11.1	-	33.4	70	-	35	-	-	-
32	6264-10-17-*-97	88.9	76.2	31.8	-	12.7	-	44.5	82.6	-	41.3	-	-	-

Tolerance at X and Y pin holes and screw holes ±0.1, at port holes ±0.2.

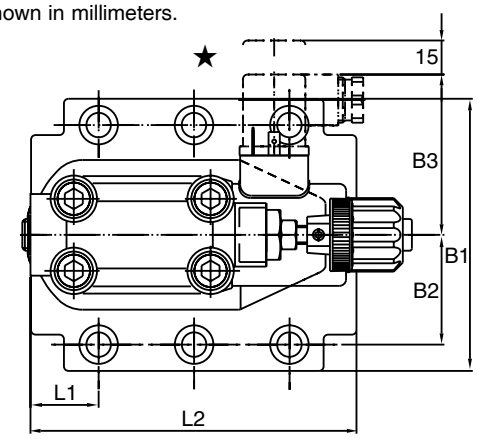
NG	ISO-code	B1	B2	H1	H2	H3	H4	H5	H6	L1	L2	L3	L4	L5	L6
10	6264-06-09-*-97	80	26.9	158.7	27	88	-	25	12	52.5	118.5	182.3	14.4		36.5
25	6264-08-13-*-97	100	35	161.2	45.5	91.5	-	25	12	37.9	124.5	182.3	14.4	-	36.5
32	6264-10-17-*-97	120	41.3	166.7	52	97	-	25	12	45	153	182.3	14.4		36.5

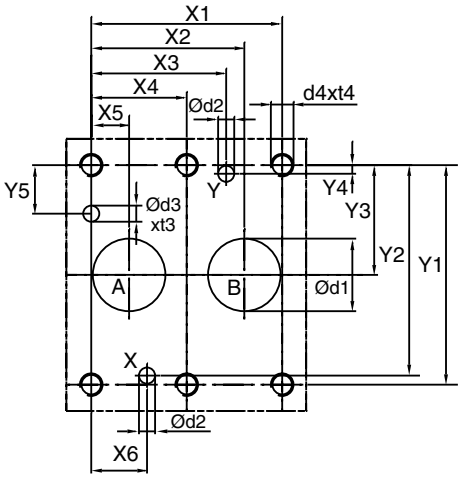
NG	ISO-code	d1max	d2max	d3	t3	d4	t4	d5	d6
10	6264-06-09-*-97	14.7	4.8	7.5	10	M12	20	13.5	20
25	6264-08-13-*-97	23.4	6.3	7.5	10	M16	27	17.5	25
32	6264-10-17-*-97	32	6.3	7.5	10	M18	28	20	30

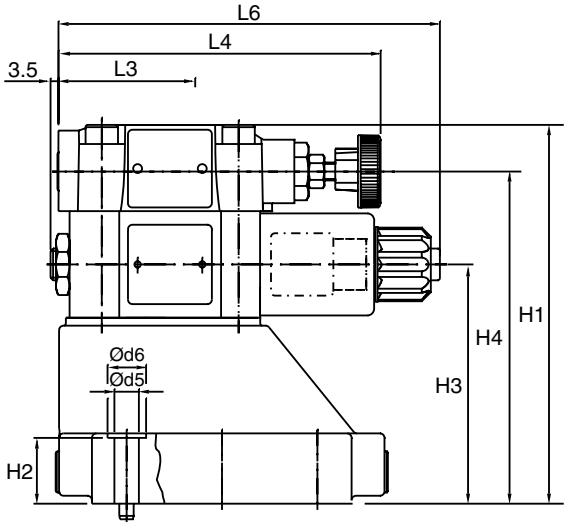
NG	ISO-code	Bolt kit DIN912 12.9		Kit NBR	Kit FPM	Surface finish
10	6264-06-09-*-97	BK-M12 x 45-4pcs	115 Nm ±15%	SK-RE10RN50	SK-RE10RV50	R_{max}6.3 ⏥ 0.01/100
25	6264-08-13-*-97	BK-M16 x 70-4pcs	281 Nm ±15%	SK-RE25RN50	SK-RE25RV50	
32	6264-10-17-*-97	BK-M18 x 75-4pcs	398 Nm ±15%	SK-RE32RN50	SK-RE32RV50	

RE*M*W

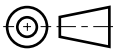
Dimensions are shown in millimeters.







★ Order plugs separately.

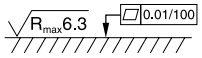


NG	ISO-code	x1	x2	x3	x4	x5	x6	x7	y1	y2	y3	y4	y5	y6
10	6264-06-09-*-97	42.9	35.8	21.5	-	7.2	21.5	0	66.7	58.8	33.4	7.9	14.3	-
25	6264-08-13-*-97	60.3	49.2	39.7	-	11.1	20.6	0	79.4	73	39.7	6.4	15.9	-
32	6264-10-17-*-97	84.2	67.5	59.5	42.1	16.7	24.6	0	96.8	92.8	48.4	3.8	21.4	-

Tolerance at X and Y pin holes and screw holes ±0.1, at port holes ±0.2.

NG	ISO-code	B1	B2	B3	H1	H2	H3	H4	H6	L1	L2	L3	L4	L5	L6
10	6264-06-09-*-97	87.3	33.35	71	130	21	68.5	109.5	-	29	94.8	-	141	-	168.8
25	6264-08-13-*-97	105	39.7	71	156.5	29	95	136	-	34.7	126.8	-	141	-	168.8
32	6264-10-17-*-97	120	48.4	71	167	29	105.5	146.5	-	30.6	144.3	-	141	-	168.8

NG	ISO-code	d1max	d2max	d3	t3	d4	t4	d5	d6
10	6264-06-09-*-97	15	7	7.1	8	M10	16	10.8	17
25	6264-08-13-*-97	23.4	7.1	7.1	8	M10	18	10.8	17
32	6264-10-17-*-97	32	7.1	7.1	8	M10	20	10.8	17

NG	ISO-code	Bolt kit DIN912 12.9		Kit NBR	Kit FPM	Surface finish
10	6264-06-09-*-97	BK-M10 x 35-4pcs	68 Nm	SK-RE10MN50	SK-RE10MV50	
25	6264-08-13-*-97	BK-M10 x 45-4pcs	68 Nm	SK-RE25MN50	SK-RE25MV50	
32	6264-10-17-*-97	BK-M10 x 45-6pcs	68 Nm	SK-RE32MN50	SK-RE32MV50	

RE_W.p65, dd

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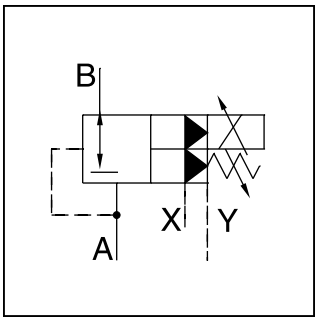
Hydraulic Valve Division
Elyria, Ohio, USA

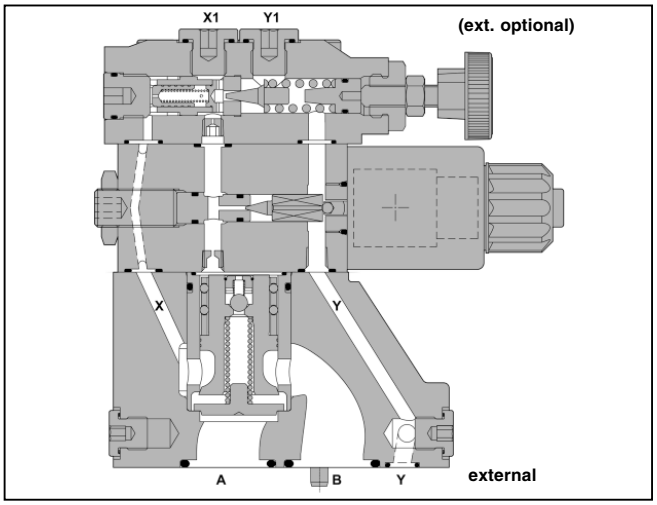
B

General Description

Series PE*W pressure reducing valves have a proportional solenoid operated pilot stage and a spool cartridge main stage.

The control command signal is provided by external electronic modules.





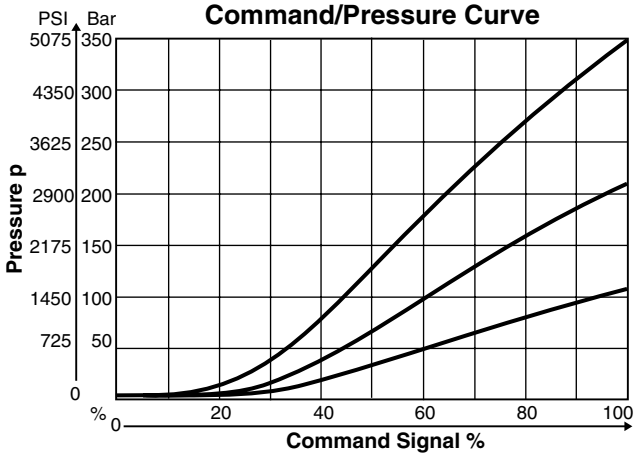
Specifications

Interface	Subplate mounting acc. ISO 5781
Mounting Position	as desired, horizontal mounting prefered
Ambient Hydraulic Temperature	-20° to +80°C (-4° to +176°F)
Maximum Operating Pressure	Ports A and X 350 Bar (5075 PSI) connection B and Y depressurized
Pressure Stages	107 Bar (1552 PSI) 175 Bar (2538 PSI) 250 Bar (3625 PSI) 350 Bar (5075 PSI)
Nominal Flow	Size 10: 150 LPM (40 GPM) Size 25: 350 LPM (93 GPM) Size 32: 650 LPM (172 GPM)
Fluid	Hydraulic oil according to DIN 51524 through 51525
Viscosity Recommended Maximum	 30 to 50 mm²/S (180 to 230 SSU) 20 to 380 mm²/S (75 to 1850 SSU)
Fluid Temperature Recommended Maximum	 30° to +50°C (86° to +122°F) -20° to +70°C (-4° to +158°F)
Permitted Contamination	ISO 4406 (1999); 18/16/13
Duty Cycle	100% ED
Protection Class	IP54 at DIN 40050 (plugged and mounted)
Nominal Voltage	12 V
Maximum Current	2.3 amps
Ambient Electrical Temperature	-20° to +60°C (-4° to +140°F)
Coil Resistance	4 ohm at 20°C (68°F)
Plug Connectors	2 pole + PE / connector EN 175301-803 / cableØ 8 to 10mm
Power Amplifier	PCD00A-400

Features

- Pilot-operated with proportional solenoid.
- Continuous adjustment by proportional solenoid.
- Subplate according to ISO 5731.
- Four pressure stages.
- Mechanical maximum pressure adjustment.

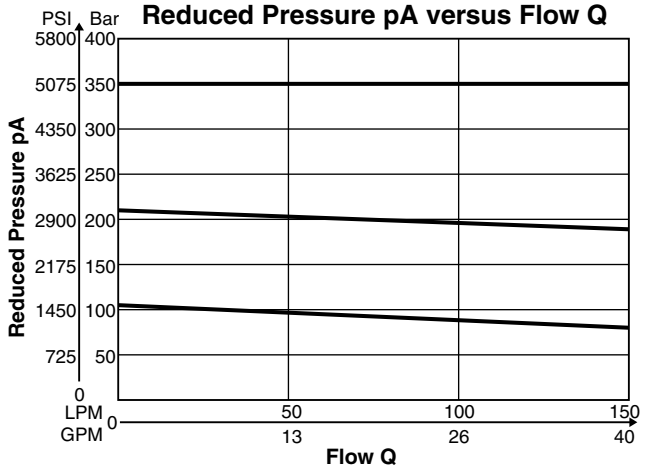
Performance Curves

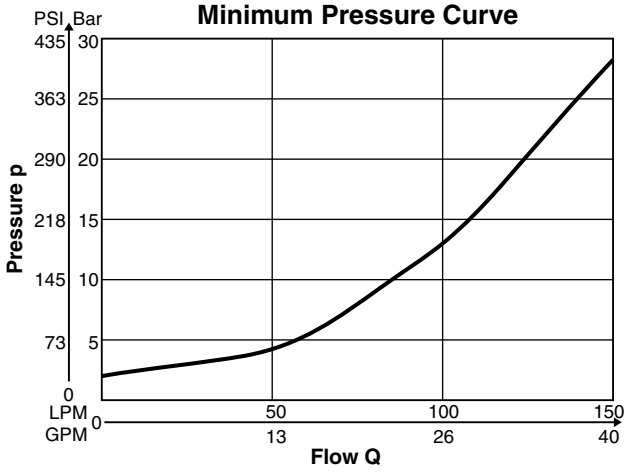


(Continued on the following page)

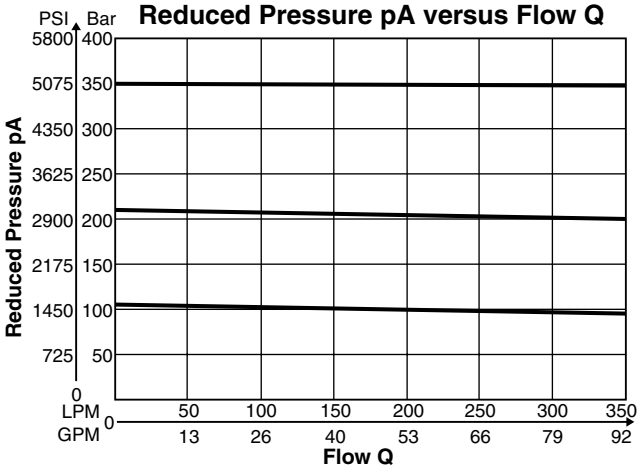
B

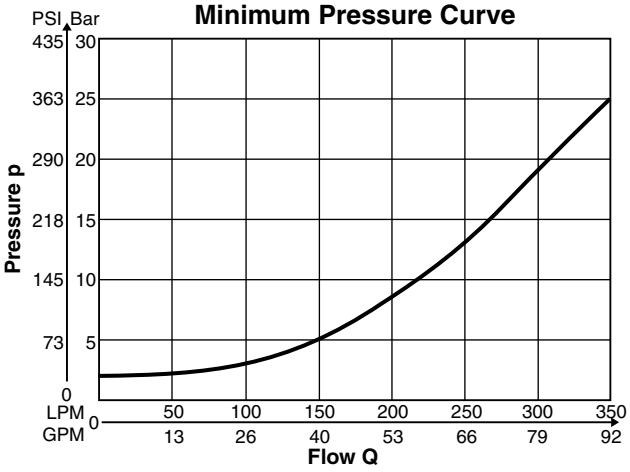
Series PE10M



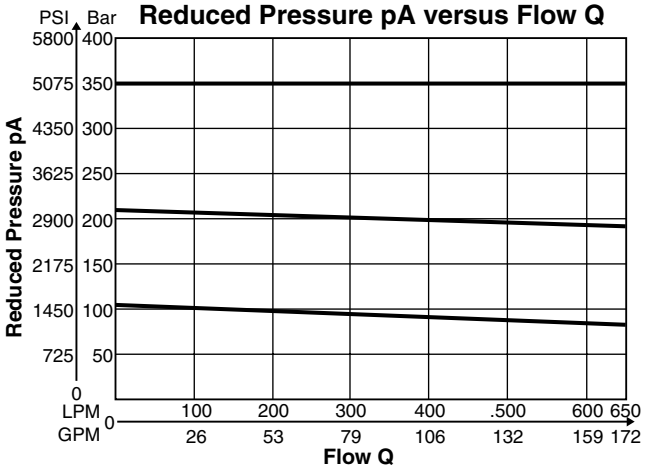


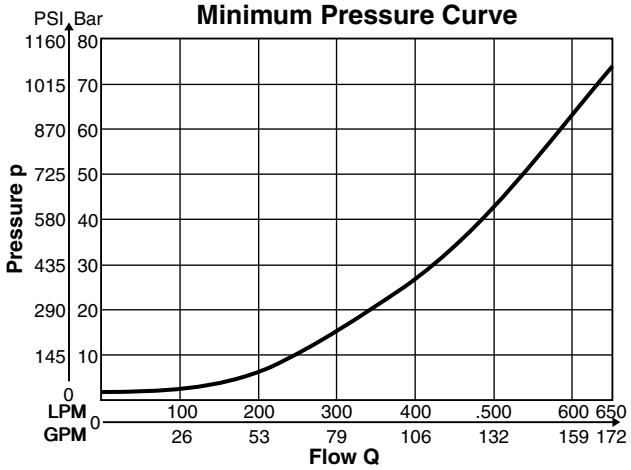
Series PE25M





Series PE32M





*Measured at 350Bar (5076 PSI) primary pressure pB.

PE_W.dd

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Elyria, Ohio, USA

B

PE		M		W	1	P		9	K	W		S02
Proportional Pressure Reducing Valve	Nominal Size	Interface	Pressure Stages	Off-Board Electronics	Pilot Oil: External Drain	Poppet Spring	Seals	Normaly Closed	Solenoid 12V, 2.3A	Without Plug	Design Series	Spool Type

Code	Nominal Size
10	NG10
25	NG25
32	NG32

Code	Pressure Stages
10	up to 105 Bar (1522 PSI)
21	up to 210 Bar (3045 PSI)
35	up to 350 Bar (5075 PSI)

Code	Description
N	Nitrile
V	Fluorocarbon

Code	Interface	
M	Subplate Mounting ISO 5781	NG 10 and 25: Y, A, B, Pin — NG 32: Y, A, B, Pin

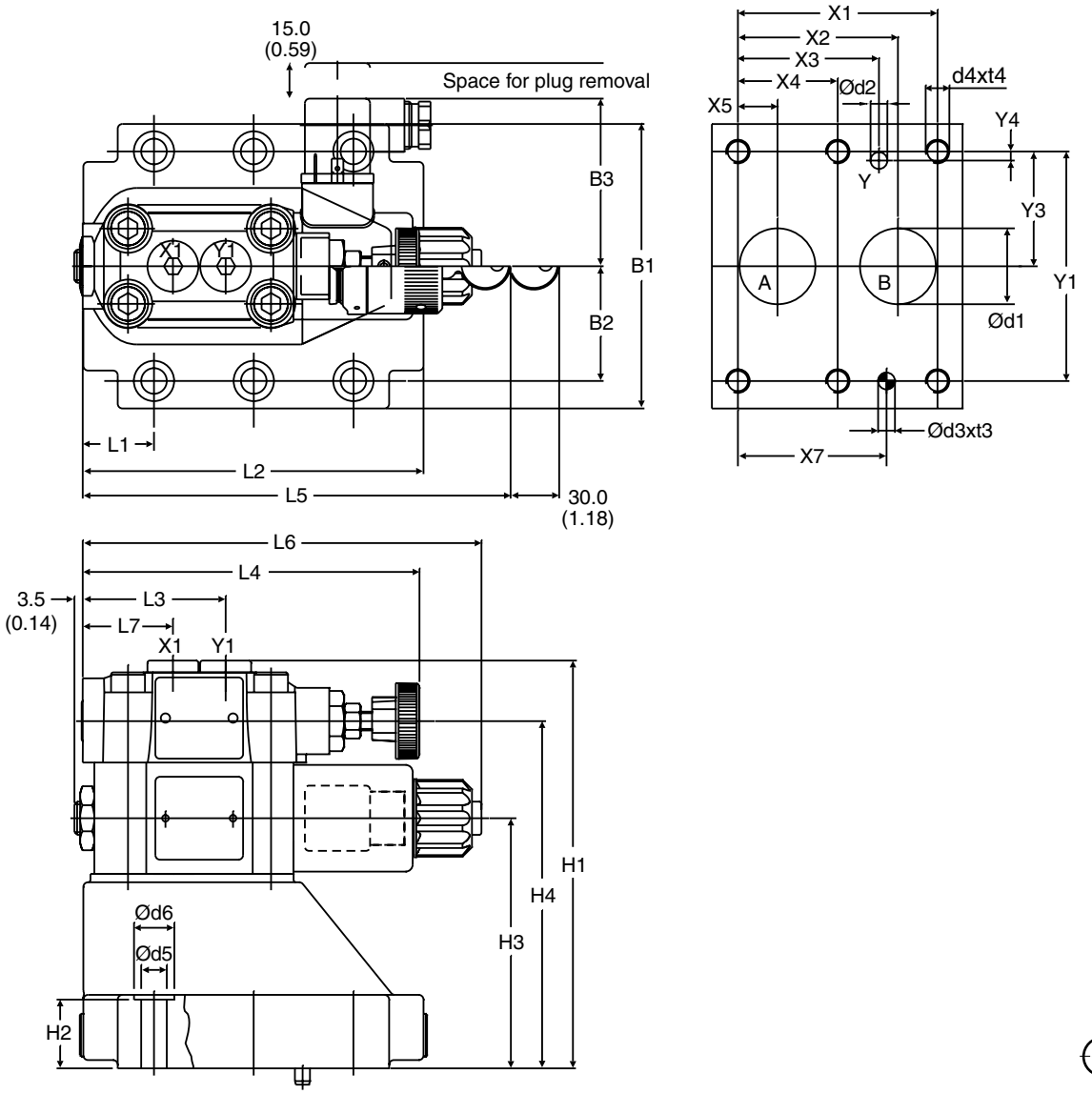
Valve Weight:

NG10: 2.7 kg (6.0 lbs.)
NG25: 4.5 kg (9.9 lbs.)
NG32: 6.0 kg (13.2 lbs.)

Driver Electronics – PCD00A-400

B

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



NG	ISO-code	x1	x2	x3	x4	x5	x6	x7	y1	y2	y3	y4	y5	y6
10	5781-06-07-0-00	42.9	35.8	21.5	-	7.2	-	31.8	66.7	-	33.4	7.9	-	-
25	5781-08-10-0-00	60.3	49.2	39.7	-	11.1	-	44.5	79.4	-	39.7	6.4	-	-
32	5781-10-13-0-00	84.2	67.5	59.5	42.1	16.7	-	62.7	96.8	-	48.4	3.8	-	-

Tolerance for all dimensions ±0.2

NG	ISO-code	B1	B2	B3	H1	H2	H3	H4	L1	L2	L3	L4	L5	L6	L7
10	5781-06-07-0-00	87.3	33.35	71	134	21	68.5	109.5	29	94.8	60.8	141	181	168.8	38.6
25	5781-08-10-0-00	105	39.7	71	160.5	29	95	136	34.7	126.8	60.8	141	181	168.8	38.6
32	5781-10-13-0-00	120	48.4	71	171	29	105.5	146.5	30.6	144.3	60.8	141	181	168.8	38.6

NG	ISO-code	d1max	d2max	d3	t3	d4	t4	d5	d6
10	5781-06-07-0-00	15	7	7.1	8	M10	16	10.8	17
25	5781-08-10-0-00	23.4	7.1	7.1	8	M10	18	10.8	17
32	5781-10-13-0-00	32	7.1	7.1	8	M10	20	10.8	17

NG	ISO-code	Bolt kit DIN912 12.9		Kit NBR	Kit FPM	Surface finish
10	5781-06-07-0-00	BK-M10 x 35-4pcs	68 Nm	SK-PE10MN50	SK-PE10MV50	R_{max}6.3 / 0.01/100
25	5781-08-10-0-00	BK-M10 x 45-4pcs	68 Nm	SK-PE25MN50	SK-PE25MV50	
32	5781-10-13-0-00	BK-M10 x 45-6pcs	68 Nm	SK-PE32MN50	SK-PE32MV50	

PE_W.dd

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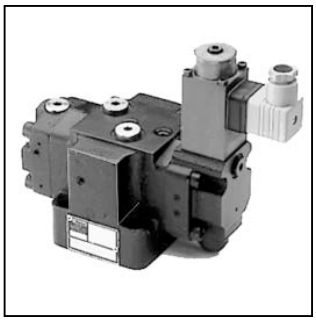
Hydraulic Valve Division
Elyria, Ohio, USA

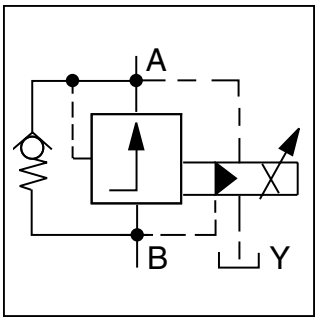
B

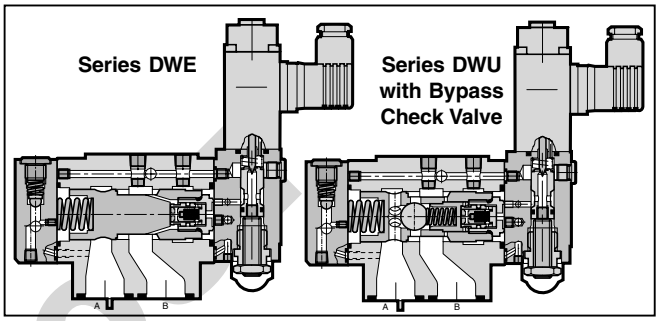
General Description

Series DWE/DWU proportional pressure reducing valves have a proportional solenoid operated pilot stage and sliding spool main stage.

Valves are controlled by off-board electronic driver modules. Refer to the electronics section for optional driver configurations.





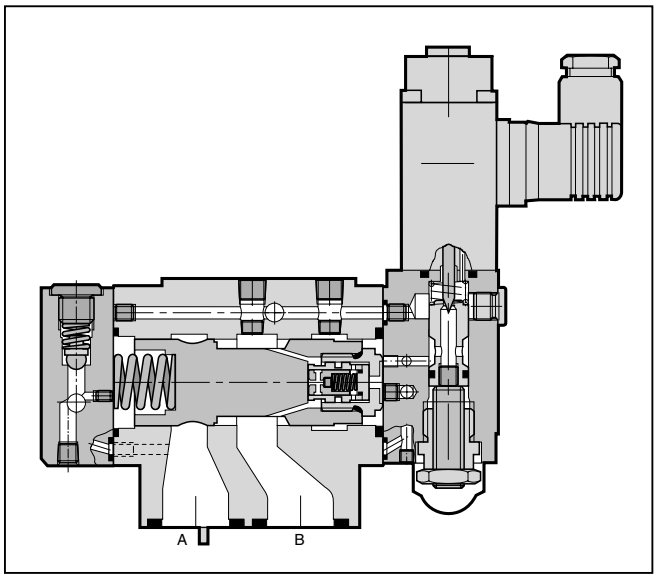


Features

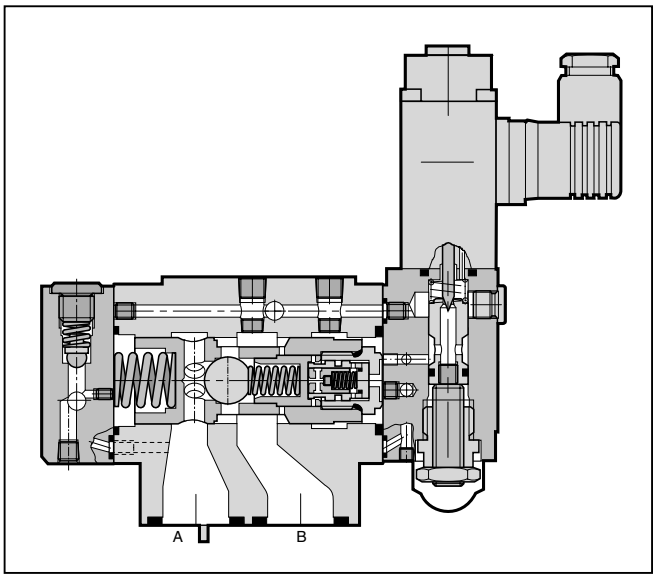
- Standard DIN/ISO interfaces.
- Optional reverse flow check valve.

Specifications

Interface	**DIN ISO/CETOP**	**NG10 5**	**NG25 8**	**NG32 10**
Nominal Flow Q	LPM (GPM)	150 (40)	250 (66)	350 (93)
Weight	kg (lbs.)	5.2 (11.5)	6.3 (13.9)	9.3 (20.5)
Maximum Operating Pressure	Bar (PSI)	Pressure port P, A: 350 (5075); Tank connection Y: not pressurized		
Adjustment Range	Bar (PSI)	10 to 350 (150 to 5075)		
Mounting Pattern		DIN 24340 Form D, ISO 5781 and ISO 6264		
Mounting Orientation		Any		



Series DWE



Series DWU with Bypass Check Valve

DWE-DWU.p65

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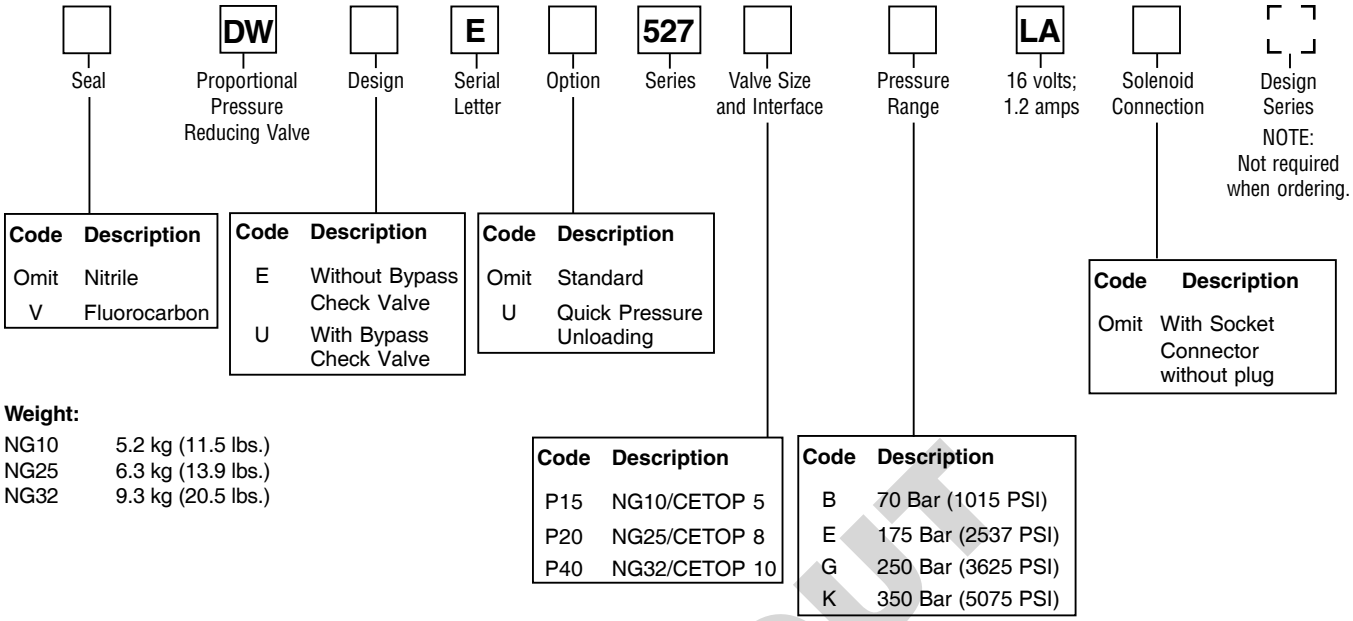
Elyria, Ohio, USA



Weight:

NG10	5.2 kg (11.5 lbs.)
NG25	6.3 kg (13.9 lbs.)
NG32	9.3 kg (20.5 lbs.)

B

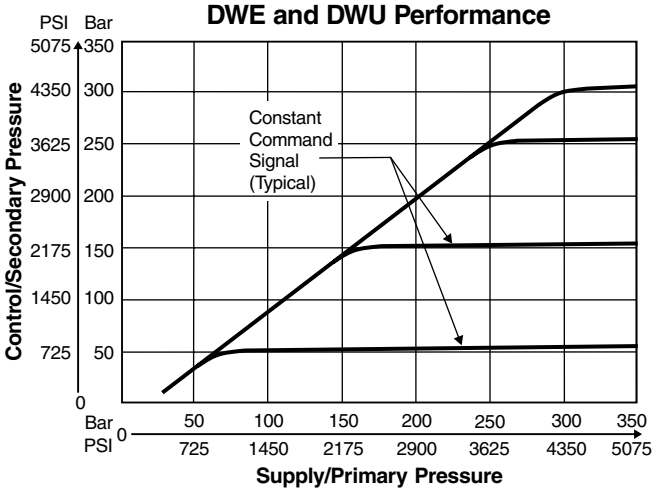
Accessories

Code	Nominal Size	Subplate	Bolt Kit	Bolt (Quantity) Size	Tightening Torque (Nm)	Sealing Kits		Plug DIN 43650 Design Type AF/PG11
						Nitrile	Fluorocarbon	
P15	NG10	SPP3M4B910	BK389	(4x) M10x50	65	SK-DWEE 5P15	SK-DWLC 5P15V	692915
P20	NG25	SPP6M8B910	BK485	(4x) M10x45	65	SK-DWEE 5P20	SK-DWLC 5P20V	692915
P40	NG32	SPP10M12B910	BK388	(6x) M10x50	65	SK-DWEE 5P40	SK-DWLC 5P40V	692915

For new applications:
DWE: Refer to PE*W
DWU: Consult Factory

B

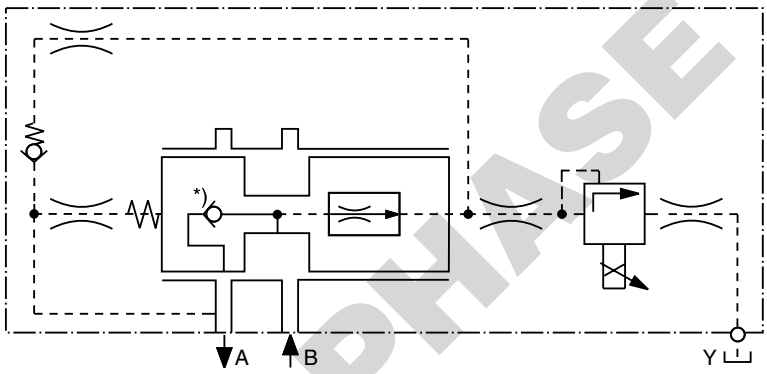
Performance Curves



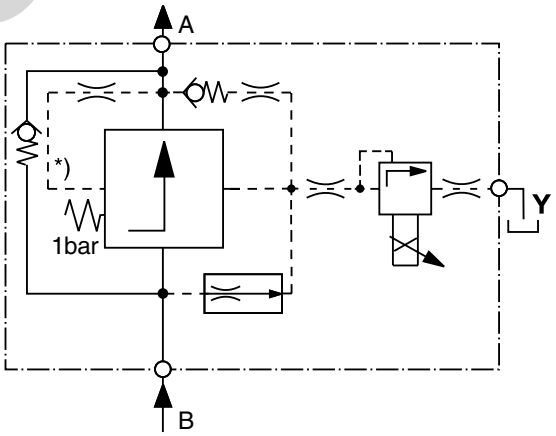
Electronic Modules

Refer to the Electronics Section for information on electronic driver modules.

DWU Functional Diagram



DWU Symbol

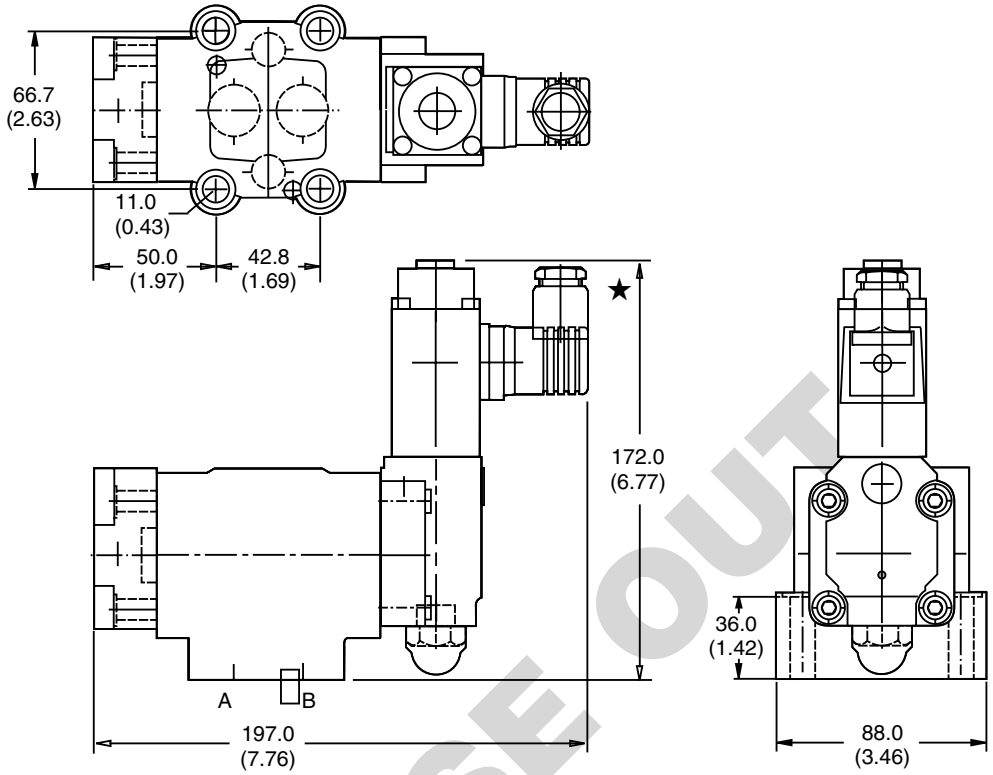


DWE functional diagram and symbol are the same as DWU without check valve as shown.

B

DWE, DWU, Size NG10

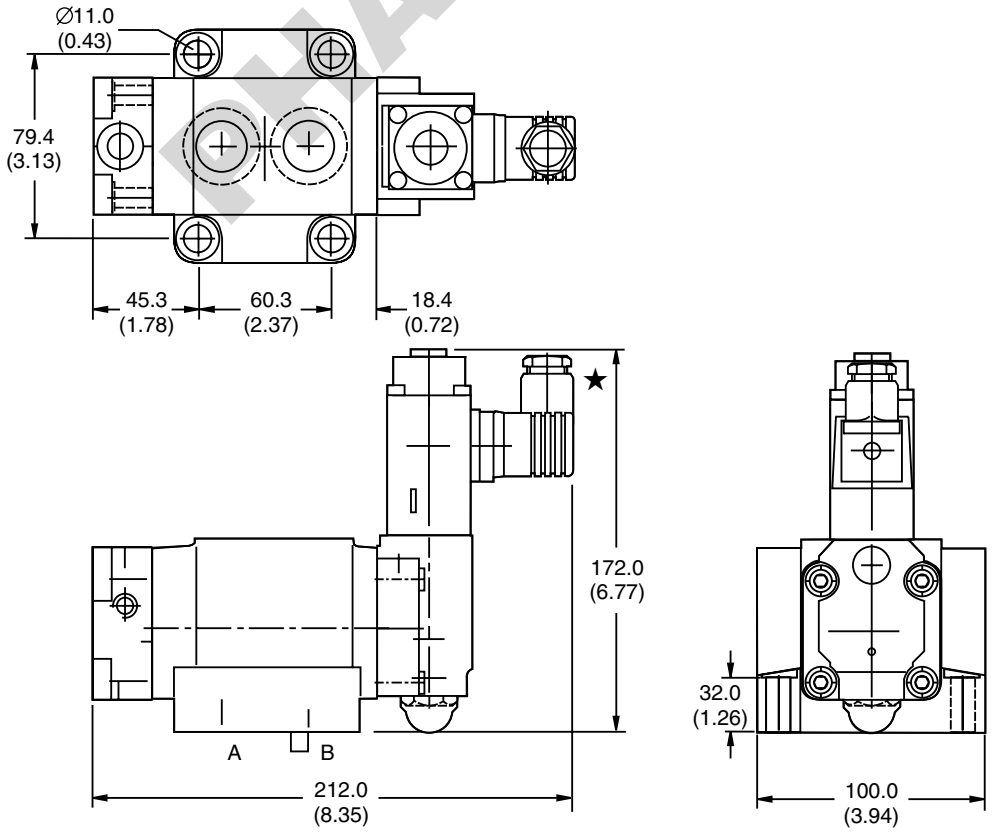
Inch equivalents for millimeter dimensions are shown in (**)



DWE, DWU, Size NG25

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

★ Order plugs separately.



DWE-DWU.p65

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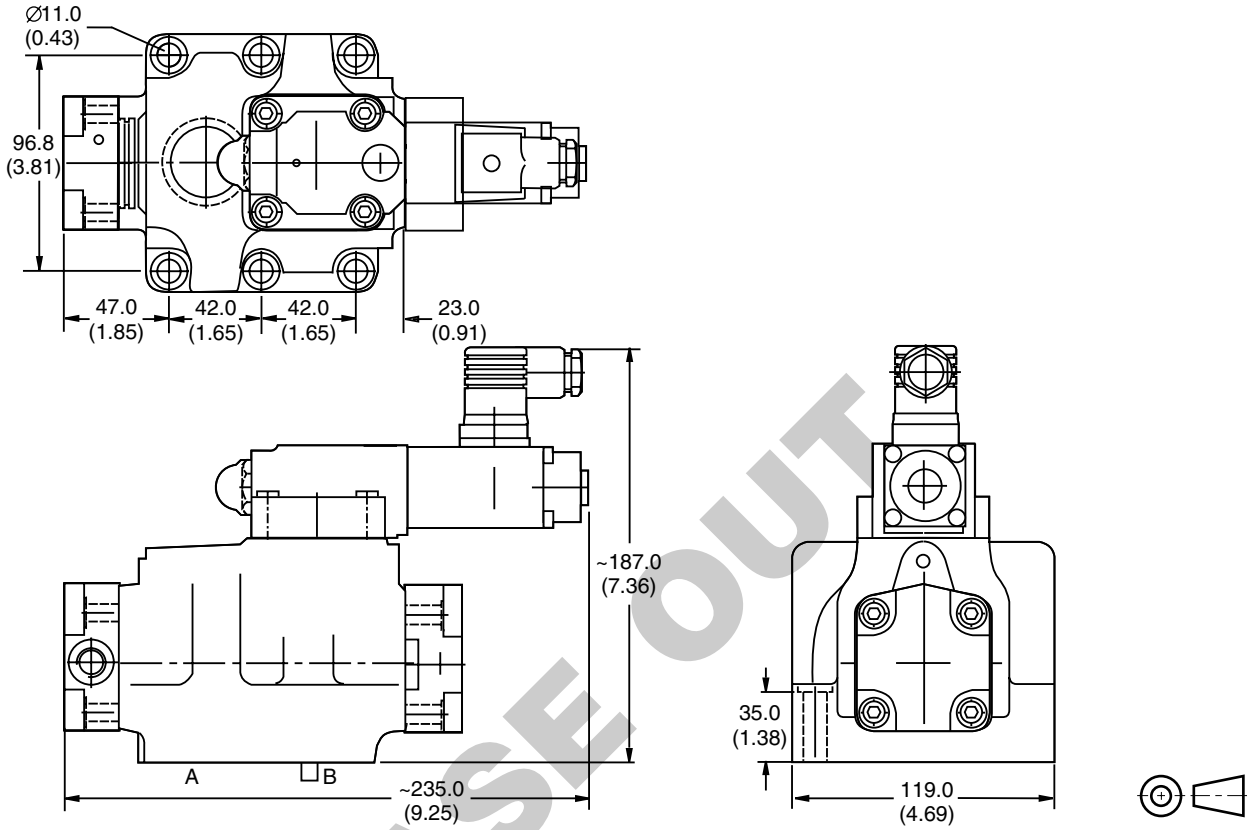
Elyria, Ohio, USA

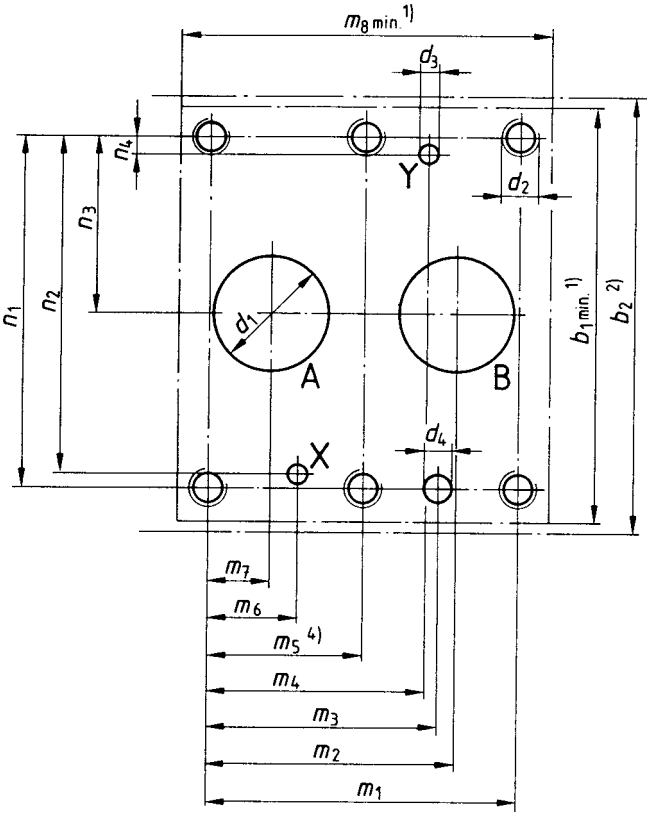
B

DWE, DWU, Size NG32

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



Mounting Pattern



Nominal Size		d1 max.	d2	d3 ±0.2	d4 H12	b1 min.	b2 max.
10	mm	14.7	M10	4.8	7.5	84.0	92.0
	inches	(0.58)	M10	(0.19)	(0.30)	(3.31)	(3.62)
25	mm	23.4	M10	4.8	7.5	97.0	105.0
	inches	(0.92)	M10	(0.19)	(0.30)	(3.82)	(4.31)
32	mm	32.0	M10	4.8	7.5	114.0	122
	inches	(1.26)	M10	(0.19)	(0.30)	(4.49)	(4.80)

Nominal Size		m1 ±0.2	m2 ±0.2	m3 ±0.2	m4 ±0.2	m5 ±0.2	m6 ±0.2
10	mm	42.9	35.7	31.8	21.4	–	21.4
	inches	(1.69)	(1.41)	(1.25)	(0.84)	–	(0.84)
25	mm	60.3	49.2	44.5	39.7	–	20.6
	inches	(2.37)	(1.94)	(1.75)	(1.56)	–	(0.81)
32	mm	84.1	67.5	62.7	59.6	42.1	24.6
	inches	(3.31)	(2.66)	(2.47)	(2.35)	1.66	(0.97)

Nominal Size		m7 min.	m8 min.	n1 ±0.2	n2 ±0.2	n3 ±0.2	n4 ±0.2
10	mm	7.1	61.0	66.7	58.7	33.3	7.9
	inches	(0.28)	(2.40)	(2.63)	(2.31)	(1.31)	(0.31)
25	mm	11.1	78.0	79.4	73.0	39.7	6.4
	inches	(0.44)	(3.07)	(3.13)	(2.87)	(1.56)	(0.25)
32	mm	16.7	102.0	96.8	92.9	48.8	4.0
	inches	(0.66)	(4.02)	(3.81)	(3.66)	(1.92)	(0.16)

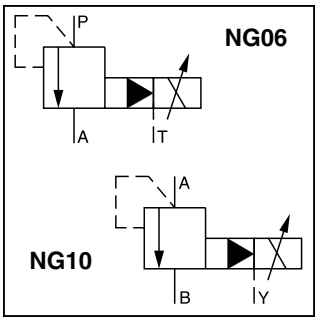
DWE-DWU.p65

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

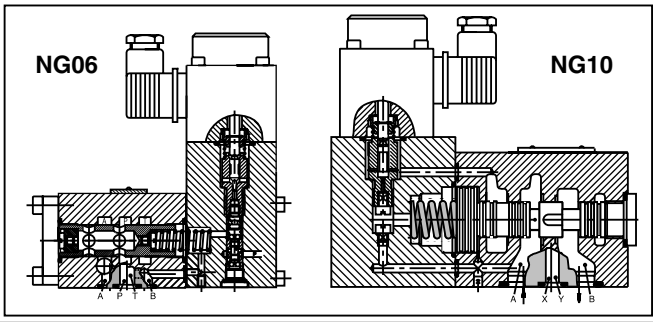
Series VBY*K pilot operated sequence valves feature proportional adjustment and an external drain. The external drain allows application as both a sequence valve and as a pressure relief valve.

These valves can also be used as a pressure relief valve. Please observe hydraulic connection.



Features

- Proportional adjustment.
- Manifold mounting acc. to ISO 5781.
- External drain.
- Main stage spool type valve.
- Pilot stage seated type valve.



Specifications

General		
Size	**NG6**	**NG10**
Design	Proportional Pressure Valve	
Mounting Pattern	ISO 5781	
Actuation	Proportional Solenoid	
Mounting Position	Any	
Ambient Temperature	-20°C to +70°C (-4°F to +158°F)	
Hydraulics		
Operating Pressure, Ports	P, A 315 Bar (4500 PSI) T depresssurized	A, B 315 Bar (4500 PSI) Y depressurized
Flow	40 LPM (10.6 GPM)	160 LPM (42.3 GPM)
Adjustment Range	64, 100, 160, 210, 315 Bar (928, 1450, 2320, 3045, 4568 PSI)	
Pressure Medium	Hydraulic oil as per DIN 51 524 to 525	
Pressure Fluid Temperature	+30°C to +50°C (+86°F to +122°F) Recommended -20°C to +70°C (-4°F to +158°F) Maximum	
Viscosity Range	30 to 50 mm²/s (135 to 230 SSU) Recommended 20 to 380 mm²/s (90 to 1750 SSU) Maximum	
Max. Contamination Level	ISO 4406 (1999) 18/16/13	
Linearity	±3.5% at > 15% p_{nom}	
Repeatability	<±2%	
Hysteresis	±1.5% to p_{max}	
Response Time	<150 ms	<200 ms
Manufacturing Tolerance	±5% to p_{max}	
Electrical		
Duty Cycle	100% ED	
Protection Class	IP54 at DIN 40050 (plugged and mounted)	
Nominal Voltage	12 VDC	
Max. current	2.7 A	
Coil Resistance	21 ohm at 20°C (68°F)	
Plug Connectors	2 pole + PE / connector EN 175301-803 / cable Ø 8 to 10mm	
Power Amplifier	PCD00A-400	

B

Ordering Information

VBY — Sequence Valve

□ — Pressure Range

Code	Description
064	**64 Bar (928 PSI)**
100	100 Bar (1450 PSI)
160	**160 Bar (2320 PSI)**
210	210 Bar (3000 PSI)
315	315 Bar (4500 PSI)

K — Linear Solenoid

Code	Description
K	12 VDC, 2.7 A

□ — Valve Size

Code	Description
06	NG6
10	NG10

□ — Seal

Code	Description
N	**Nitrile**
V	Fluorocarbon

Design Series

NOTE: Not required when ordering.

Weight: 5 kg (11.0 lbs.)

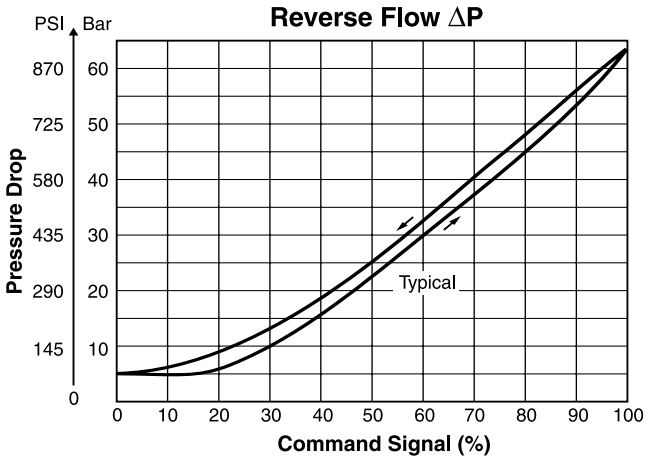
Bold: Designates Tier I products and options.

Non-Bold: Designates Tier II products and options. These products will have longer lead times.

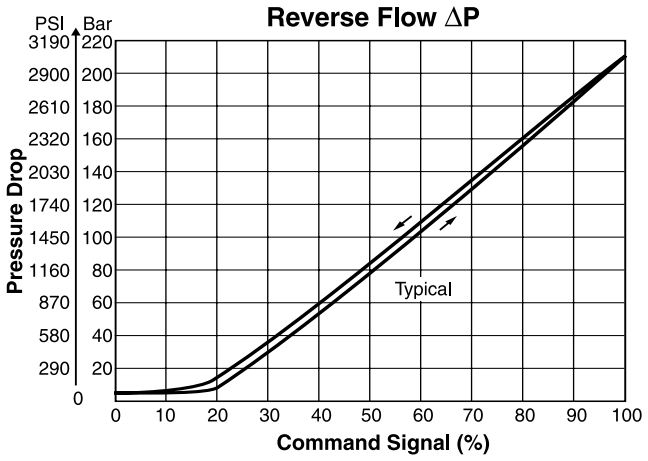
Performance Curves - NG06

Pressure Curves where $p = f(U_{set})$

Setting Range max. 64 Bar (870 PSI)

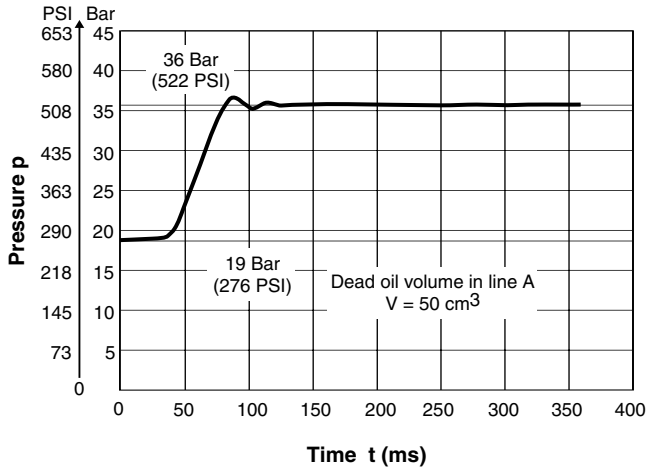


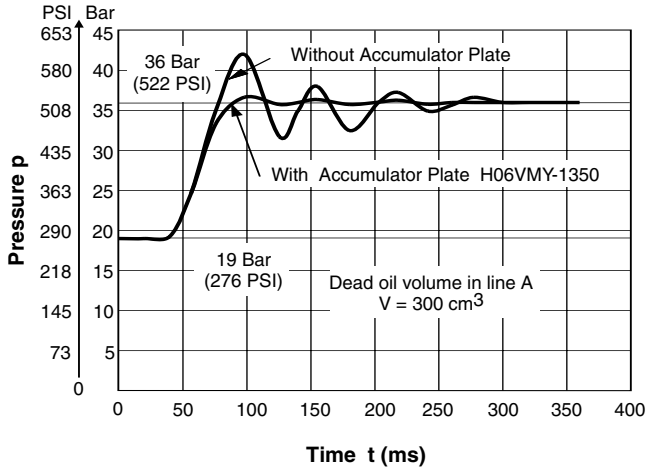
Setting Range max. 210 Bar (3045 PSI)



Step Response Signal

Setting Range max. 210 Bar (3045 PSI)



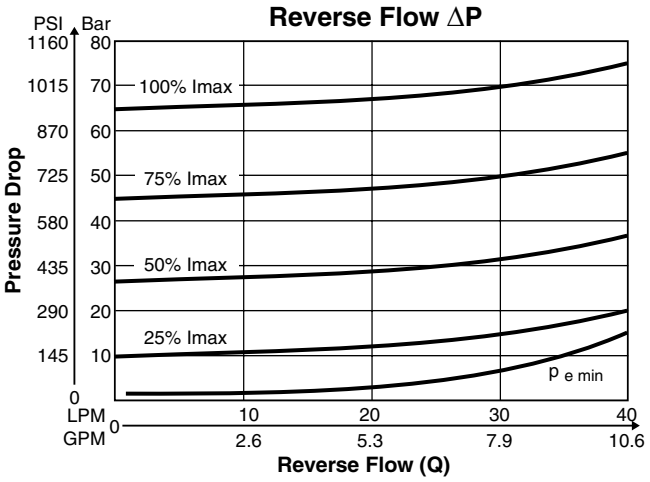


B

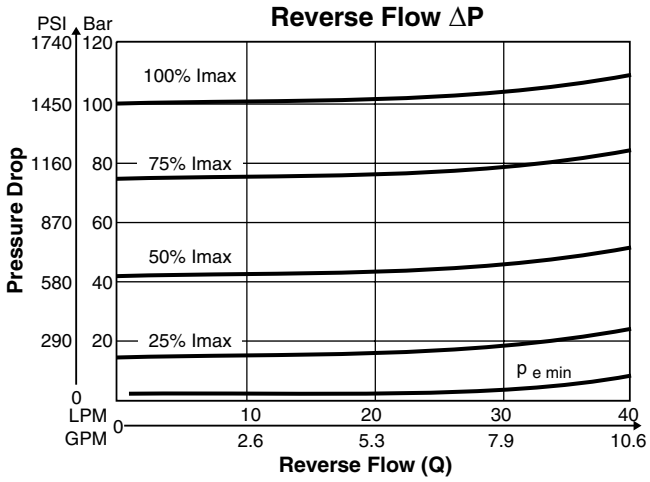
NG06

p/Q Performance Curves measured at t = 50°C (122°F) and v = 36mm²/s

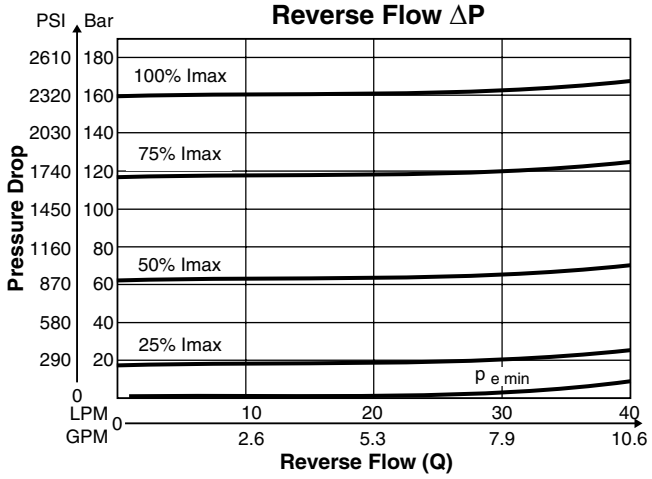
Setting Range max. 64 Bar (870 PSI)



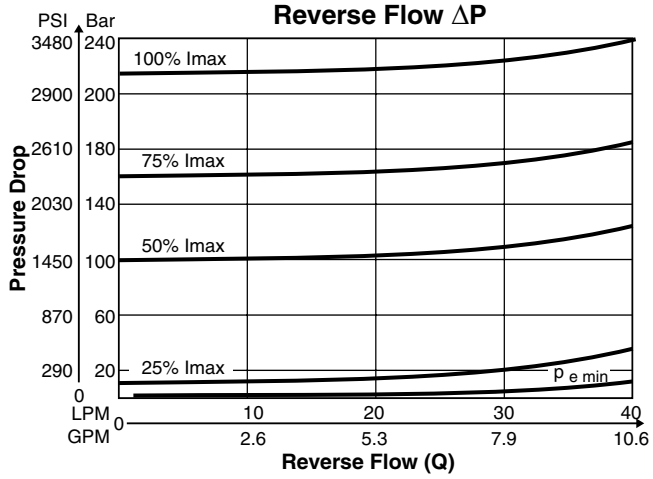
Setting Range max. 100 Bar (1450 PSI)



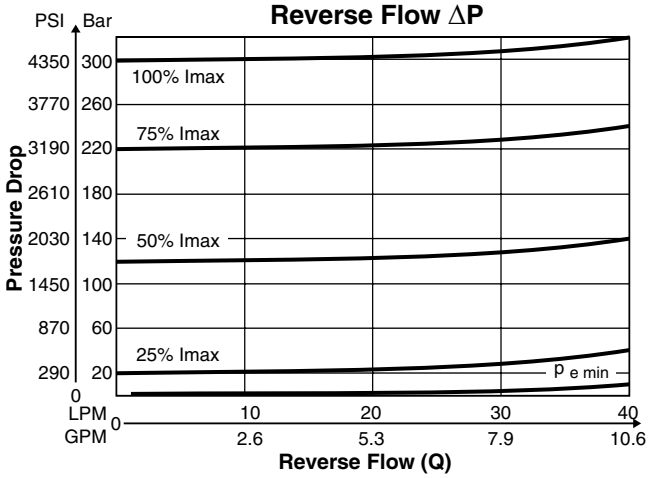
Setting Range max. 160 Bar (2320 PSI)



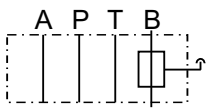
Setting Range max. 210 Bar (3000 PSI)



Setting Range max. 315 Bar (4500 PSI)



Note:
Accumulator Plate
H06 VMY - 1350
Height: 40 mm (1.58 in.)

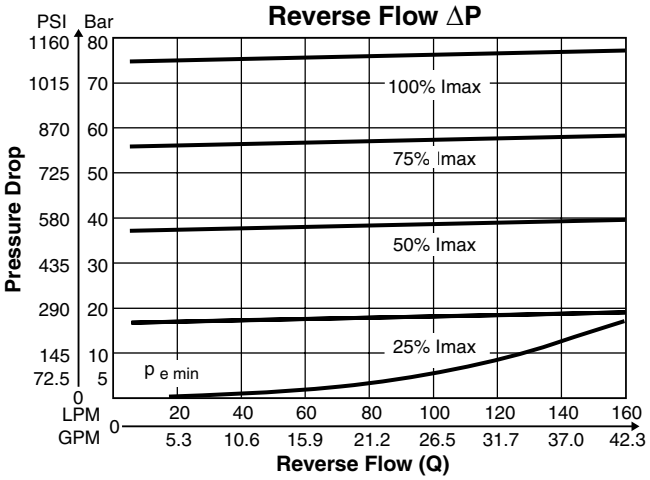


B

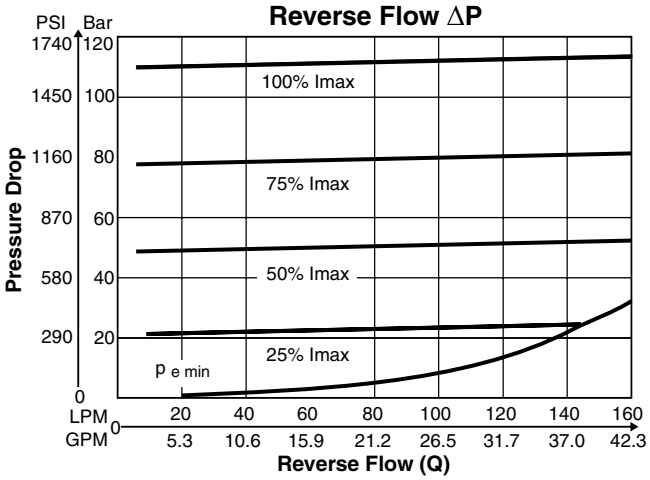
NG10

p/Q Performance Curves measured at t = 50°C (122°F) and v = 36mm²/s

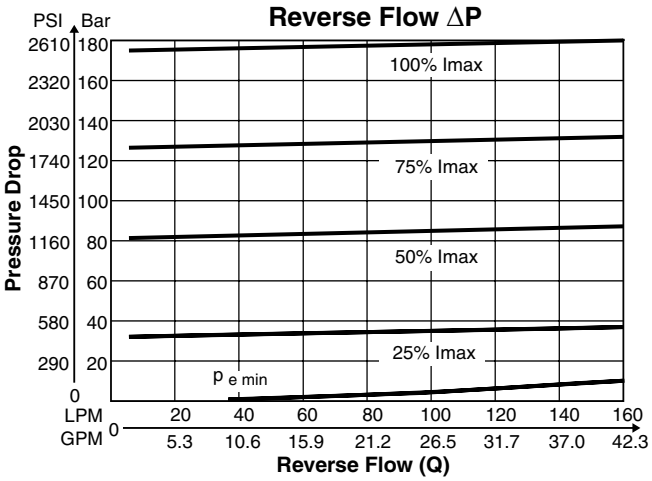
Setting Range max. 64 Bar (870 PSI)



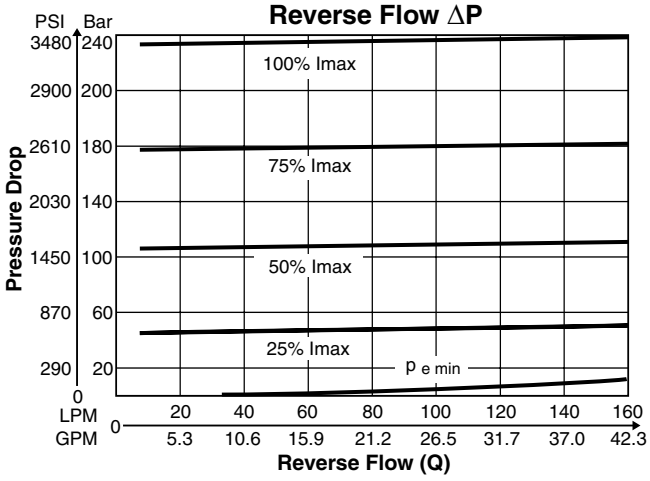
Setting Range max. 100 Bar (1450 PSI)



Setting Range max. 160 Bar (2320 PSI)



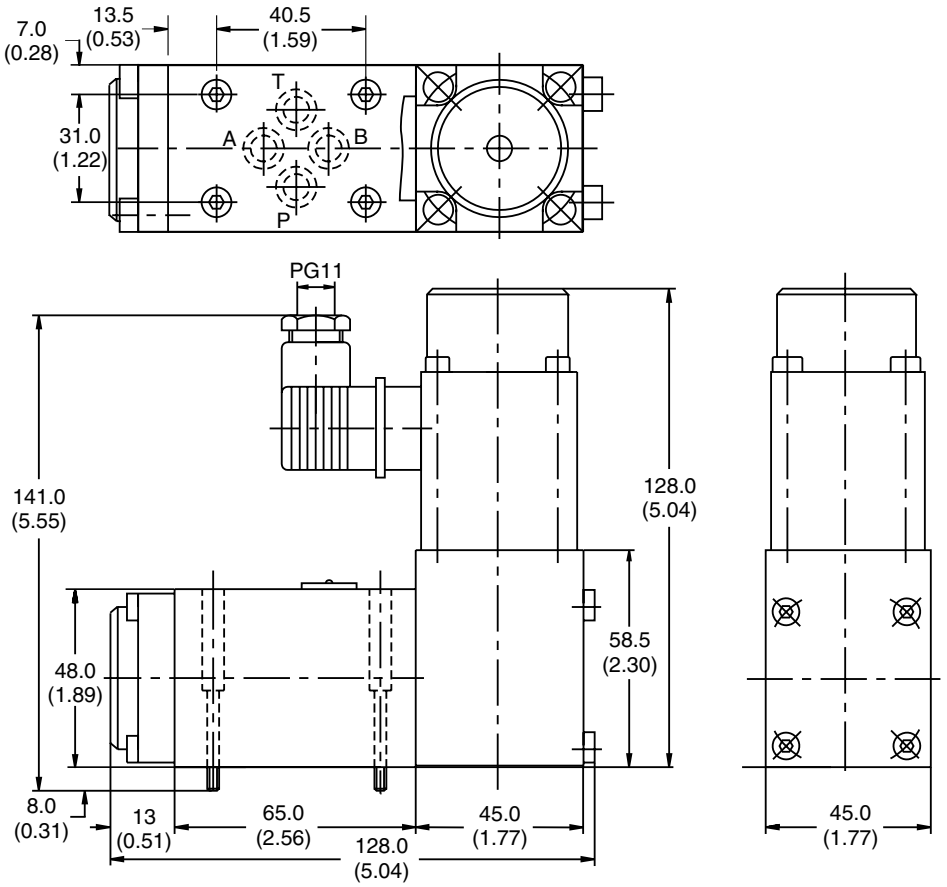
Setting Range max. 210 Bar (3045 PSI)



B

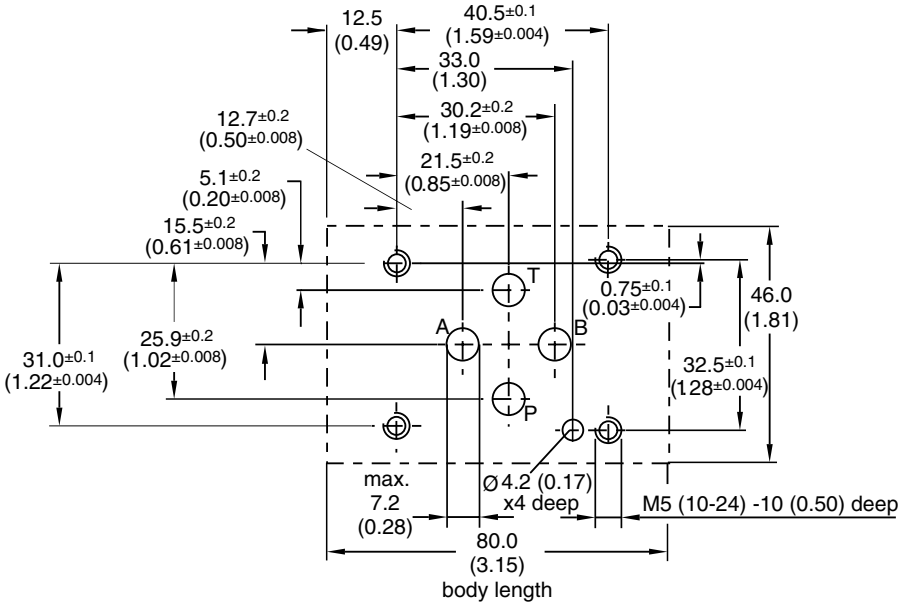
Dimensions - NG6

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



Surface finish	Bolt kit DIN912 12.9		Kit NBR	Kit FPM
R_{max}6.3 ▱ 0.01/100	BK375 4x-M5x30 BK209 4x10-24x1.25"	7.5 Nm (5.5 lb.-ft.)	SK-VMY-L06-N	SK-VMY-L06-V

Mounting Pattern ISO 5781-03-04-0-00



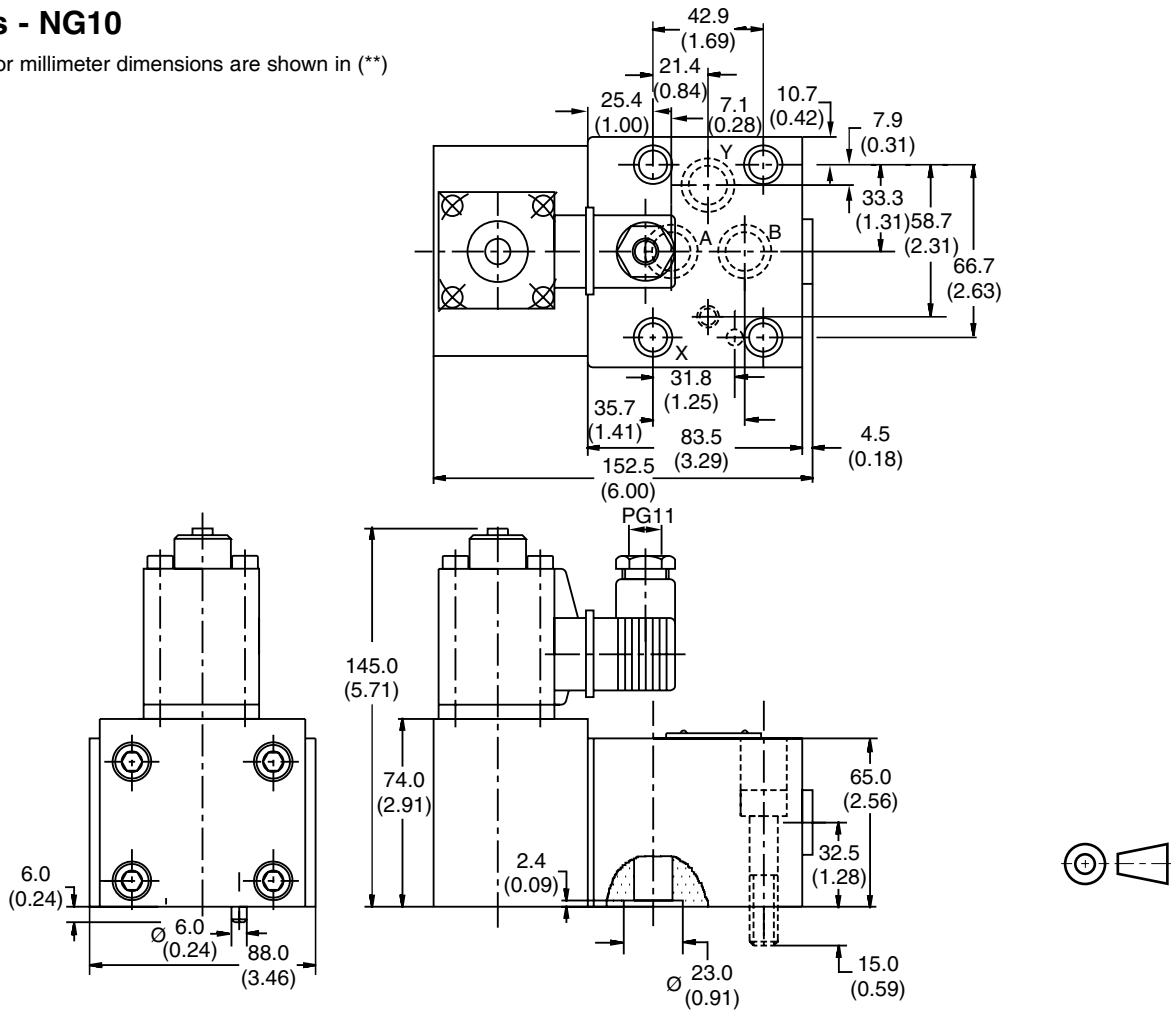
VBY_K.p65 dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

B

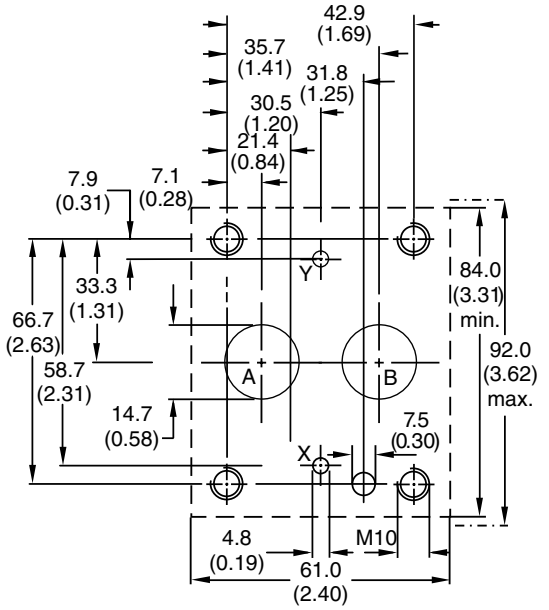
Dimensions - NG10

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



Surface finish	Bolt kit DIN912 12.9		Kit FPM
$\sqrt{R_{max}6.3}$ 0.01/100	BK389 4xM10x50 BK153 4x3/8-16x2	65 Nm (47.9 lb.-ft.)	SK-VB/VM-A10V

Mounting Pattern ISO 5781-06-07-0-00



VBY_K.p65 dd

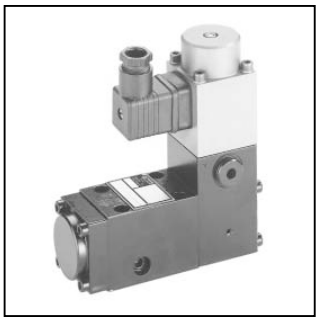
B

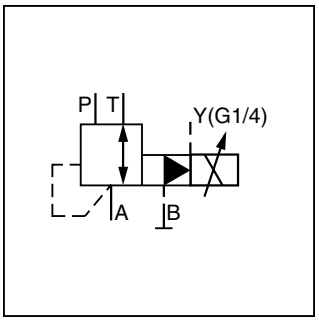
General Description

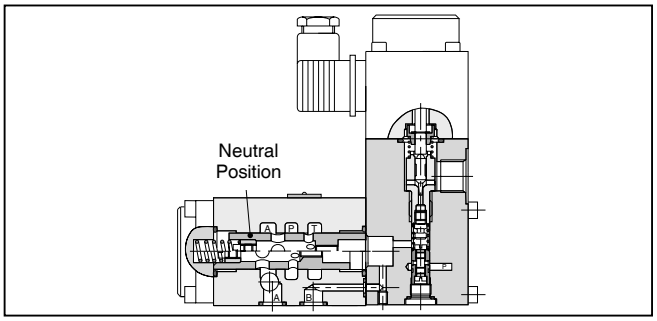
Series VMY*06 valves consist of the main stage with valve spools and the pilot stage with the proportional solenoids. The desired pressure can be variably set corresponding to the command signal specified on the amplifier. The proportional solenoid converts the current of the amplifier into force on the valve poppet of the pilot stage.

In the pilot stage, there is a flow limiter which supplies the pilot valve with pressure-independent pilot oil flow from the pressure port P.

The proportional pressure reducing valves of the series VMY*06 allow the variable adjustment of the reduced pressure from 0 bar up to p_{max}. Typical applications are pressure systems, test equipment, or counterweight systems. The electrical control of the valve takes place using the digital amplifier module PCD00A-400. Use in closed pressure control circuits is also possible. The valve is distinguished by its constancy.







Features

- Consistent performance.
- Variable adjustment.
- Pilot operated with proportional solenoid.
- Subplate according to ISO 5781.

Function

With the proportional solenoids de-energised the main spring forces the main spool into the neutral position. Port A is connected to port T. Thus the reduced pressure only depends on the back pressure in the external drain pipe and/or the tank pressure and can accordingly be reduced down to 0 bar. The pressure present in the P line delivers the pilot oil to the pilot stage via a flow control valve.

When the proportional solenoid is energised, the pilot pressure is increased in the pilot pressure area, and the main spool moves against the spring until the connection P - A opens. The regulation of the reduced pressure on connection A takes place by the constant comparison of the actual pressure and the reference pressure of the pilot stage.

Ordering Information

VMY	☐	K	06	☐	V	⌐ ⌙	P
Reducing Valve	Pressure Range	Linear Solenoid	Valve Size	Pilot Oil	Seal	Design Series	High Pressure Channel

NOTE: Not required when ordering.

Code	Description
064	**64 Bar (928 PSI)**
100	**100 Bar (1450 PSI)**
160	**160 Bar (2320 PSI)**
210	**210 Bar (3000 PSI)**
315	315 Bar (4500 PSI)

Code	Description
06	NG6

Code	Description
V	Fluorocarbon

Code	Pilot	Drain
N [1]	Internal	External [2]
T	Internal	Internal

[1] connection on drain port only

[2] p_{min} = 0 bar possible

Weight: 2.8 kg (6.2 lbs.)

Bold: Designates Tier I products and options.

Non-Bold: Designates Tier II products and options. These products will have longer lead times.

VMY.p65 dd

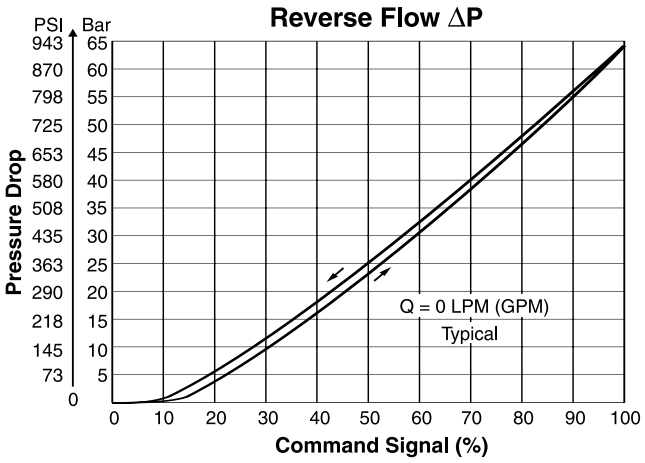
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

B

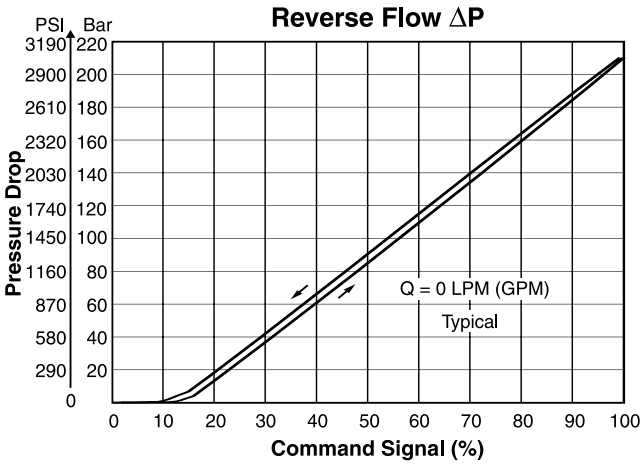
General	
Design	Proportional Reducing Valve
Size	NG6
Mounting Pattern	ISO 5781
Actuation	Proportional Solenoid
Mounting Position	Any
Ambient Temperature	-20°C to +70°C (-4°F to +158°F)
Hydraulics	
Operating Pressure, Ports	P, A and B 315 Bar (4500 PSI) T depresssurized
Flow	40 LPM (10.6 GPM)
Adjustment Range	64, 100, 160, 210, 315 Bar (928, 1450, 2320, 3045, 4568 PSI)
Pressure Medium	Hydraulic oil as per DIN 51 524 to 525
Pressure Fluid Temperature	+30°C to +50°C (+86°F to +122°F) Recommended -20°C to +70°C (-4°F to +158°F) Maximum
Viscosity Range	30 to 50 mm²/s (135 to 230 SSU) Recommended 20 to 380 mm²/s (90 to 1750 SSU) Maximum
Max. Contamination Level	ISO 4406 (1999) 18/16/13
Linearity	See Performance Curves
Repeatability	<±2%
Hysteresis	±1.5% to p_{max}
Response Time	<150 ms
Manufacturing Tolerance	±5% to p_{max}
Electrical	
Duty Cycle	100% ED
Protection Class	IP54 at DIN 40050 (plugged and mounted)
Nominal Voltage	9 VDC
Maximum Current	2.5 A
Ambient Temperature	-20°C to +70°C (-4°F to +158°F)
Coil Resistance	2.1 ohm at 20°C (68°F)
Plug Connectors	2 pole + PE / connector EN 175301-803 / cable Ø 8 to 10mm
Power Amplifier	PCD00A-400

Presssure Curves where p = f(U_{set})

Setting Range max. 64 Bar (870 PSI)

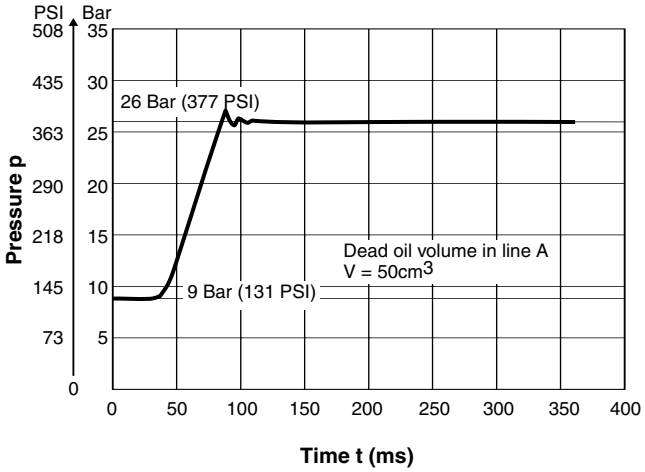


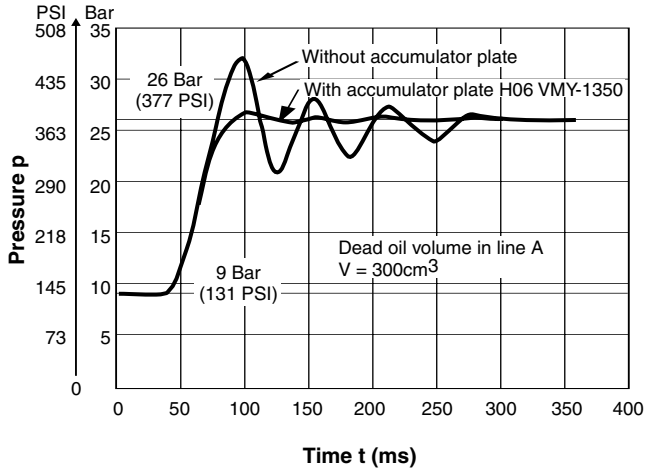
Setting Range max. 210 Bar (3045 PSI)



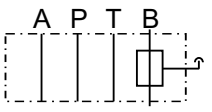
Step Response

Typical Curve





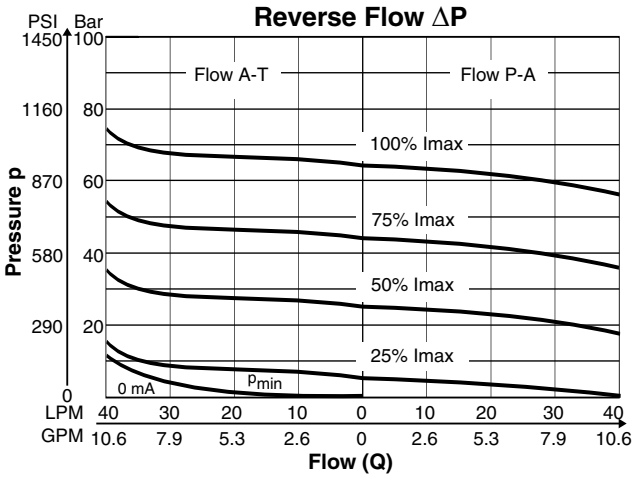
Note:
Accumulator Plate
H06 VMY - 1350
Height: 40 mm (1.58 in.)



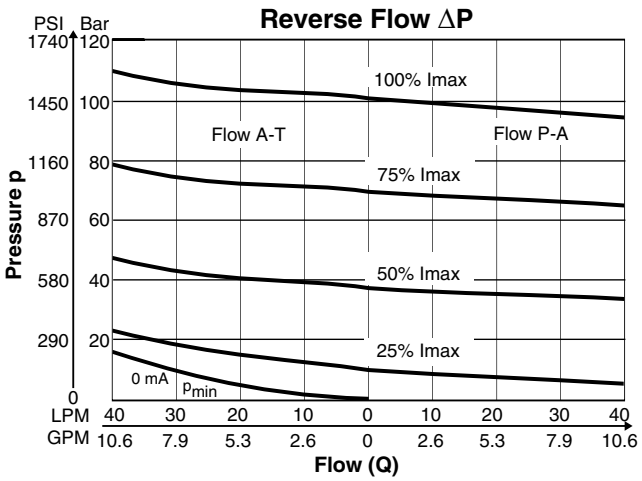
B

p/Q Performance Curves measured at t = 50°C (122°F) and v = 35mm²/s

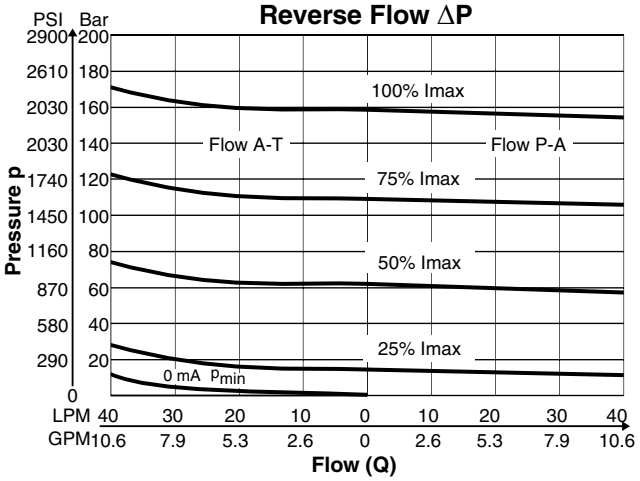
Setting Range max. 64 Bar (870 PSI)



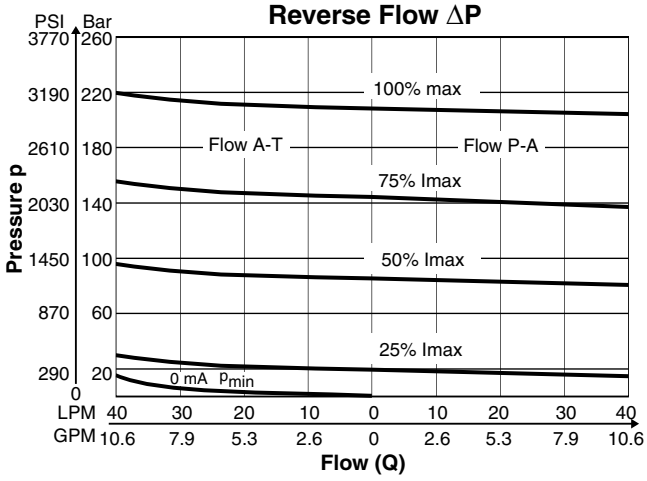
Setting Range max. 100 Bar (1450 PSI)



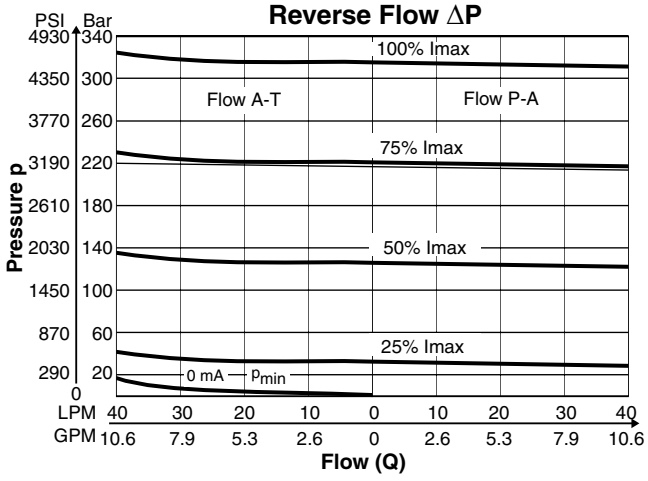
Setting Range max. 160 Bar (2320 PSI)



Setting Range max. 210 Bar (3000 PSI)



Setting Range max. 315 Bar (4500 PSI)



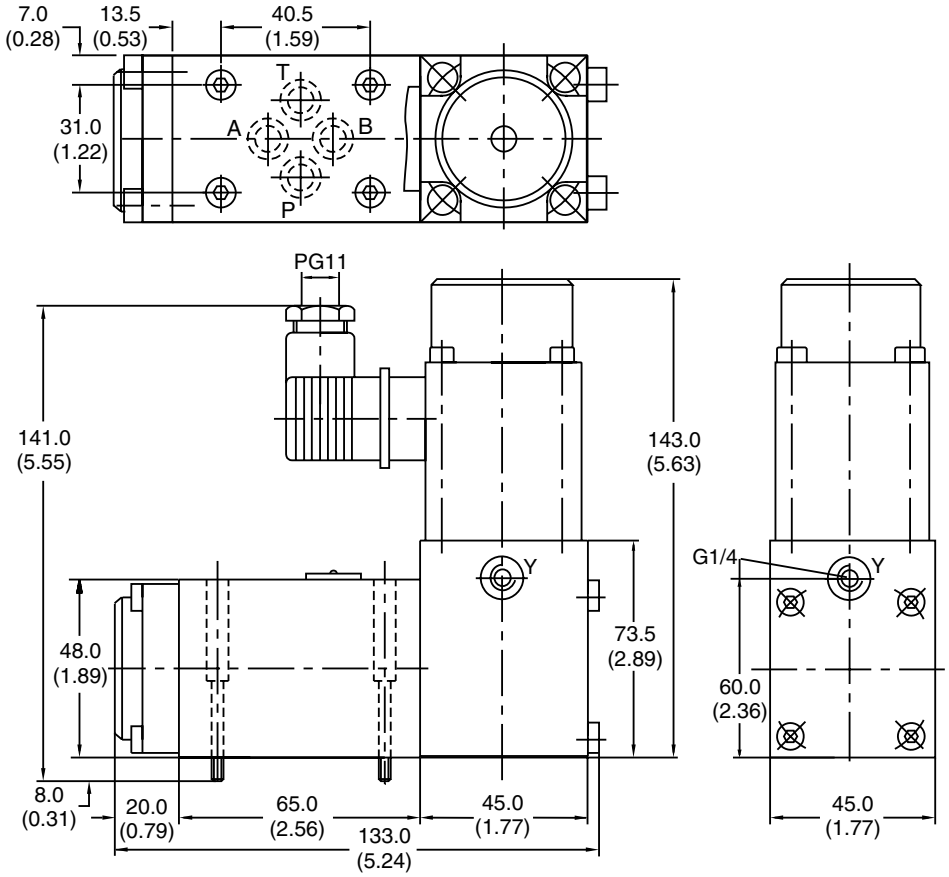
VMY.p65 dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

B

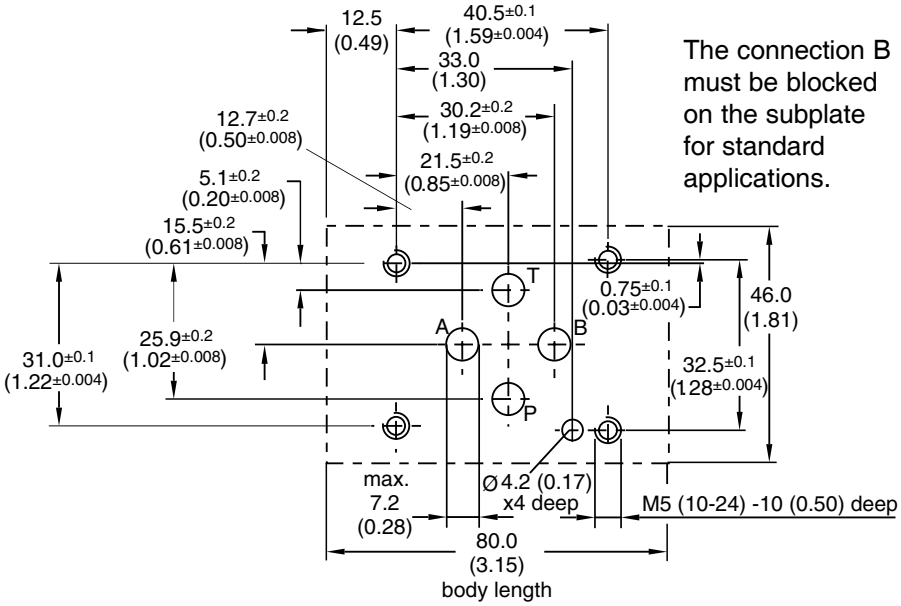
Dimensions

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



Surface finish	Bolt kit DIN912 12.9		Kit FPM
R_{max}6.3 ▱ 0.01/100	BK-M5x30-4pcs	7.5 Nm (5.5 lb.-ft.)	SK-VMY-L06-V

Mounting Pattern ISO 5781-03-04-0-00



The connection B must be blocked on the subplate for standard applications.

VMY.p65 dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

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Cleveland, Ohio 44124-4141
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Parker Hannifin Corporation

About Parker Hannifin Corporation

Parker Hannifin is a leading global motion-control company dedicated to delivering premier customer service. A Fortune 500 corporation listed on the New York Stock Exchange (PH), our components and systems comprise over 1,400 product lines that control motion in some 1,000 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, and electromechanical motion-control solutions. Our Company has the largest distribution network in its field, with over 7,500 distributors serving nearly 400,000 customers worldwide.

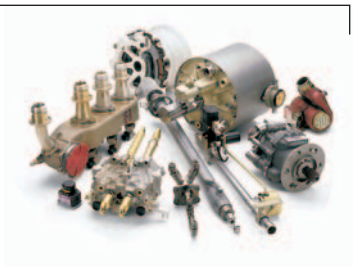
Parker's Charter

To be a leading worldwide manufacturer of components and systems for the builders and users of durable goods. More specifically, we will design, market and manufacture products controlling motion, flow and pressure. We will achieve profitable growth through premier customer service.

Product Information

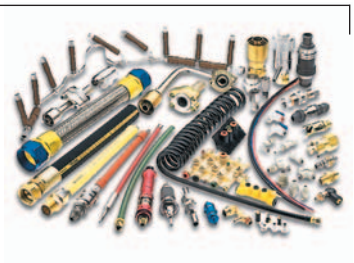
North American customers seeking product information, the location of a nearby distributor, or repair services will receive prompt attention by calling the Parker Product Information Center at our toll-free number: 1-800-C-PARKER (1-800-272-7537). In Europe, call 00800-C-PARKER-H (00800-2727-5374).

The Aerospace Group is a leader in the development, design, manufacture and servicing of control systems and components for aerospace and related high-technology markets, while achieving growth through premier customer service.



The Climate & Industrial Controls Group designs, manufactures and markets system-control and fluid-handling components and systems to refrigeration, air-conditioning and industrial customers worldwide.

The Fluid Connectors Group designs, manufactures and markets rigid and flexible connectors, and associated products used in pneumatic and fluid systems.



The Seal Group designs, manufactures and distributes industrial and commercial sealing devices and related products by providing superior quality and total customer satisfaction.

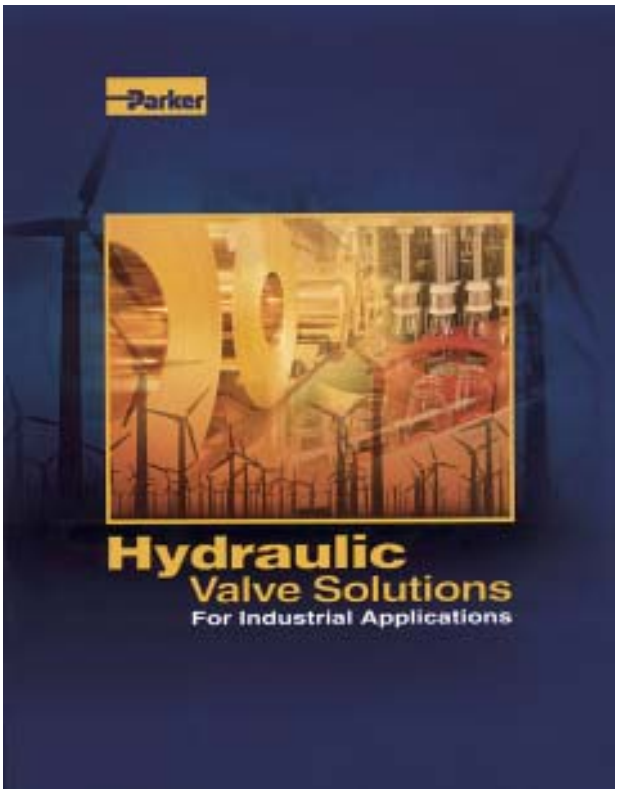
The Hydraulics Group designs, produces and markets a full spectrum of hydraulic components and systems to builders and users of industrial and mobile machinery and equipment.

The Filtration Group designs, manufactures and markets quality filtration and clarification products, providing customers with the best value, quality, technical support, and global availability.

The Automation Group is a leading supplier of pneumatic and electromechanical components and systems to automation customers worldwide.

The Instrumentation Group is a global leader in the design, manufacture and distribution of high-quality critical flow components for worldwide process instrumentation, ultra-high-purity, medical and analytical applications.

6/99



Bulletin HY14-2530/US
Catalog CD HY14-2530/US (included inside brochure)

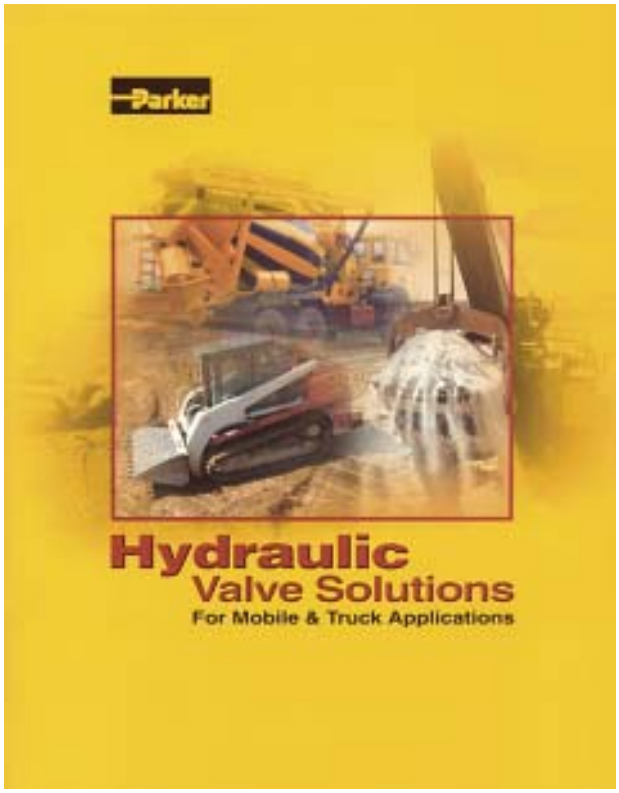
For the latest hydraulic valve information
www.parker.com/hydraulicvalve

To locate your nearest hydraulic valve distributor
www.parker.com/hyd/distloc

For North America, Europe and the rest of the world regional offices, see Parker Hydraulics International Sales Offices at the back of this catalog.

Parker Hydraulic Valve wants to keep you informed. Listed below are connection opportunities for you to resource additional information or speak directly with the industry's most knowledgeable hydraulic valve professionals.

To order literature or locate a distributor by phone
1-800-C-Parker



Bulletin HY14-2400/US
Catalog CD HY14-2400/US (included inside brochure)

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Hydraulic Valve Division
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Elyria, Ohio, 44035 USA
Tel: (440) 366-5200
Fax: (440) 366-5253
www.parker.com/hydraulicvalve

Catalog HY14-2550/US,
3.5M, 1/07, PageLitho

Contents

Series	Description	Page
BD15	Two-Stage Torque Motor Servovalve (up to 20 GPM)	C2 - C8
BD30	Two-Stage Torque Motor Servovalve (up to 40 GPM)	C2 - C5, C9 - C11
PH76	Two-Stage Torque Motor Servovalve (up to 15 GPM)	C12 - C15
DY1S	One-stage Torque Motor Servovalve (Pressure Control)	C16 - C18
DY3H/DY6H	Two-stage Torque Motor Servovalve (up to 6 GPM)	C19 - C22
DY01	Two-stage Torque Motor Servovalve (up to 3 GPM)	C23 - C26
DY05	Two-stage Torque Motor Servovalve (.25 to 5 GPM)	C27 - C30
DY10	Two-stage Torque Motor Servovalve (7.5 to 10 GPM)	C31 - C34
DY12	Two-stage Torque Motor Servovalve (12.5 to 15 GPM)	C35 - C38
DY15	Two-stage Torque Motor Servovalve (15 to 25 GPM)	C39 - C42
DY25	Two-stage Torque Motor Servovalve (25 to 30 GPM)	C43 - C46
DY45	Two-stage Torque Motor Servovalve (40 to 60 GPM)	C47 - C50

C

Description

Series BD servovalves provide high resolution in the control of position, velocity and force in motion control applications.

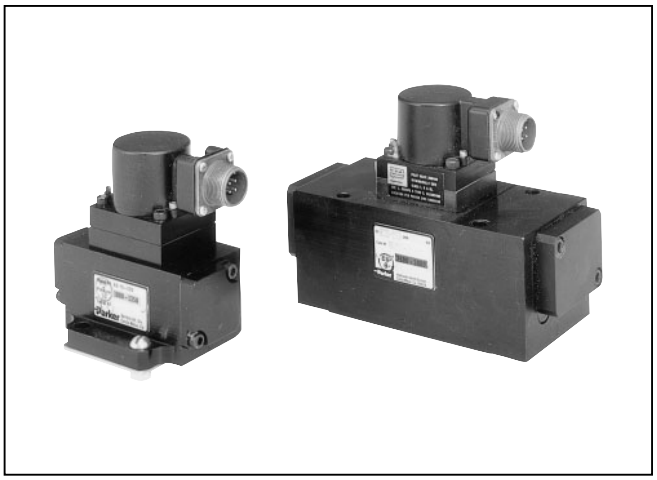
Features

- Rugged reliable trouble-free operation.
- Reduced contaminant sensitivity.
- Linear flow gain characteristics.
- Intrinsically safe model available.
- Explosion proof model available.

C

Operation

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.



Specifications

Rated Flow @ 1000 PSI ΔP	3.78–151 LPM (1.0 – 40 GPM)
Linearity	≤ 5%
Hysteresis	≤ 3%
Threshold	≤ 0.5%
Fluid	Mineral oil, 60–225 SSU, max. 1000 SSU
Oper. Temp. (Ambient)	–1 to 106°C (30 to +225°F)
Pressure Gain	3% of spool shift
Null Shift with Temperature with Supply Pressure	 < ± 2% per 38°C (100°F) < 2% per 69 Bar (1000 PSI)
Quiescent Flow (Std. Spool Lap)	BD15 – 1.5–2.1 LPM (.40–.55 GPM) BD30 – 2.1–3.78 LPM (.55 – 1.0 GPM)

Step Response Input	Model	Typical Step Response Input
	BD15	10 to 90%, 26 ms
	BD30	10 to 90%, 30 ms

Pressure Ranges

For optimum performance, Parker Servo Valves are designed to operate within specific system supply pressure ranges.

System Supply Pressure

180–210 Bar	(2600–3000 PSI)	48–66 Bar	(700–950 PSI)
138–172 Bar	(2000–2500 PSI)	14–45 Bar	(200–650 PSI)
95–133 Bar	(1400–1950 PSI)	0–210 Bar	(0–3000 PSI)
68–90 Bar	(1000–1300 PSI)		External Pilot

Filtration	SAE Class 3 or better, ISO Code 17/15/12
Protection Class	NEMA 1 (IP54)

Flow–Load Characteristics

Control flow to the load will change with load pressure and valve current as shown in figure 1. These characteristics closely follow the theoretical square–root relationship for sharp–edged orifices as illustrated in the equation below.

$$Q = K\sqrt{\Delta P}$$

Q = Control flow, cubic inches/sec
K = Valve constant
ΔP = Valve pressure drop

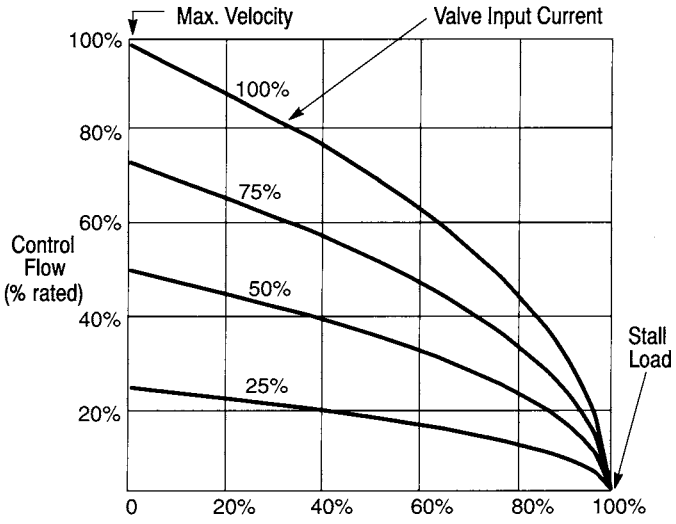


Figure 1. Change in flow with current and load pressure

Quick Reference Data Chart

Model	Flow Capacity @ 1000 PSID LPM (GPM)	Max. Pressure Rating	Max. Tank Pressure	Port Circle	Electrical Input (Std.) Single Coil	Coil Resistance (Std.) Each Coil	Weight
BD15	3.8, 9.5, 19, 37, 57, 76 (1, 2.5, 5, 10, 15, 20)	210 Bar (3000 PSI)	14 Bar (200 PSI)	.875	60 mA (Full Flow)	60 ohms	1.2 kg (2.6 lbs.)
BD30	76, 95, 113, 151 (20, 25, 30, 40)	210 Bar (3000 PSI)	14 Bar (200 PSI)	1.75	60 mA (Full Flow)	60 ohms	2.9 kg (6.3 lbs.)

BD.p65, dd

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Hydraulic Valve Division
Elyria, Ohio, USA

BD — Basic Model

Size

Code
15
30

Options

Code	Description
A	Standard Valve
B	Intrinsic Safe, Factory Mutual
C	Explosion Proof, Factory Mutual
J	Explosion Proof, CSA Approved
N	Explosion Proof, ATEX Approved

See Note 1.

Coil

Code	m(A)	Ohm
A	60 (Std.)	60
B	15	1016
C	20	591
D	30	243
E	40	138
F	50	90
G	100	22
H	200	5.7
J*	30/30	118/118
K	80	36

* For intrinsic safe only.

Connector

BD15

Code	Description
A	C_2B (Std.)
B	C_2D
C	C_1B
D	C_1D
J	Intrinsic Safe
L	Explosion Proof

BD30

Code	Description
E	C_2B (Std.)
F	C_2D
G	C_1B
H	C_1D
K	Intrinsic Safe
M	Explosion Proof

See Note 2.

Seals

Code	Description
N	Nitrile (Std.)
V	Fluorocarbon

Supply Pressure

Code	Description
B	2600–3000 (Standard)
C	2000–2500
D	1400–1950
E	1000–1300
F	700–950
G	200–650
H	0–3000 (5th Port)

See Note 3.

Flow

BD 15

Code	Flow (GPM)
1	3.8 LPM (1 GPM)
2.5	9.5 LPM (2.5 GPM)
5	18.9 LPM (5 GPM)
10	37.9 LPM (10 GPM)
15	56.8 LPM (15 GPM)
20	75.7 LPM (20 GPM)

BD 30

Code	Flow (GPM)
20	75.7 LPM (20 GPM)
25	94.6 LPM (25 GPM)
30	113.6 LPM (30 GPM)
40	151.4 LPM (40 GPM)

Mounting Bolt Kit (U.S.)
BD15 BK07 (4) 5/16-18 x 1
BD30 BK46 (4) 5/16-10 x 3 1/4

Note 1: **"B" Intrinsic Safe Option meets** Factory Mutual Intrinsically Safe Class I, II and III, Division 1 Groups A through G. Refer to Parker Bulletin 1452.

"C" Explosion Proof meets:
Factory Mutual Explosion Proof
Class I, II, III, Division 1, Groups A through G

"J" Exposion Proof meets:
Canadian Standards Association
Class I, Groups A through D
Class II, Groups E, F and G
Class III
Refer to Parker Bulletin 1451.

"N" Explosion Proof meets:
ATEX Ex II2G EExm II T3 T_{amb} 45°C to -50°C
Request Parker Documentation Package: 1200074

Note 2: Connector Location & Flow Polarity
(Standard connector over C_2 + to B = P to C_1 flow).

C_2B = Connector over Port C_2, + to Pin B = P to C_1 flow.

C_2D = Connector over Port C_2, + to Pin D = P to C_1 flow.

C_1B = Connector over Port C_1, + to Pin B = P to C_1 flow.

C_1D = Connector over Port C_1, + to Pin D = P to C_1 flow.

Note 3: Supply Pressure: Code "H" applies to 5th Port/External Pilot Option. This requires the use of a blank orifice "-00". First stage pressure should be limited to 41.4 Bar (600 PSI) and no less than 27.6 Bar (400 PSI).

Servo valve rated flow at 1000 PSID ±10%.

Accessories

Model	Description
6522A11	1/16" Hex Allen Wrench
810005-1	Orifice Filter
810013-**	Valve Orifice Kit, Fluorocarbon
810014-**	Valve Orifice Kit, Nitrile
****Dash #**	**Operating Pressure**
-16	180 – 210 Bar (2600 – 3000 PSI)
-18	138 – 176 Bar (2000 – 2550 PSI)
-20	96 – 134 Bar (1400 – 1950 PSI)
-22	69 – 93 Bar (1000 – 1350 PSI)
-33	48 – 66 Bar (700 – 950 PSI)
-50	14 – 45 Bar (200 – 650 PSI)
-00	0 – 210 Bar (0 – 3000 PSI) 5th Port

Model	Description
820089-1	BD30 Servovalve Shippping Container
BD830008	BD90/95 Amplifier Board Shipping Container
810089-1	BD15 Servovalve Shipping Container
820000TF3	Filter Wrench
MS3106E-14S-2S	SV Mating Connector
1200127 1200128	Flushing valve for BD15 Flushing valve for BD30

Adapters

□ — □

Type of Adapter

Seals

Code	To Mount A _____	Onto A _____ Pattern
810092-1	BD15	BD30 (1.75)
810093-5	BD15	D05
810094-5	BD15	D03
810098-1	BD15	.937 Port Circle
810097-3	BD15	.785 Port Circle
810096-5	BD15	.625 Port Circle
820006-1	BD30	Moog 62-303B & Atchley 231
820007-1	BD30	D08
820091-1	BD30	BD15 (.875)
820092-1	BD30	2.00 Port Circle
Consult Factory	BD30	1.375
Consult Factory	BD15	D05H

Code	Description
Omit	Nitrile
V	Fluorocarbon

Subplates

Valve Model	Subplate	Port Size	Location	Bolt Kit	Torque Specifications (Lubricated)
BD15	810090-3	SAE12	Side	BK07	17 ft. lbs
BD30	820090-3	SAE16	Side	BK46	17 ft. lbs.

Cables

EHC — □ — **4** — **S**

Electrohydraulic Cable for BD Series Valves

Length

Code	Length
9	Length
15	in Feet

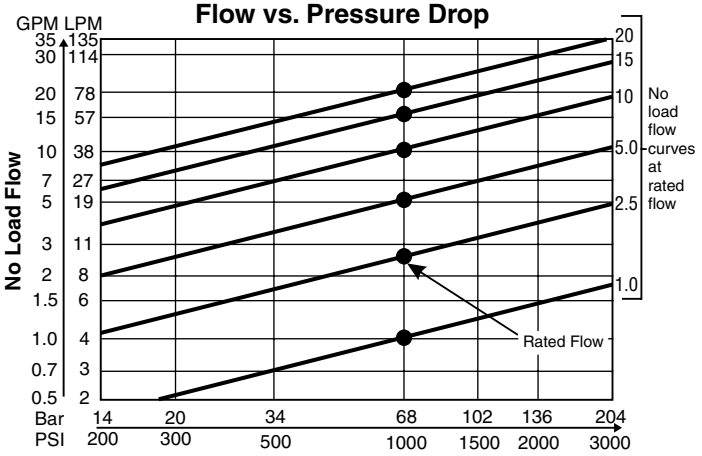
Cable Type

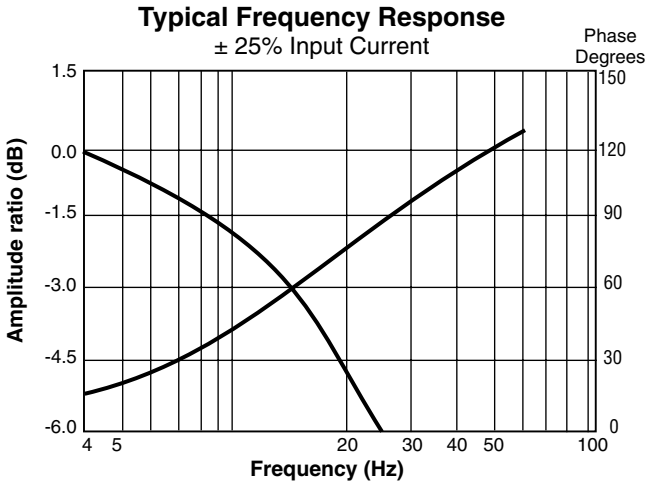
Code	Description
4	4-wire, 20 awg. shielded Belden 9402)

Pin Orientation

Code	Description
S	BD Series

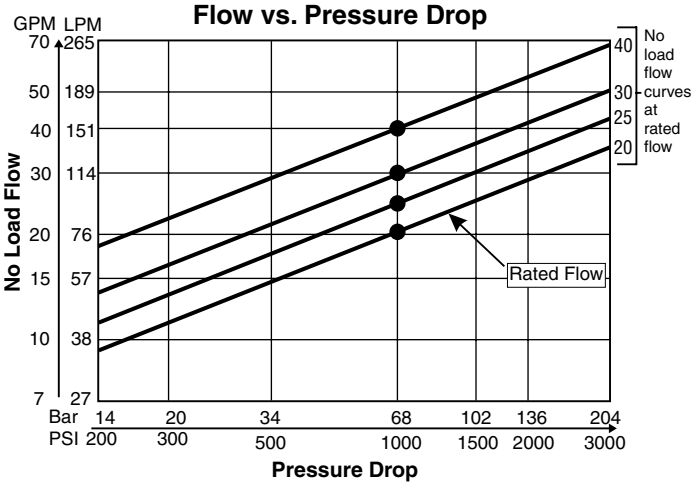
Series BD15

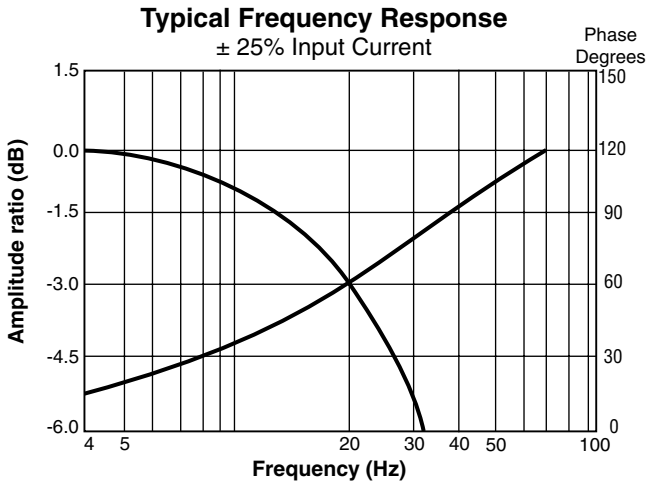




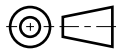
C

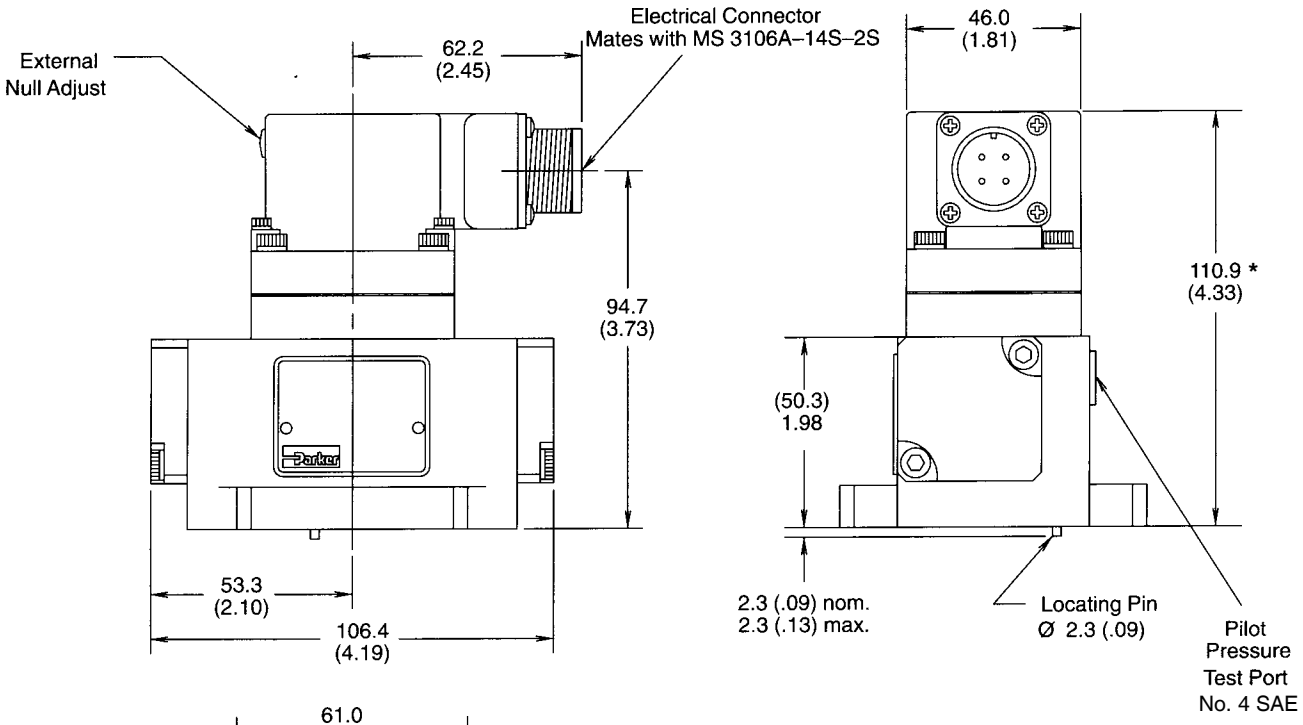
Series BD30

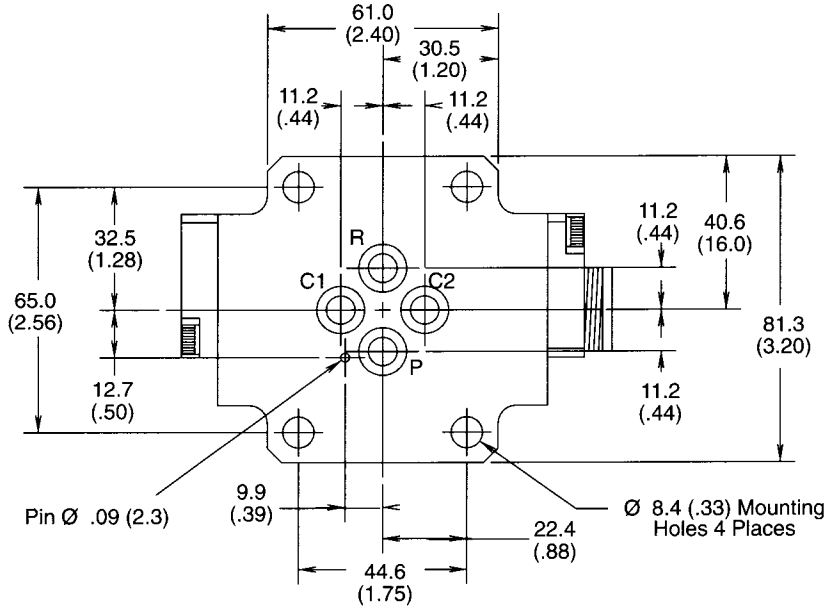


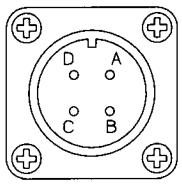


Inch eqivalents for millimeter dimensions are shown in (**)





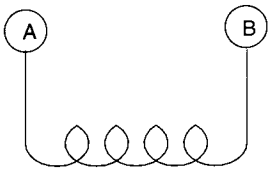




Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

* 140 (5.50) for BD15C; explosion proof, FM approved.
Note: Vertically oriented 1/2 NPT threaded male conduit connection with lead wires (not as shown).

Wiring



Positive current to the Pin “B” yields flow from the C1 port.

BD.p65, dd

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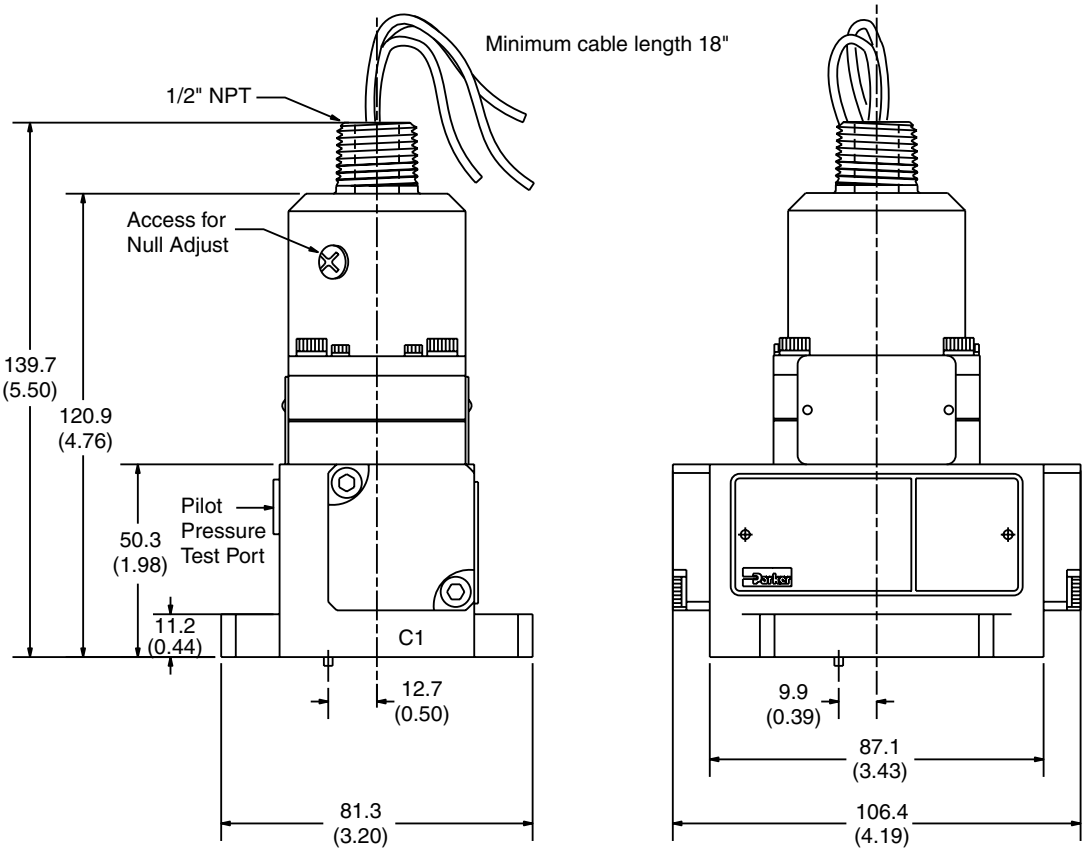
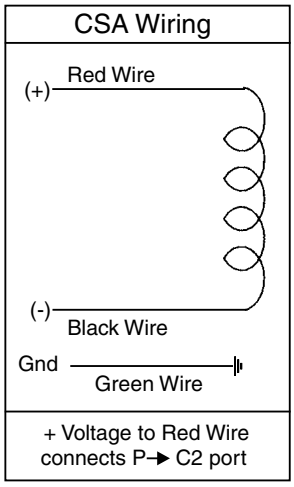
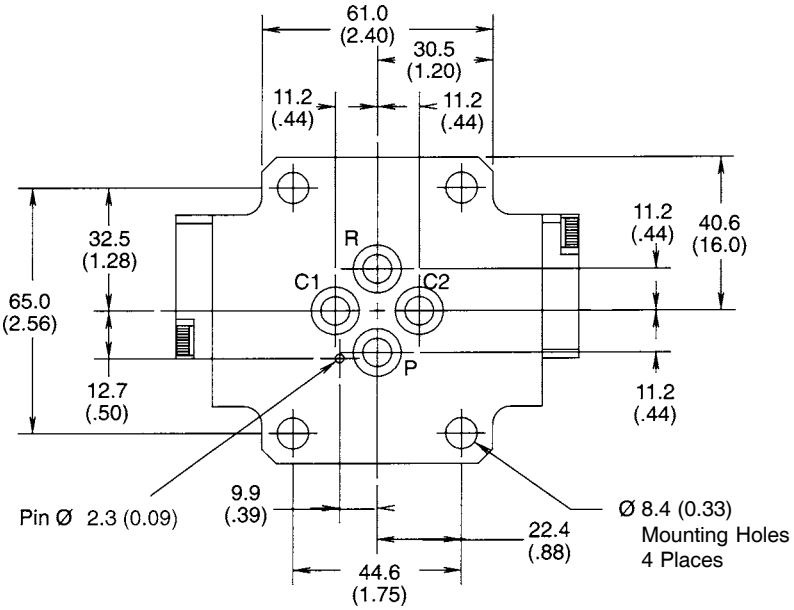
Elyria, Ohio, USA

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







Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

BD.p65, dd

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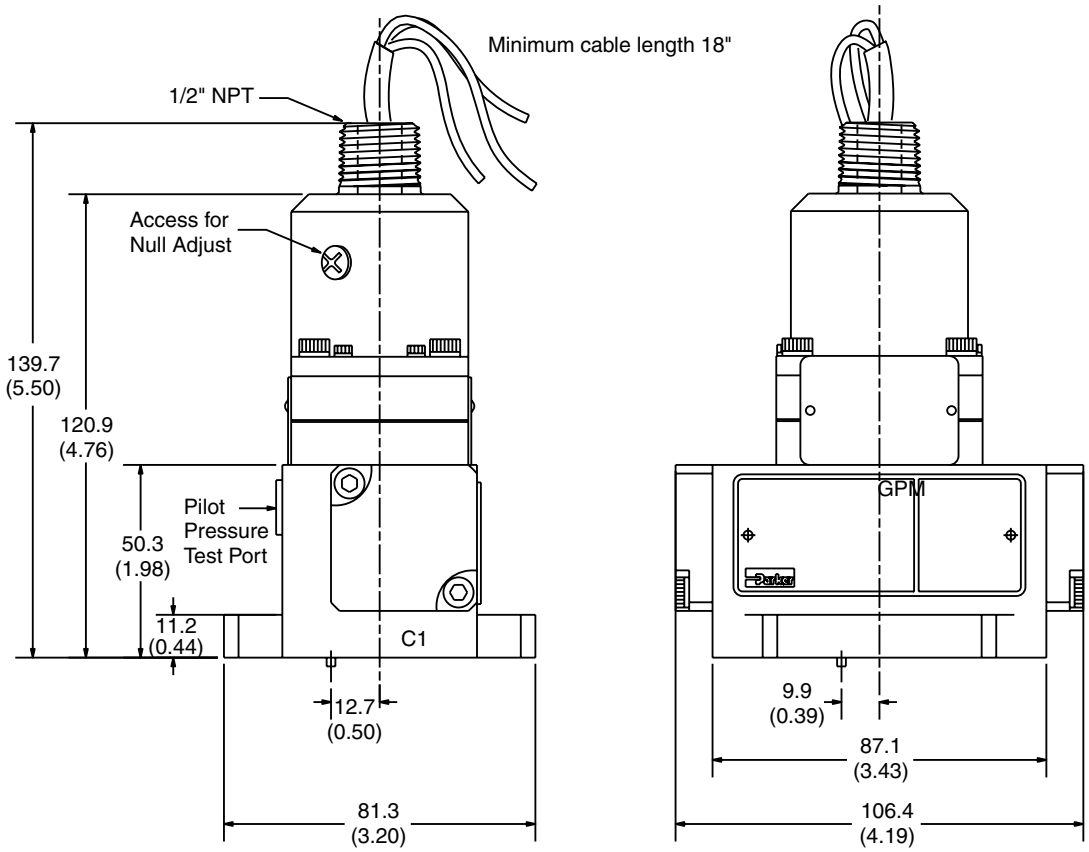
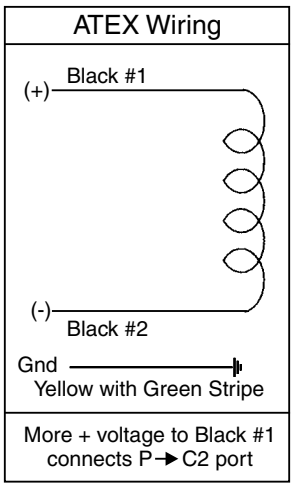
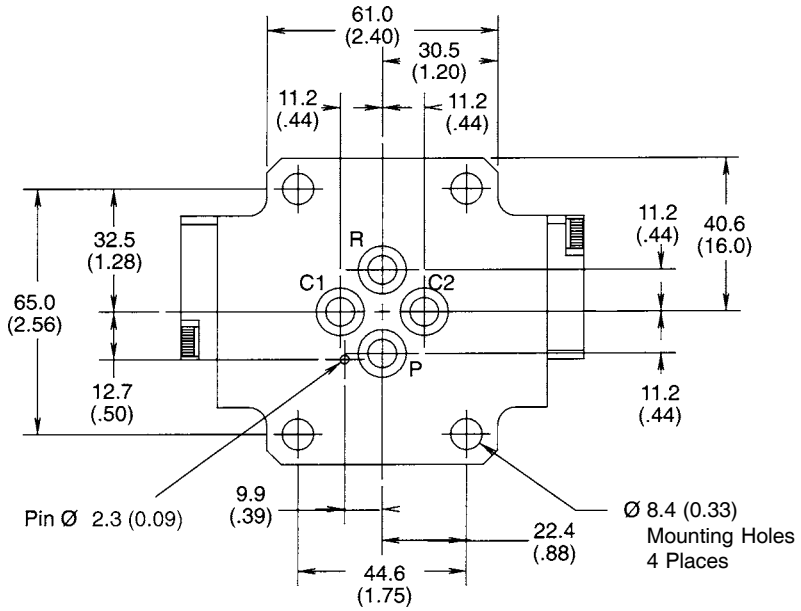
Hydraulic Valve Division
Elyria, Ohio, USA

C

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

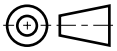


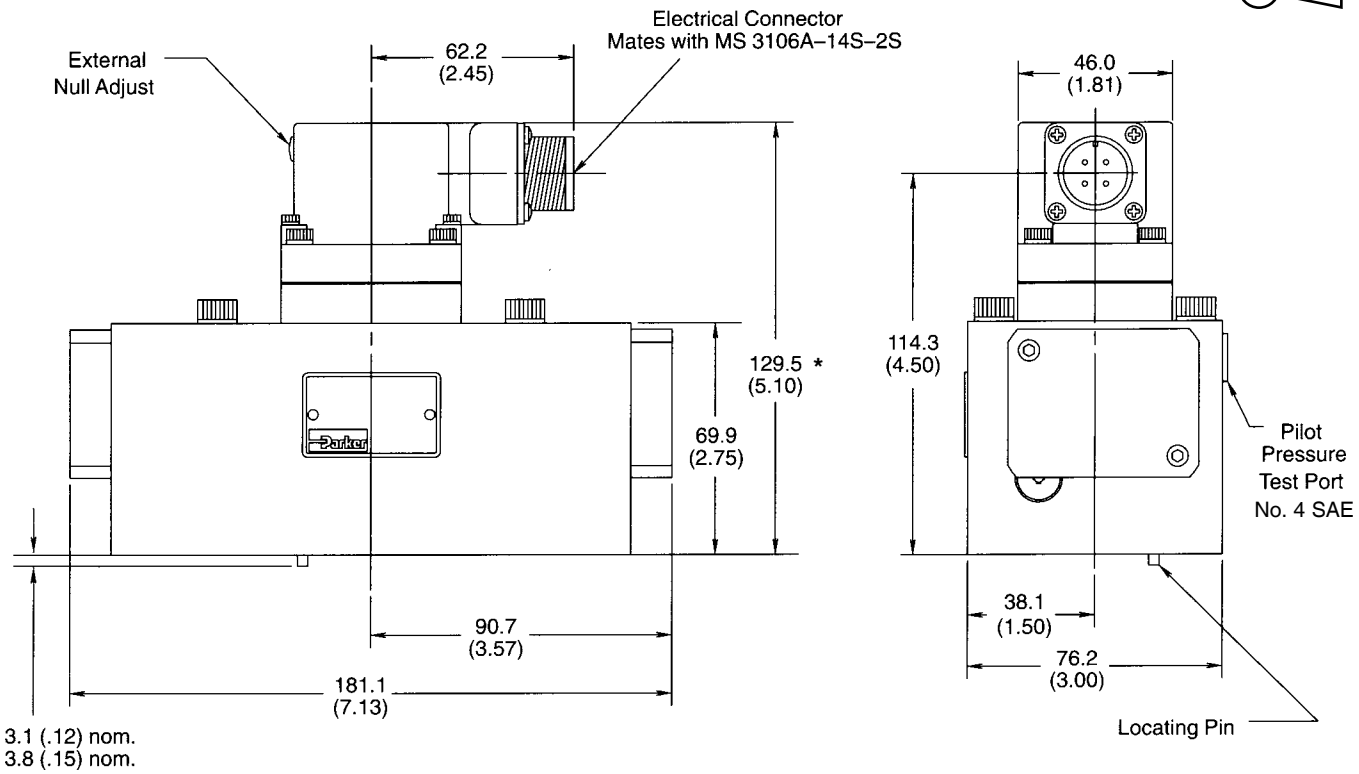


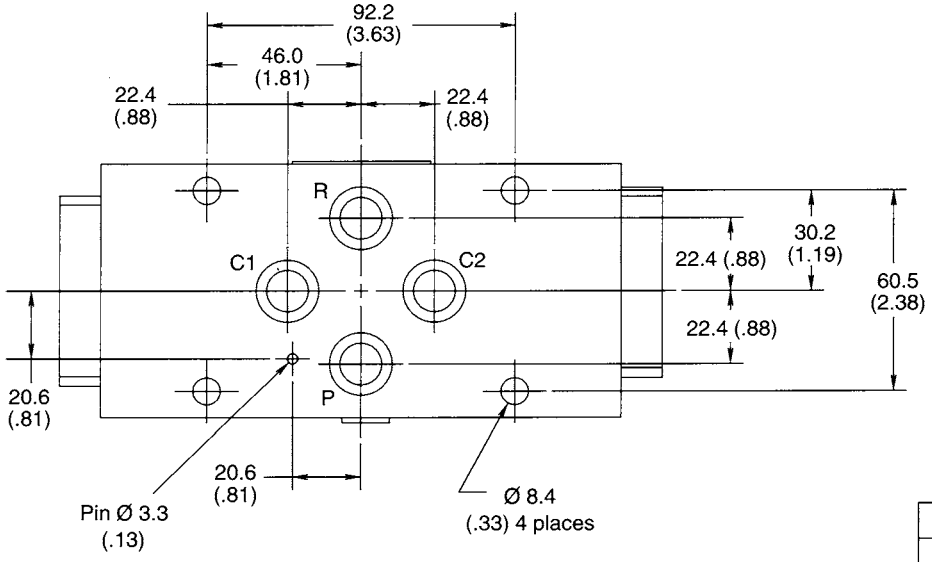


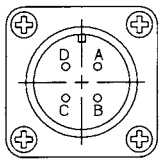
Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

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





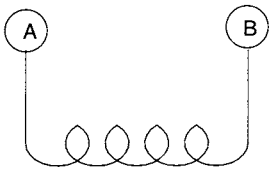




Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

* 160 (6.25) for BD30C; explosion proof, FM approved. Note: Vertically oriented 1/2 NPT threaded male conduit connection with lead wires (not as shown).

Wiring



Positive current to the Pin “B” yields flow from the C1 port.

BD.p65, dd

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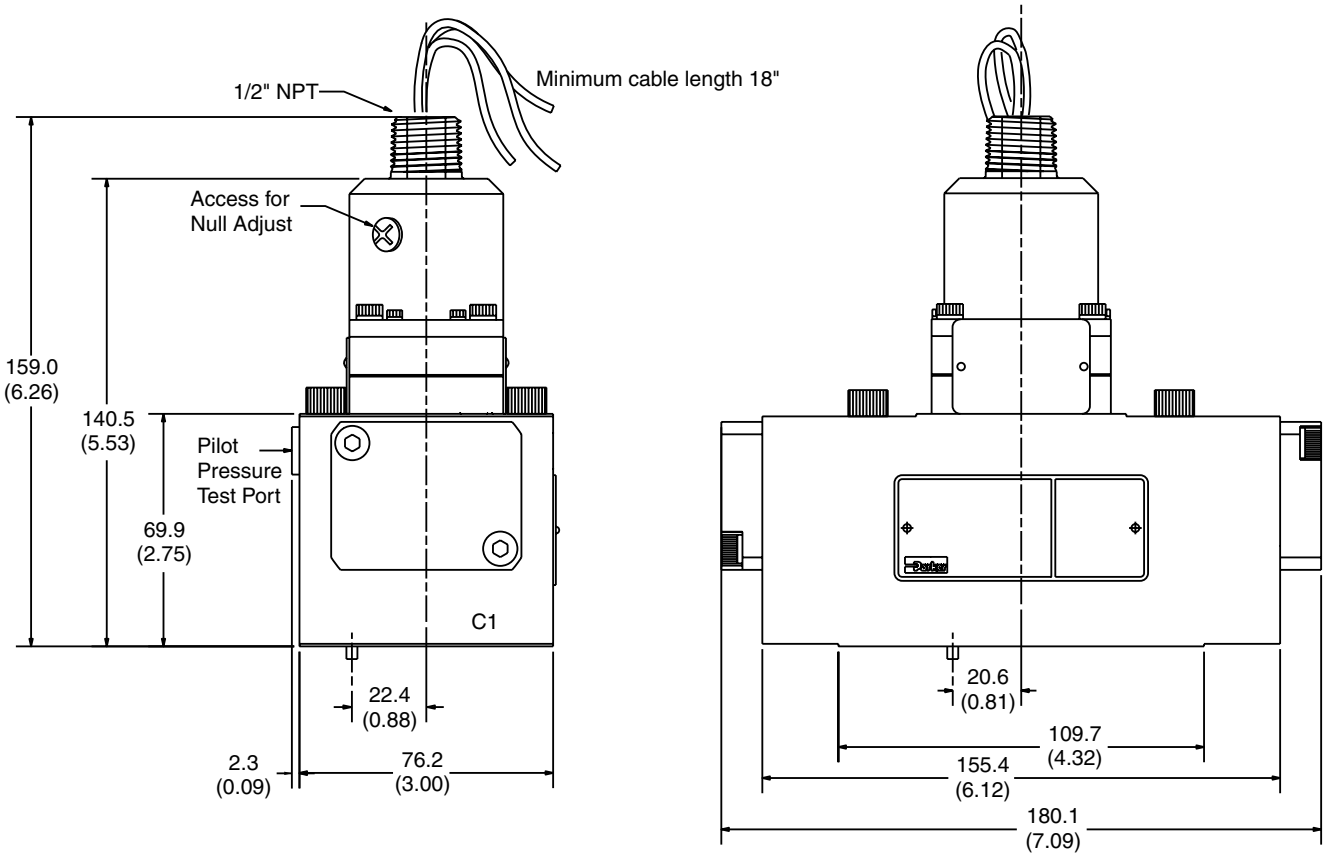
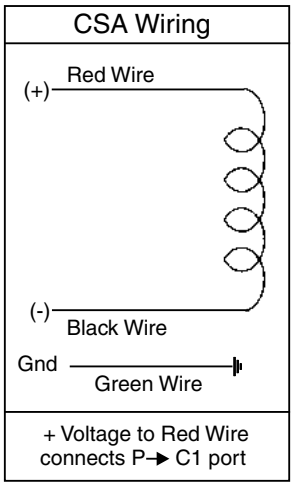
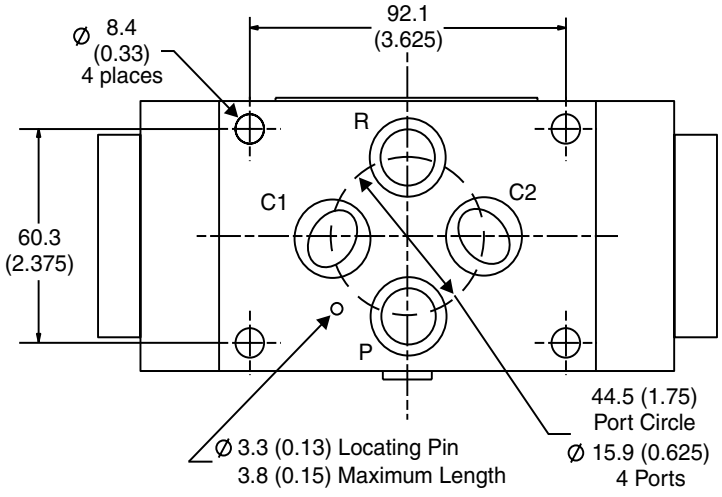
Hydraulic Valve Division
Elyria, Ohio, USA

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

C

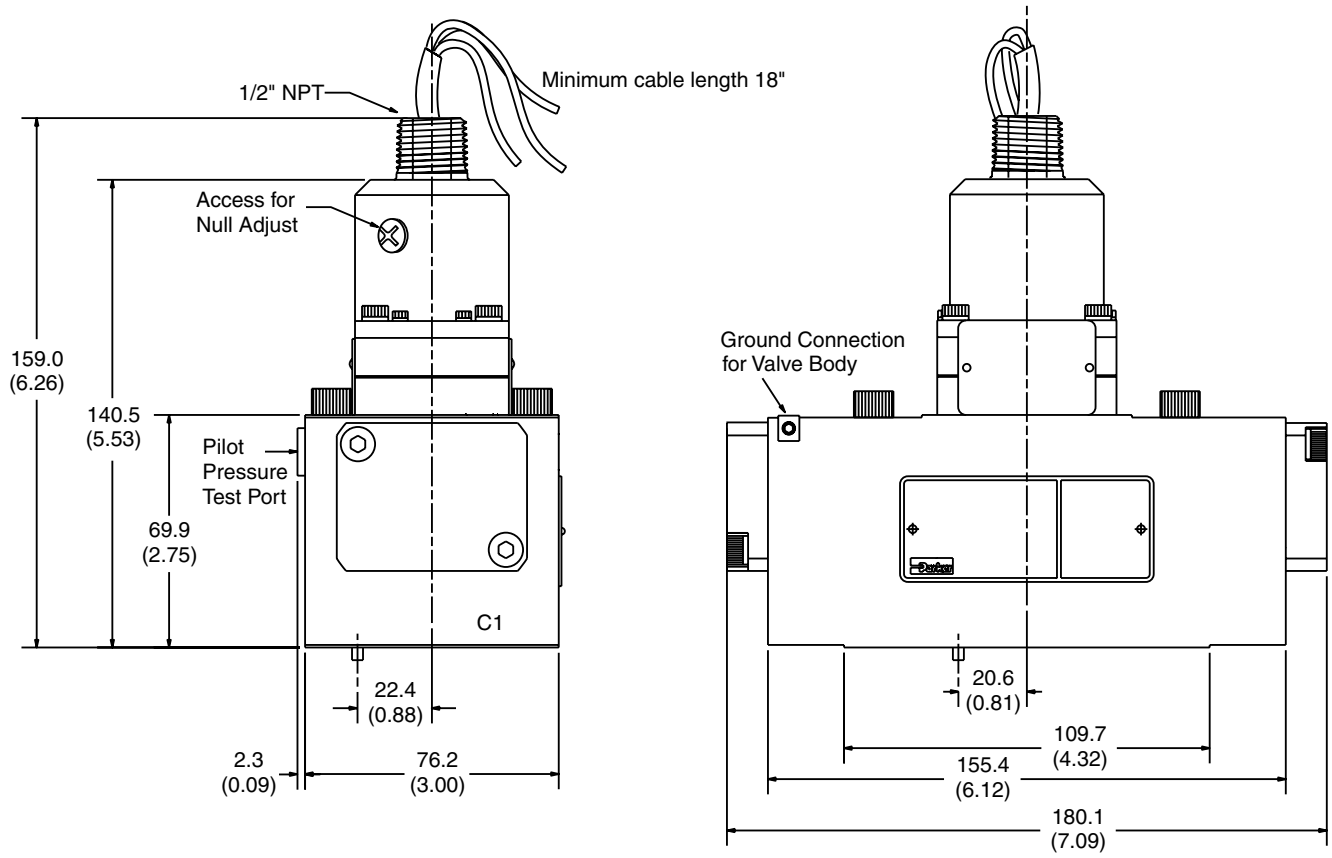


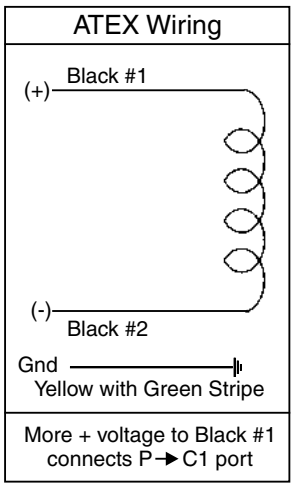


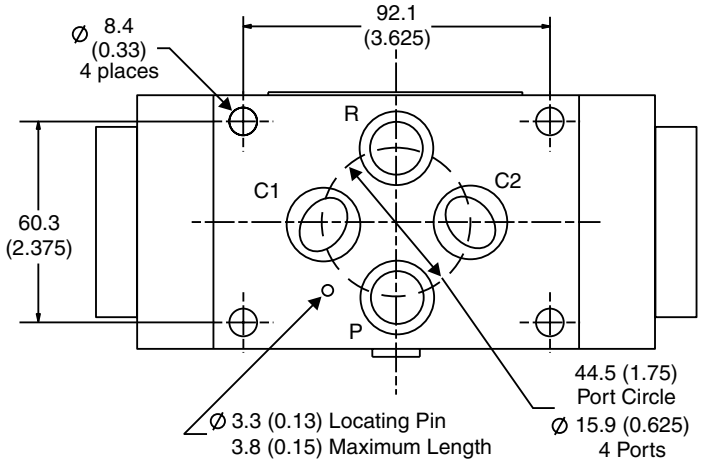


Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

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



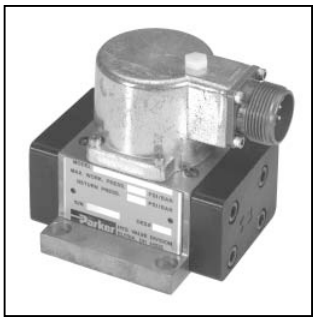


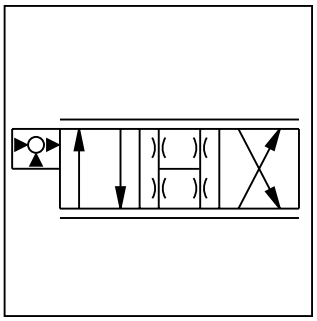


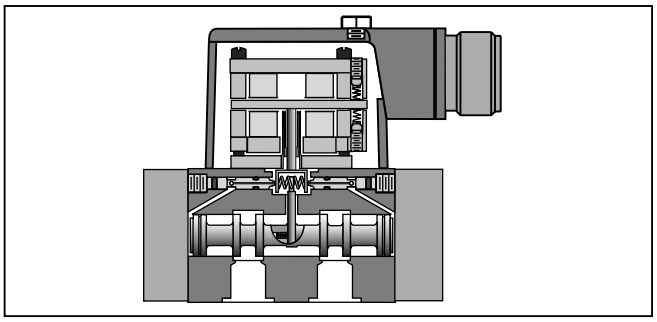
Note: Valve mating surface to be flat within 0.002 TIR, and smooth to within 63 RMS

General Description

Series PH76 servovalves are high performance, two stage valves, with a range of rated flows from 3.8 to 57 LPM (1 to 15 GPM). The pilot stage is a symmetrical double-nozzle and flapper, driven by a double air gap, dry torque motor. A low current signal to the torque motor pilot stage results in a proportional flow from the output stage. The output stage is a 4-way, sliding spool which provides a mechanical feedback using an exclusive “no ball glitch” design.







C

Features

- Built to survive tank port pressure spikes.
- No ball glitch.
- Tool steel spool and body.
- Optional 5th port for external pilot.
- ISO 10372 standard 22.23 mm (0.875 in) port circle.

Specifications

Flow Rating ±10% @ 70 Bar (1000 PSID)	3.8, 9.5, 19, 28, 38, 57 LPM (1, 2.5, 5, 7.5, 10, 15 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Null Leakage Flow per 70 Bar (1000 PSID)	0.2 – 0.8 LPM (0.05 – 0.20 GPM)
Pilot Flow @ 210 Bar (3000 PSID)	0.8 – 1.2 LPM (0.21 – 0.33 GPM)
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 90 Hz (See Performance Curves)
Non-Linearity	≤ 10%

Threshold	≤ 0.5%
Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Pressure Gain % change in pressure per 1% change in input command	30% minimum, 70% max.
Step Response	10 – 90%, < 6 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to +82°C (+30°F to +180°F)
Protection Class	NEMA 4, IP65
Fluid Cleanliness	ISO 4406 15/12 or better

PH76 — Series

□ Pilot Source

Code	Description
C	External (5th port)
A	Internal

For internal pilot the 5th port is blocked internally.

□ Material Options

Code	Description
A	Steel (standard)
Z	Special (specify)

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	40 mA	20 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
M	475 ohm	40 mA	20 mA
T	1000 ohm	8 mA	4 mA
Z	Special (Specify)		

□ Wiring

Code	Connector over	Flow P to C2 with:
B	Port C2	(+) signal to A, C
A	Port C1	(+) signal to A, C
P	Port P	(+) signal to A, C
T	Port T	(+) signal to A, C

□ Seals

Code	Description
V	Fluorocarbon (std.)
N	Nitrile
E *	EPR
Z *	Special (specify)

* Consult factory for delivery.

□ Operating Pressure

Code	Description	
A	210 Bar	(3000 PSI)
Z	Special	(specify)

□ Flows

Code	Description	
1	3.8 LPM	(1.0 GPM)
2.5	9.5 LPM	(2.5 GPM)
5	19.0 LPM	(5.0 GPM)
7.5	28.0 LPM	(7.5 GPM)
10	38.0 LPM	(10.0 GPM)
15	57.0 LPM	(15.0 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) Consult factory for price, delivery, and availability of special options.

□□□□□□ Factory Code for Special Options

Weight: 1 kg (2.2 lb)

Cable with mating connector: EHC154S

Mating connector: MS3106E-14S-2S

Bolt kit: Included with valve. BK07 (4) 5/16-18x1"

Flushing valve: 1200127 (same for 4 or 5 port PH76 valve)

Subplate, 5 ports: 1402303 (4) #12 SAE side ports, (1) #4 SAE side port

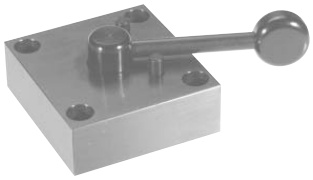
Subplate, 4 ports: 810090-3 (4) #12 SAE side ports

Null adjust tool: 27-0210

Driver cards: 23-5030**,** 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA



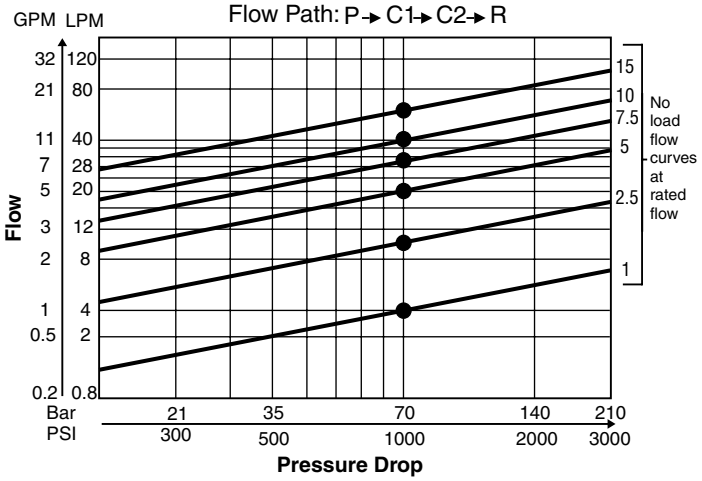
Flushing valve is rated for 3000 psi operation.

C

Performance Curves

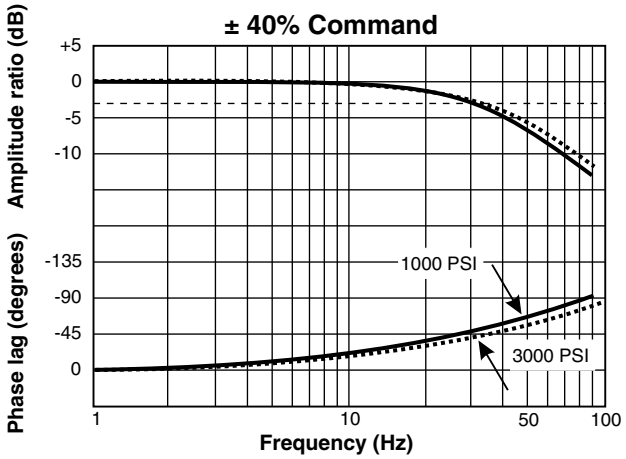
Servovalve flow is proportional to the square root of the pressure drop through the valve. The nominal flow rating for the servo-valves is based upon a 70 Bar (1000 PSI) pressure drop.

Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→R



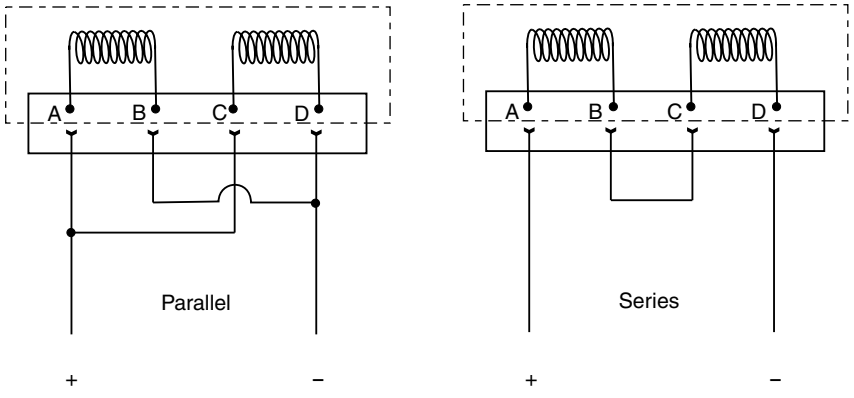
Frequency Response

The frequency response curves for the PH76 servovalves show no significant change for signal amplitudes between ±10% and ±40%. Frequency response is unaffected by changes in supply pressures above 70 Bar (1000 PSI).



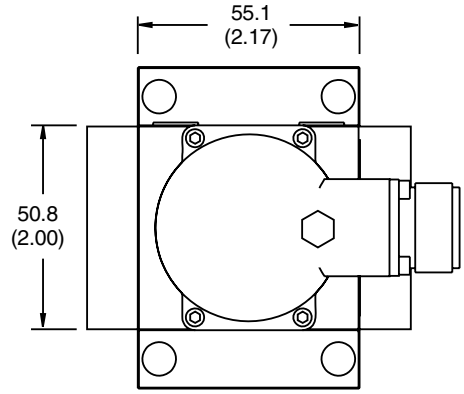
Installation Wiring Options

The PH76 servovalve has two coils. One is wired across pins A to B, the other across pins C to D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. In either case, a positive voltage to pin A connects valve flow from ports P to C2 and ports C1 to R.



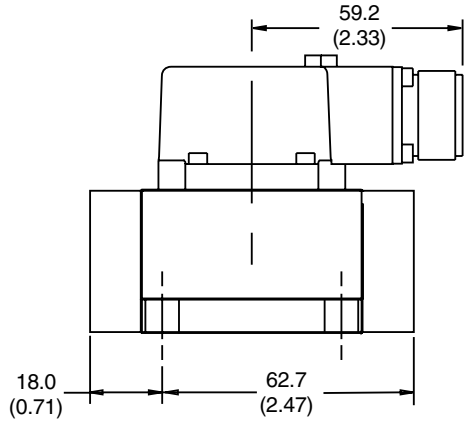
Polarity shown (+A, -B, +C, -D) connects flow from P to C2 port.

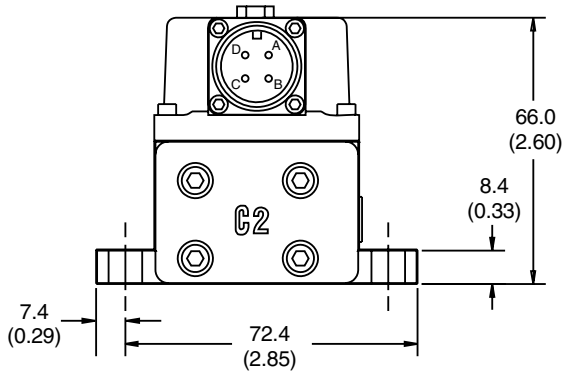
Inch equivalents for millimeter dimensions are shown in (**)



Connector shown over C2 port. See ordering information for other connector locations.

The connector location is factory set and is not field changeable.

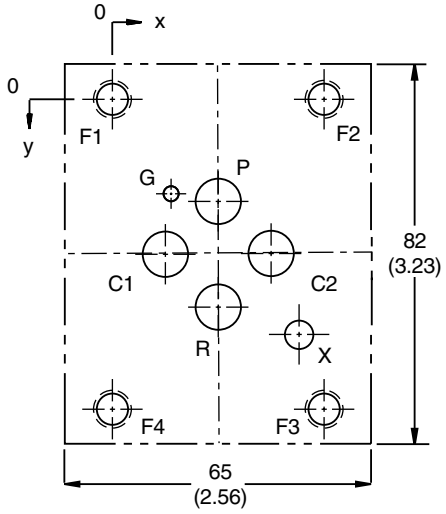




Mounting Surface Dimensions

Metric Dimensions (millimeters)						± 0.1 mm				
Axis	**P**	**C1**	**R**	**C2**	**G**	**X**	**F1**	**F2**	**F3**	**F4**
	∅ 8.2 max.	∅ 8.2 max.	∅ 8.2 max.	∅ 8.2 max.	∅ 3.5 max.	∅ 5	M8	M8	M8	M8
X	22.2	11.1	22.2	33.3	12.3	49.5	0	44.4	44.4	0
Y	21.4	32.5	43.6	32.5	19.8	39	0	0	65	65

U.S. Dimensions (inches)						± .004 in				
Axis	P	C1	R	C2	G	X	F1	F2	F3	F4
	∅ 0.32 max.	∅ 0.32 max.	∅ 0.32 max.	∅ 0.32 max.	∅ 0.14 max.	∅ 0.2	5/16 - 18			
X	0.875	0.437	0.875	1.311	0.484	1.531	0	1.750	1.750	0.000
Y	0.846	1.280	1.717	1.280	0.780	1.950	0	0	2.562	2.562



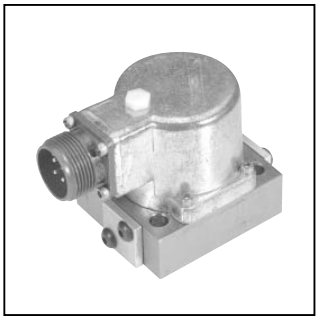
Minimum depth of G is 2 mm (0.08 in)
Recommended full thread depth for bolt holes 22 mm (0.87 in)
Surface roughness: Ra < 0.8 µm (0.031 in) as specified in ISO 468 and 1302
Surface flatness: 0.025 mm (0.001 in) as specified in ISO 1101

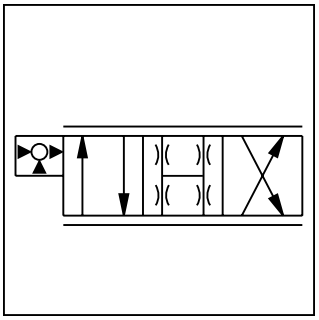
ph76.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

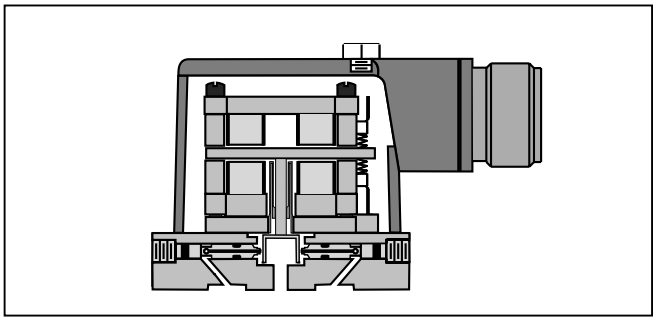
Series DY1S are open center, single stage differential pressure control valves. They are operated by a current driven torque motor. These valves controls the pressure difference between the two actuator ports, C1 and C2, by varying the resistance to flow through their nozzles.





Features

- No mechanical wear points.
- High frequency response.
- Nozzle and flapper design.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.



Specifications

Flow Rating @ 90 Bar (1300 PSI)	0.4 LPM (0.1 GPM)
Quiescent Flow @ 90 Bar (1300 PSI)	1.3 – 1.9 LPM (0.3 – 0.5 GPM)
Supply Pressure	7 – 90 Bar (100 – 1300 PSI)
Tank Port Pressure	90 Bar (1300 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	 ≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	1% minimum
Step Response	10 – 90%, < 5 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY1S
Series

Description
0.4 LPM (0.1 GPM)
90 Bar (1300 PSI)

Material Options

Code	Description
A	Standard
Z	Special (specify)

Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
F	80 ohm	80 mA	40 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	650 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Wiring

Code	Description
C	Standard
Z	Special

Seals

Code	Description
N	Nitrile
V	Fluorocarbon (standard)
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

Factory Code for Special Options

C

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-2 SAE-6 Side ports

Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

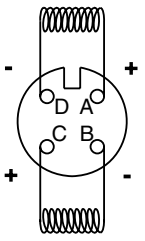
Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals

Weight: 0.5 kg (1.2 lbs.)

Wiring Option C
(Standard)



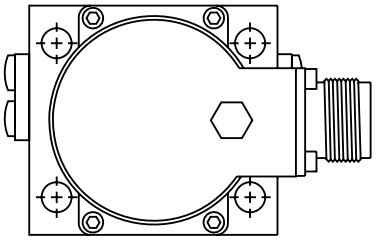
Polarity shown connects
P to C2 port.

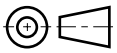
Flushing valve is rated for 3000 psi operation.

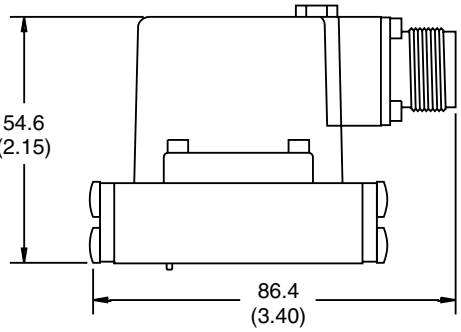
C

Dimensions

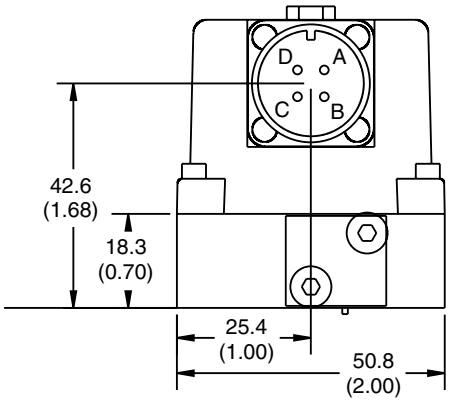
Inch equivalents for millimeter dimensions are shown in (**)



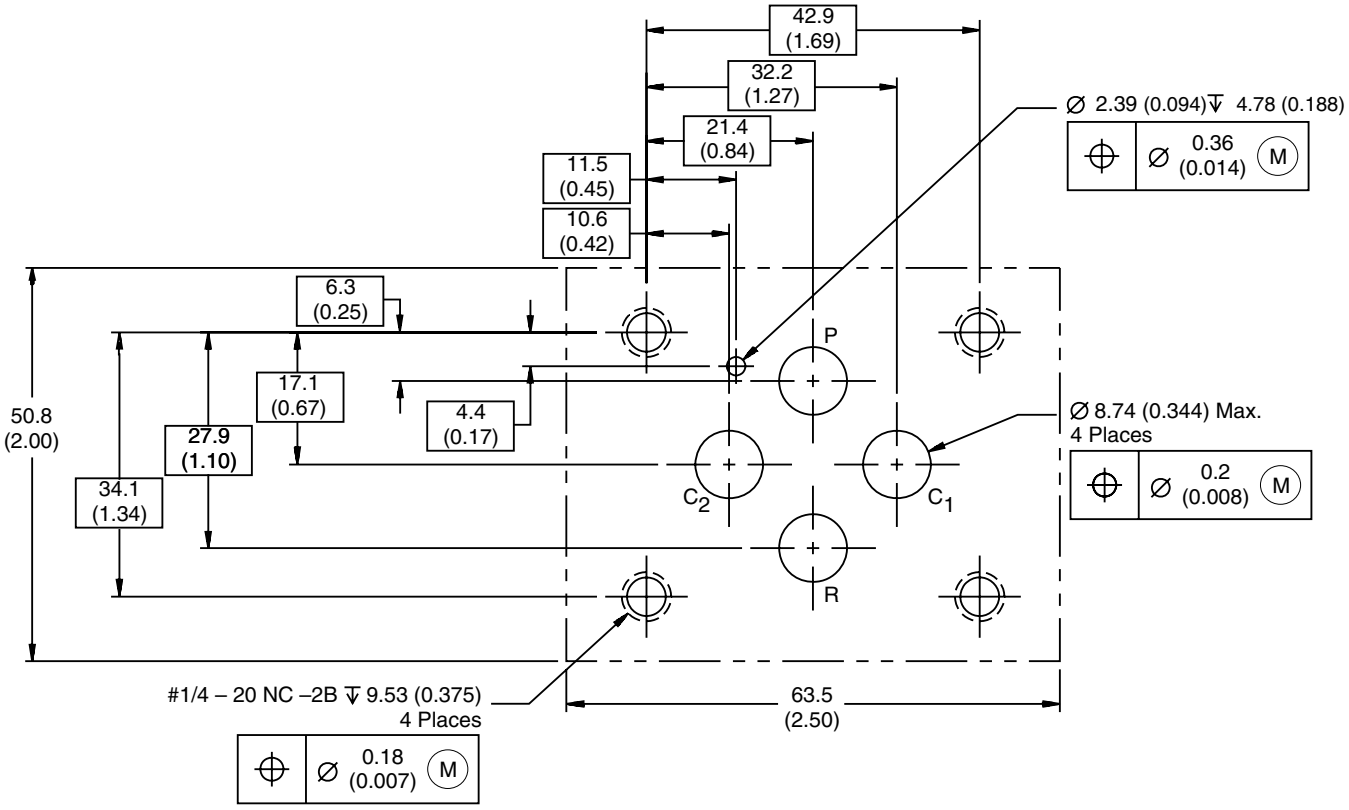




Connector over C1 port



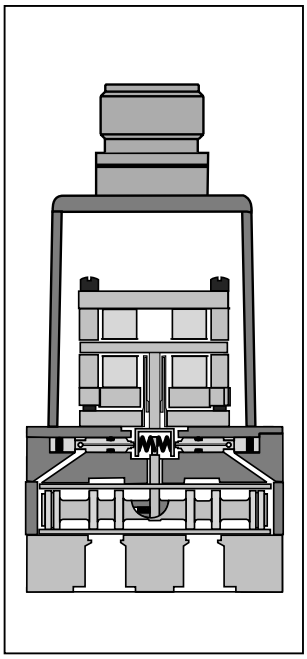
Mounting Interface

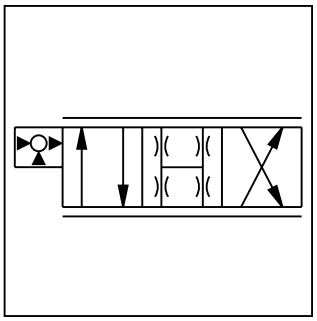


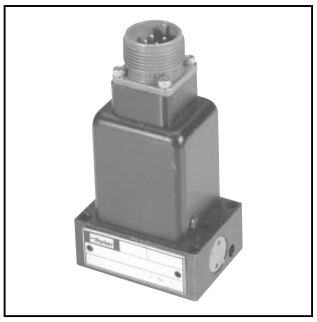
General Description

Series DY3H and DY6H are two stage, 4-way, high frequency, closed center servovalves, with mechanical spool position feedback. These valves use a flapper and nozzle type, torque motor driven pilot stage to drive the sliding spool second stage. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves.

The DY3H and DY6H offer a compact, lower cost alternative without sacrificing performance in systems operating at 105 Bar (1500 PSI) or less.







Features

- Precision lapped spool and sleeve.
- No ball glitch.
- High frequency response.
- Nozzle and flapper design.
- Adapters available for mounting to D03 or ISO port patterns.

C

Specifications

Flow Rating @ 70 Bar (1000 PSID)	11 and 22 LPM (3 and 6 GPM)
Supply Pressure	10 – 105 Bar (145 – 1500 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	1.3 – 1.9 LPM (0.3 – 0.5 GPM)
Tank Port Pressure	105 Bar (1500 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 190 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	 ≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 6 ms for DY3H < 8 ms for DY6H
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

C

Series

Code
DY3H
DY6H

Material Options

Code	Description
A	Standard
Z	Special (specify)

Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	650 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Wiring

Code	Description
C	Standard
Z	Special

Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Operating Pressure: **E**

Code	Description
E	105 Bar (1500 PSI)

Flows

Code	Description
3	11 LPM (3 GPM)
6 *	22 LPM (6 GPM)

* 6 GPM for DY6H only

Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

Factory Code for Special Options

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0300

Subplate: 55-0100-2 SAE-6 Side ports

Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

Special Options:

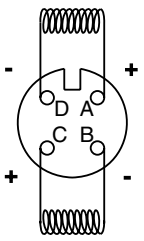
Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals

Weight:

DY3H	0.34 kg (0.56 lbs.)
DY6H	0.34 kg (0.56 lbs.)

Wiring Option C
(Standard)

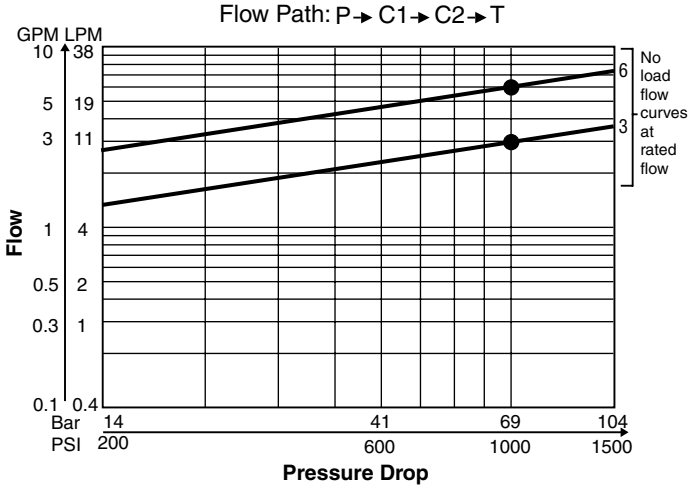


Polarity shown connects
P to C2 port.

Flushing valve is rated for 3000 psi operation.

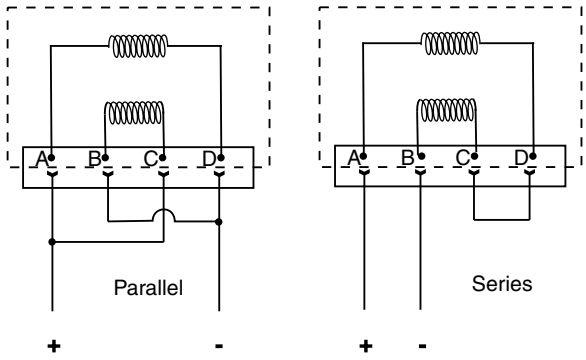
Performance Curves

Flow vs. Pressure Drop
at 100% command
Flow Path: P→ C1→ C2→ T



Installation Wiring Options

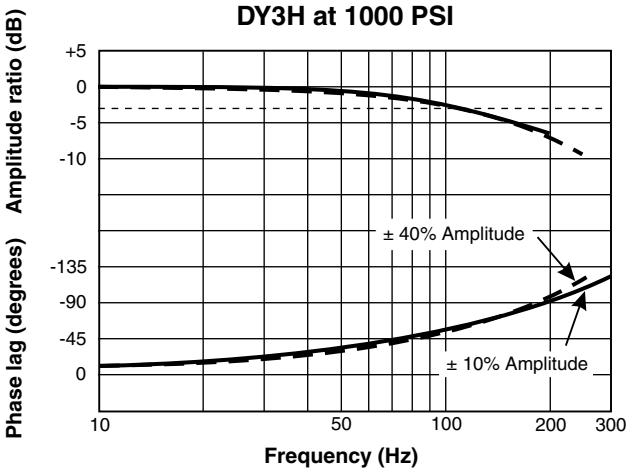
This servovalve has two coils. This illustration shows the internal wiring configurations for these valves. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustration below and to the mounting pattern for this valve to insure proper control phasing.

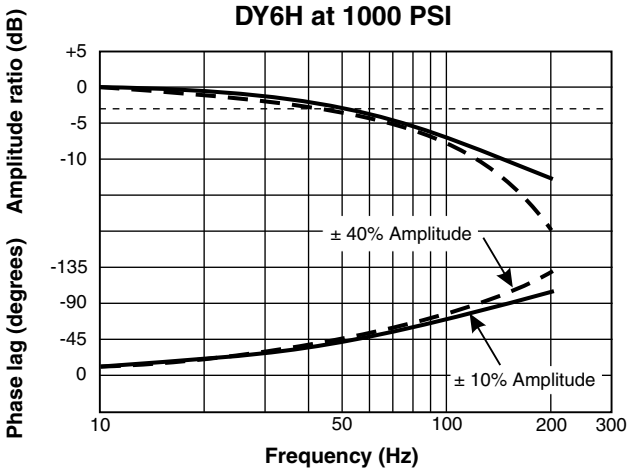


Polarity shown connects flow from P to C2 port.

C

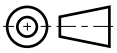
Frequency Response

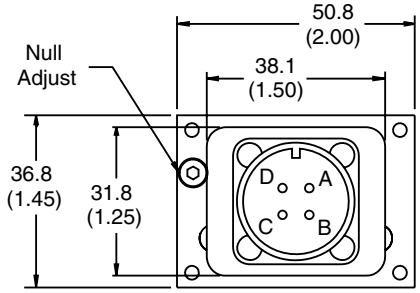


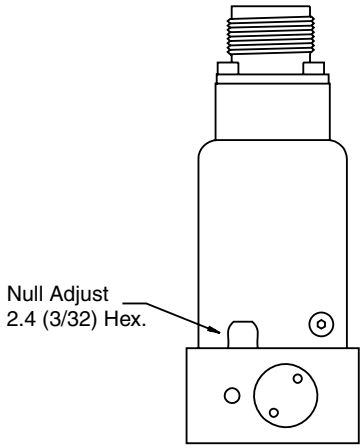


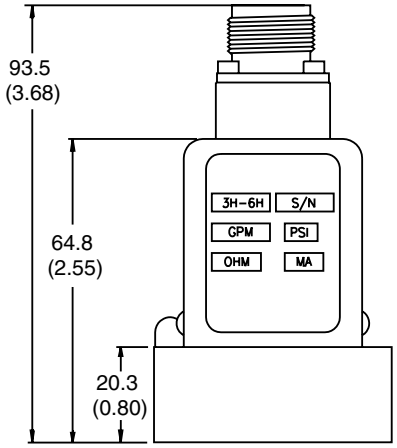
Dimensions

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

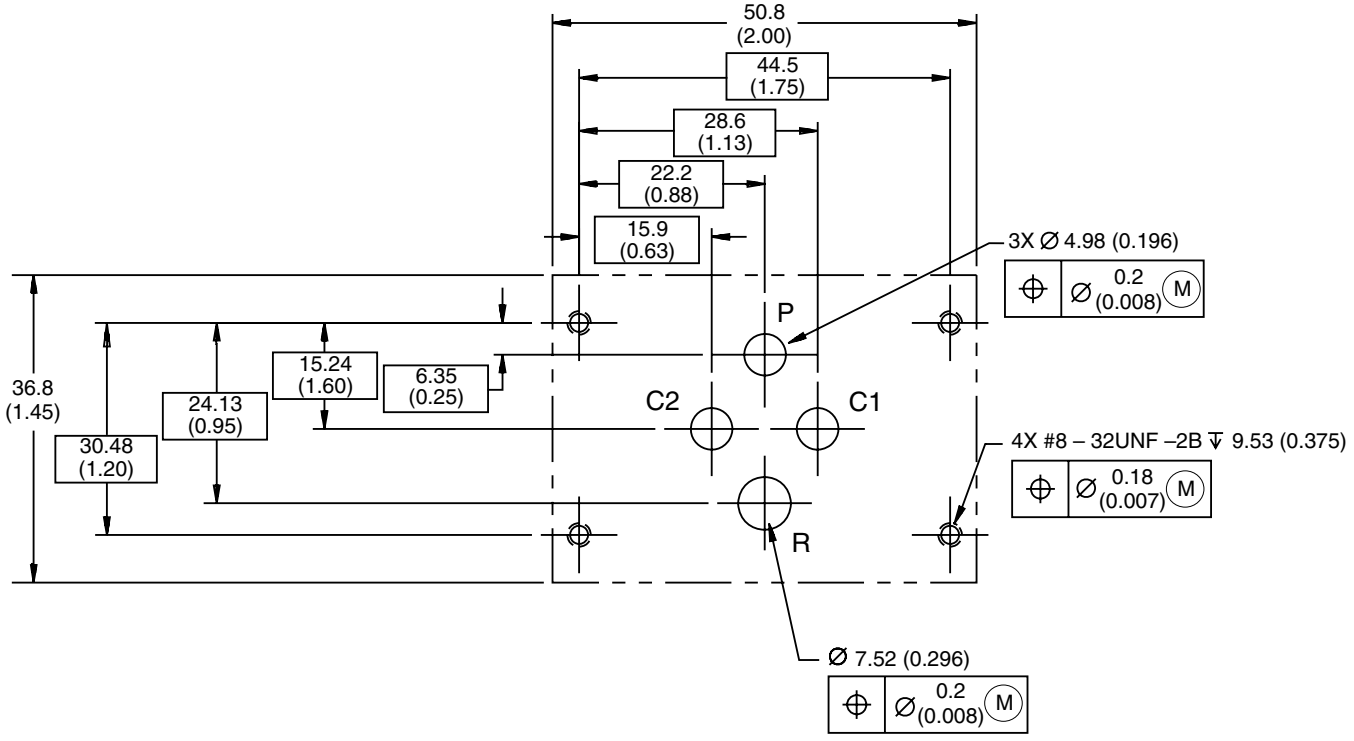








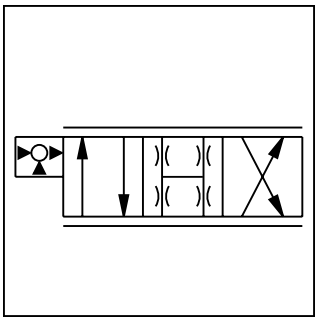
Mounting Interface

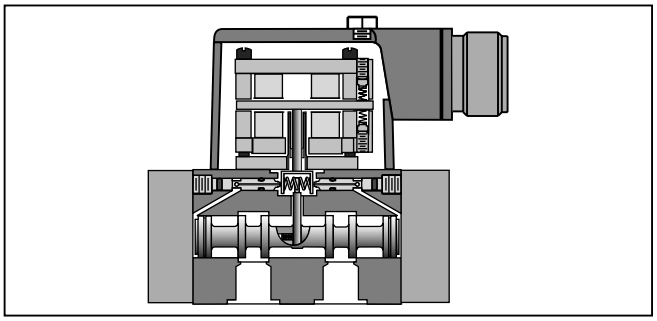


General Description

Series DY01 are two stage, 4-way, flapper and nozzle style servovalves. The DY01 servovalve combines a spool and sleeve construction, and a high frequency torque motor, for optimal performance. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. This valve is rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.

The DY01 servovalve was specially designed for high precision flight simulator applications.





Features

- Precision lapped spool and sleeve.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	3 and 11 LPM (1 and 3 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.42 – 0.95 LPM (0.11 – 0.25 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 180 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% Minimum, 70% Maximum
Step Response	10 – 90%, < 8 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY01 Series | Material Options | Coils | Wiring | Seals | Operating Pressure | Flows | Special Options | Factory Code for Special Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not not affect operating pressure.

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

Code	Description
1	3.8 LPM (1 GPM)
1.5	5.7 LPM (1.5 GPM)
3	11 LPM (3 GPM)

Code	Description
Omit	Standard
D	(Specify) See list below

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

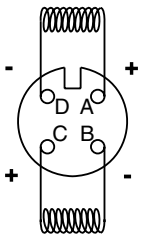
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

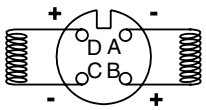
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Polarity shown connects P to C2 port.

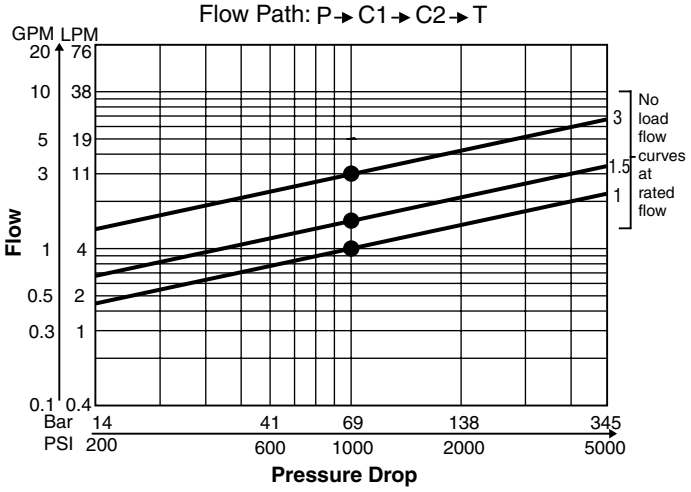
Wiring Option D



Moog, Atchley and Vickers standard.

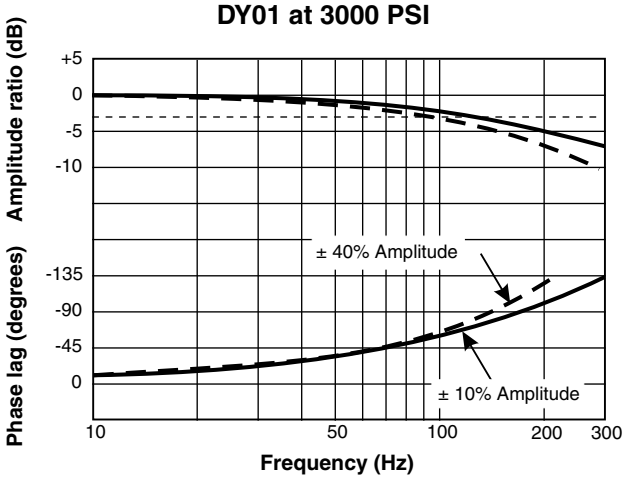
Performance Curves

DY01 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

DY01 at 3000 PSI

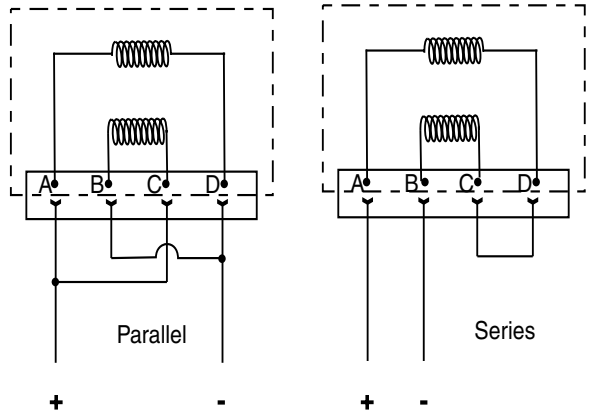


C

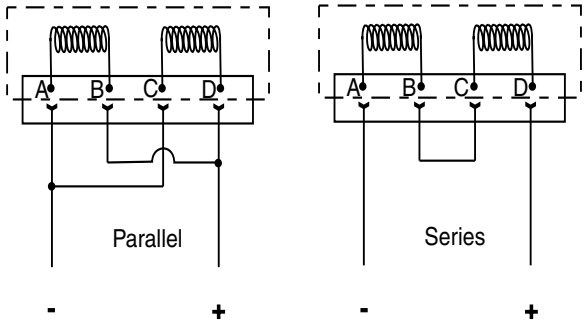
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



Option D

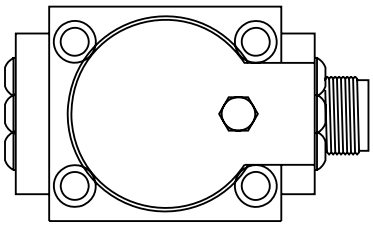


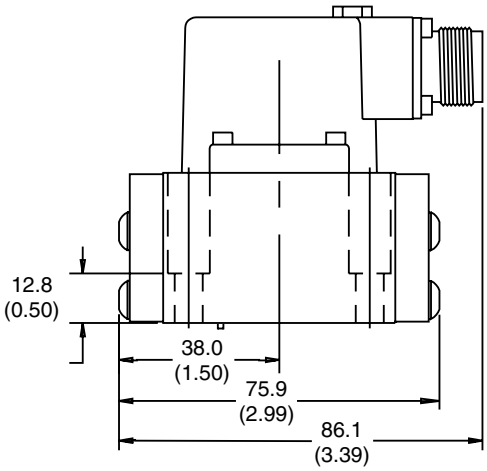
Polarity shown connects flow from P to C2 port.

C

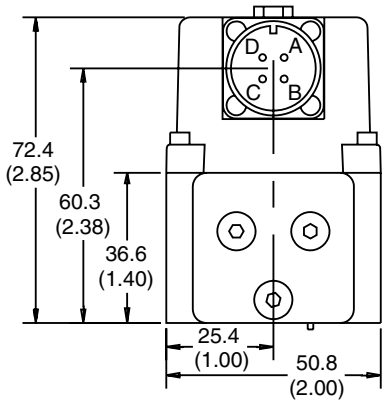
Dimensions

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

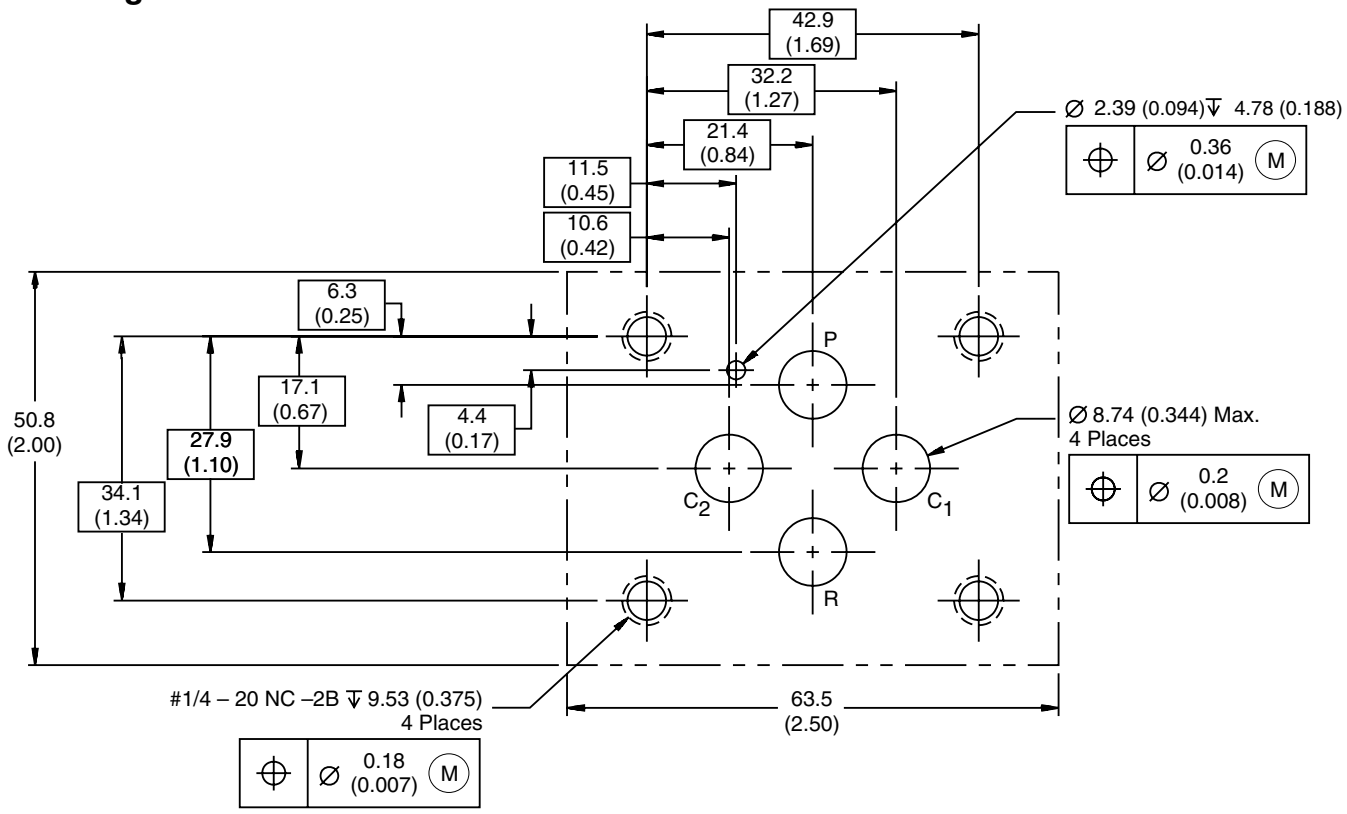




Connector over port C1



Mounting Interface

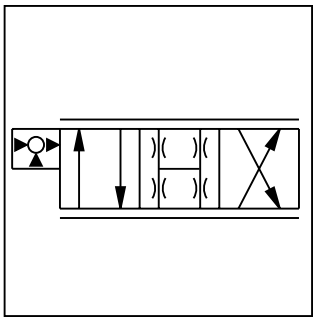


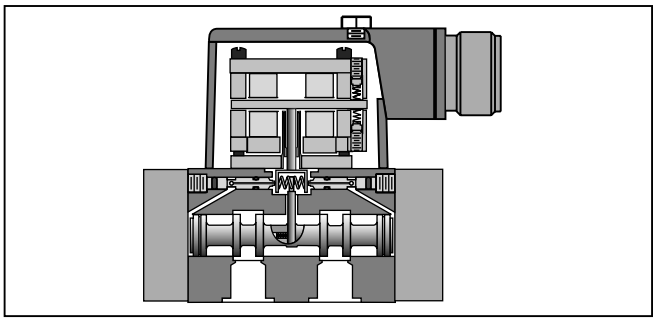
DY01.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY05 are two stage, 4-way, flapper and nozzle style servovalves. The DY05 has a wide range of flow ratings within a lower cost spool and body design. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servo-valves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





C

Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	0.95, 1.9, 3.8. 9.5 and 19 LPM (0.25, 0.5, 1.0, 2.5 & 5 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.42 – 0.95 LPM (0.11 – 0.25 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 11 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY05 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not not affect operating pressure.

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
0.25	0.95 LPM (0.25 GPM)
0.5	1.9 LPM (0.5 GPM)
1	3.8 LPM (1 GPM)
2.5	9.5 LPM (2.5 GPM)
5	19 LPM (5 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□ Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with Valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

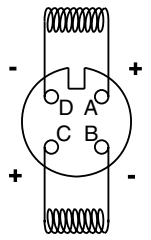
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95*, and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

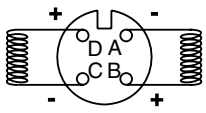
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D



Moog, Atchley and Vickers standard.

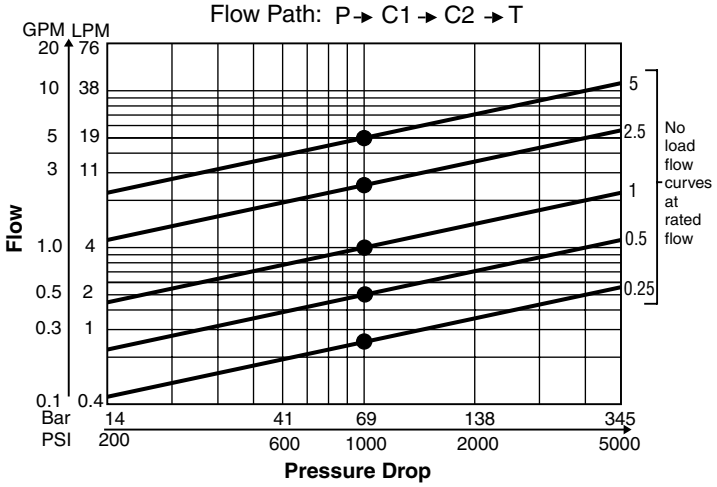
In both cases, polarity shown connects P to C2 port.

DY05.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

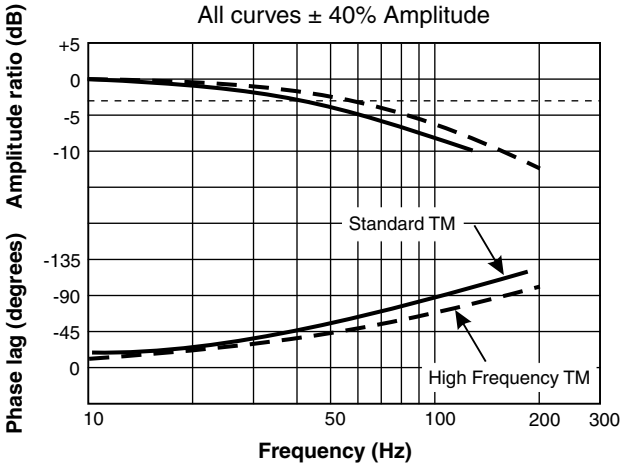
Performance Curves

DY05 Flow vs. Pressure Drop
at 100% command
Flow Path: P→ C1→ C2 →T



Frequency Response

DY05 at 3000 PSI
All curves ± 40% Amplitude

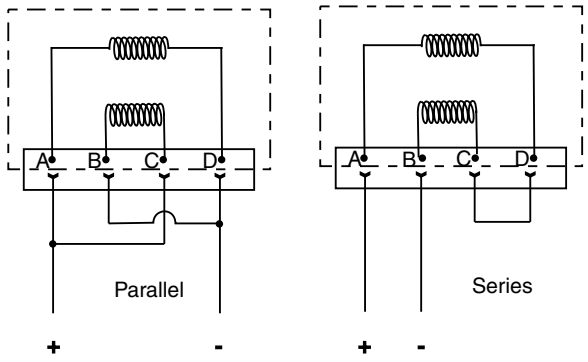


C

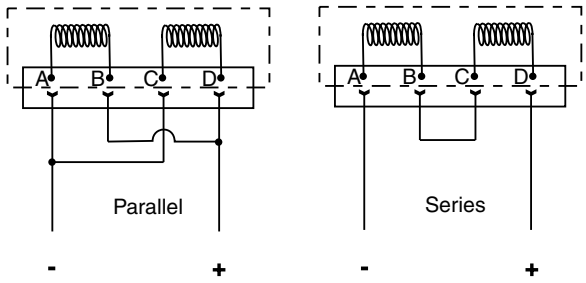
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



Option D

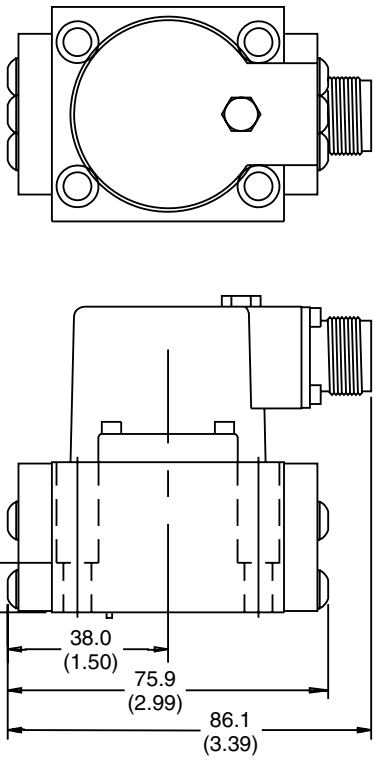


Polarity shown connects flow from P to C2 port.

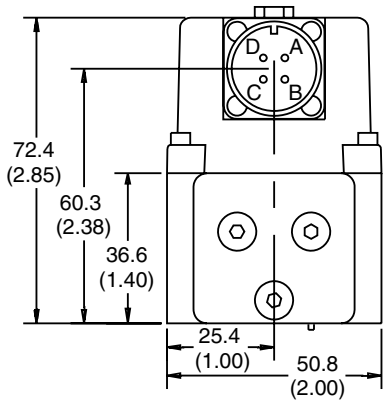
C

Dimensions

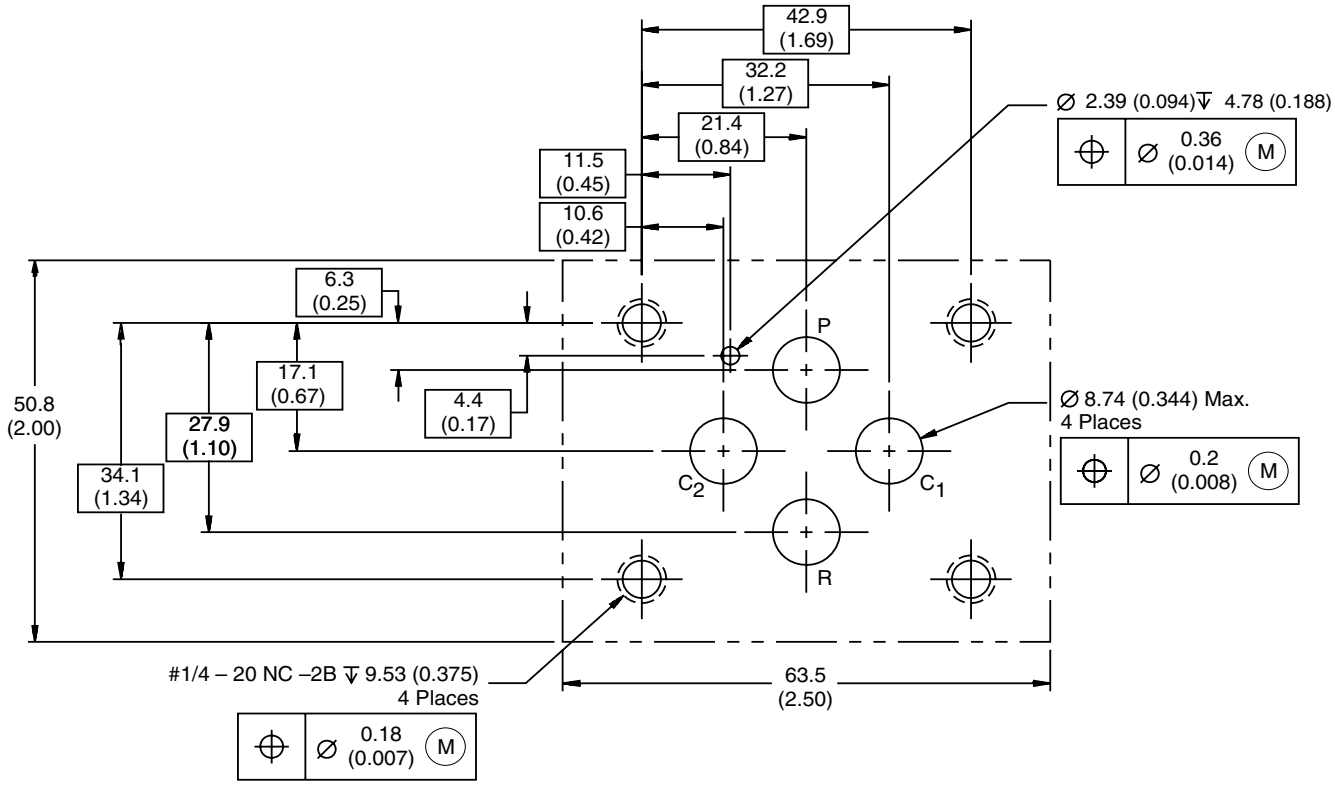
Inch eqivalents for millimeter dimensions are shown in (**)



Connector over port C1

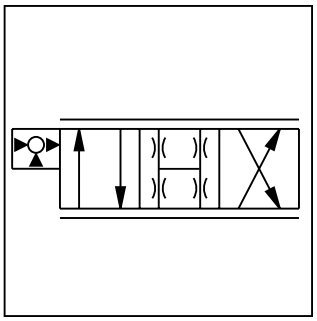


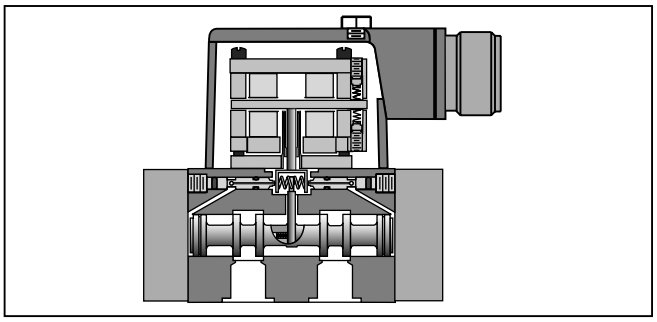
Mounting Interface



General Description

Series DY10 are two stage, 4-way, flapper and nozzle style servovalves. The DY10 is a higher flow version of the DY05. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.
- Survives high tank port pressures.

C

Specifications

Flow Rating @ 70 Bar (1000 PSID)	28 and 38 LPM (7.5 and 10 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.57 – 1.1 LPM (0.15 – 0.3 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 13 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY10 — Series

□ — Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure.

□ — Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ — Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ — Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ — Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ — Flows

Code	Description
7.5	28 LPM (7.5 GPM)
10	38 LPM (10 GPM)

□ — Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□ □ □ □ □ □ — Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

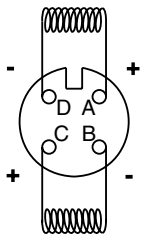
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

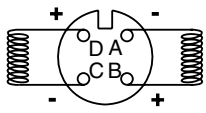
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

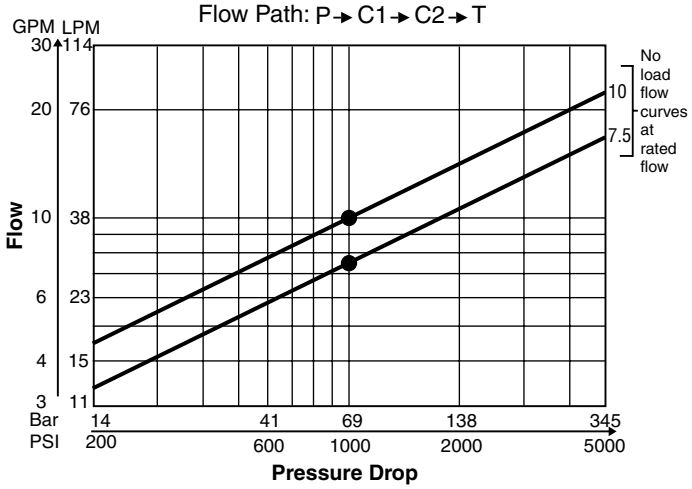


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

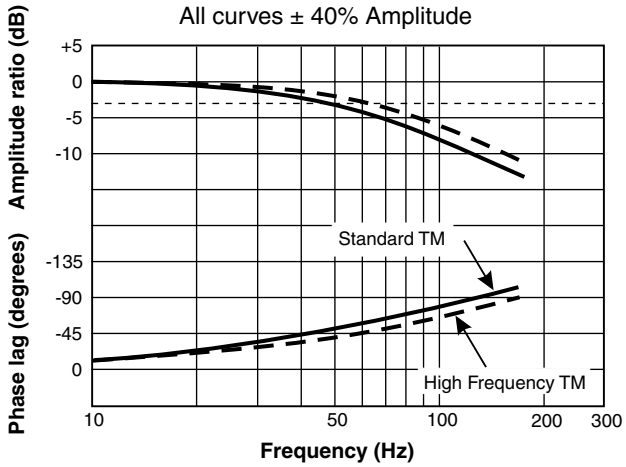
Performance Curves

DY10 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

DY10 at 3000 PSI
All curves ± 40% Amplitude

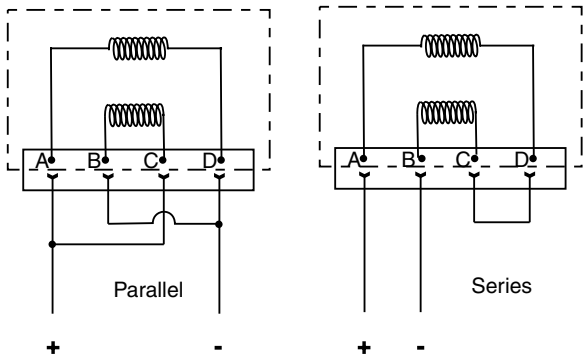


C

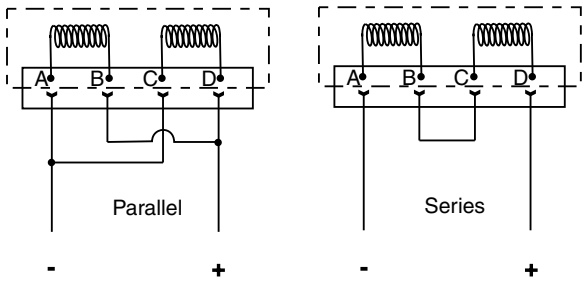
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



Option D

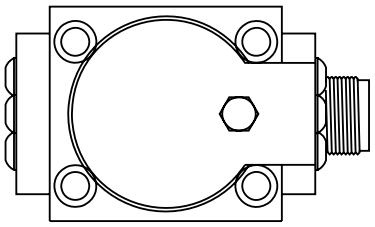


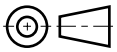
Polarity shown connects flow from P to C2 port.

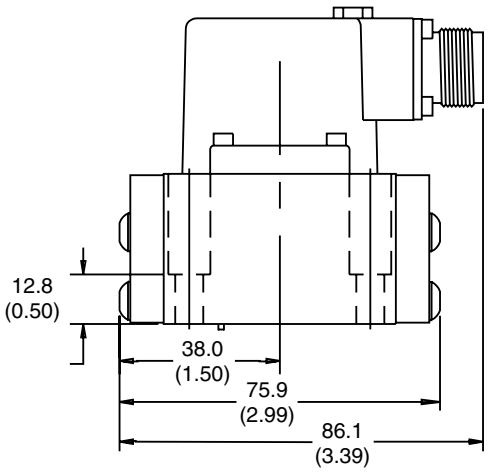
C

Dimensions

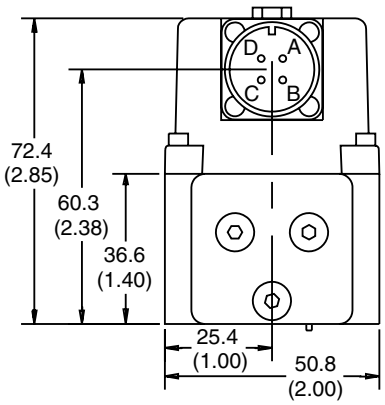
Inch equivalents for millimeter dimensions are shown in (**)



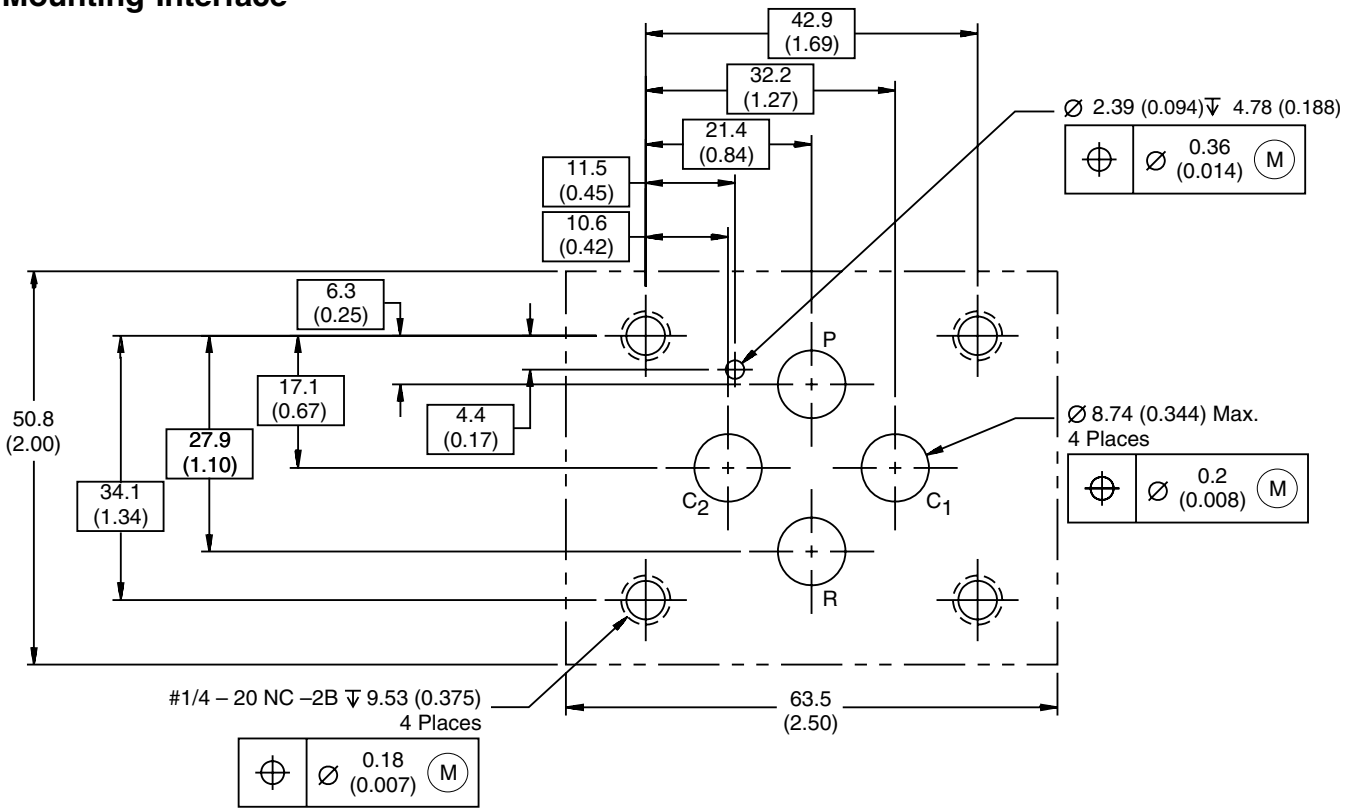




Connector over port C1



Mounting Interface

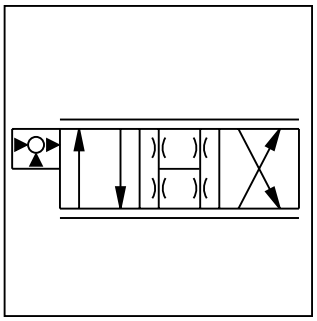


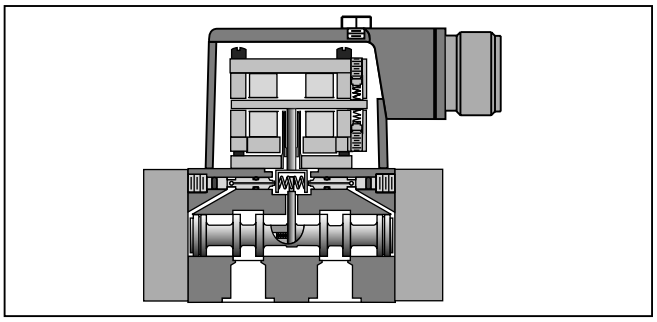
DY10.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY12 are two stage, 4-way, flapper and nozzle style servovalves. They have the same port pattern and body as the DY10 valve, but have a longer spool stroke for higher flow. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.937 in.) port circle patterns.
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	47 and 57 LPM (12.5 and 15 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.57 – 1.1 LPM (0.15 – 0.3 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 13 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY12 | Material Options | Coils | Wiring | Seals | Operating Pressure | Flows | Special Options | Factory Code for Special Options

Series

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure.

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z*	Special (specify)	

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

Code	Description
12.5	47 LPM (12.5 GPM)
15	57 LPM (15 GPM)

Code	Description
Omit	Standard
D	(Specify) See list below

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

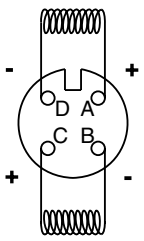
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

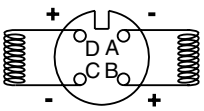
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D



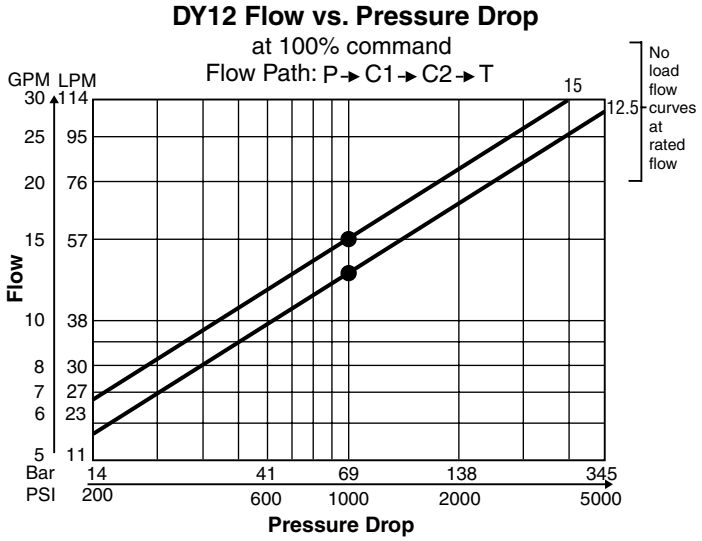
Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

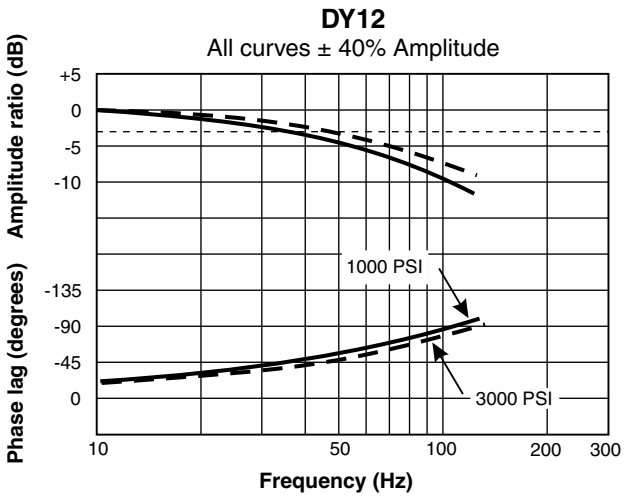
DY12.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Performance Curves



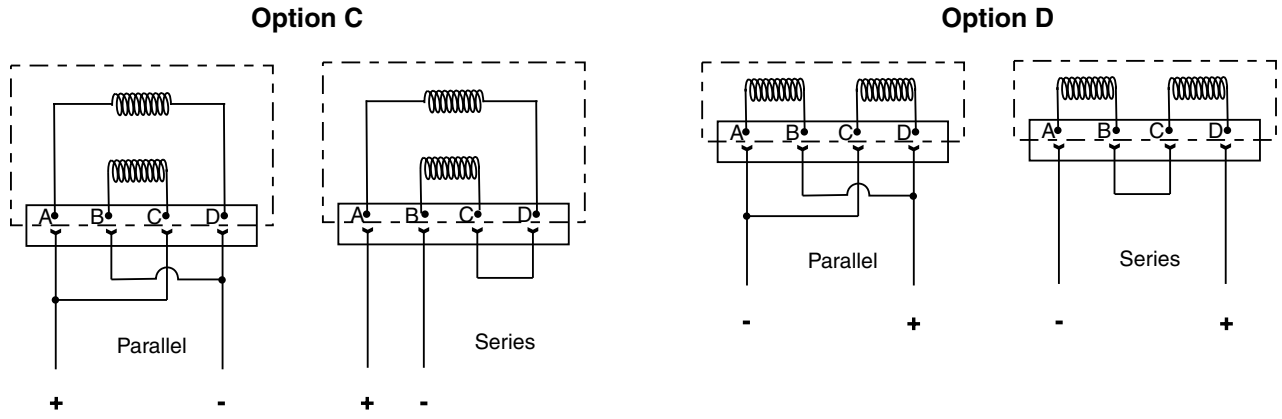
Frequency Response



C

Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for these valves. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustration below and to the mounting pattern for this valve to insure proper control phasing.

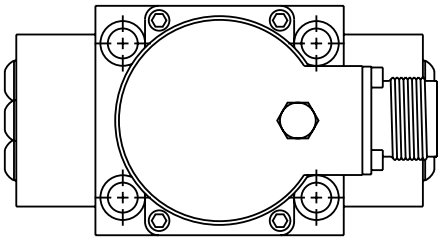


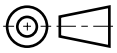
Polarity shown connects flow from P to C2 port.

C

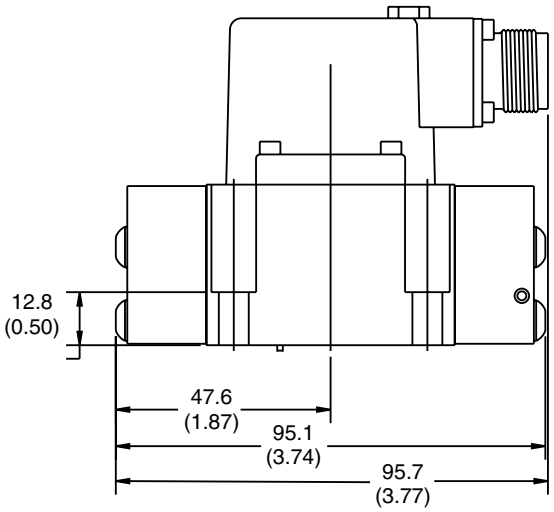
Dimensions

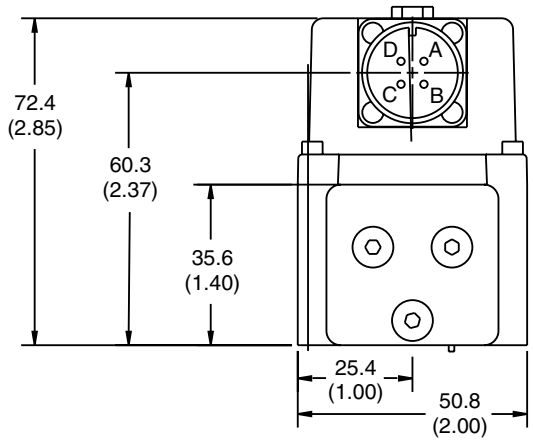
Inch equivalents for millimeter dimensions are shown in (**)



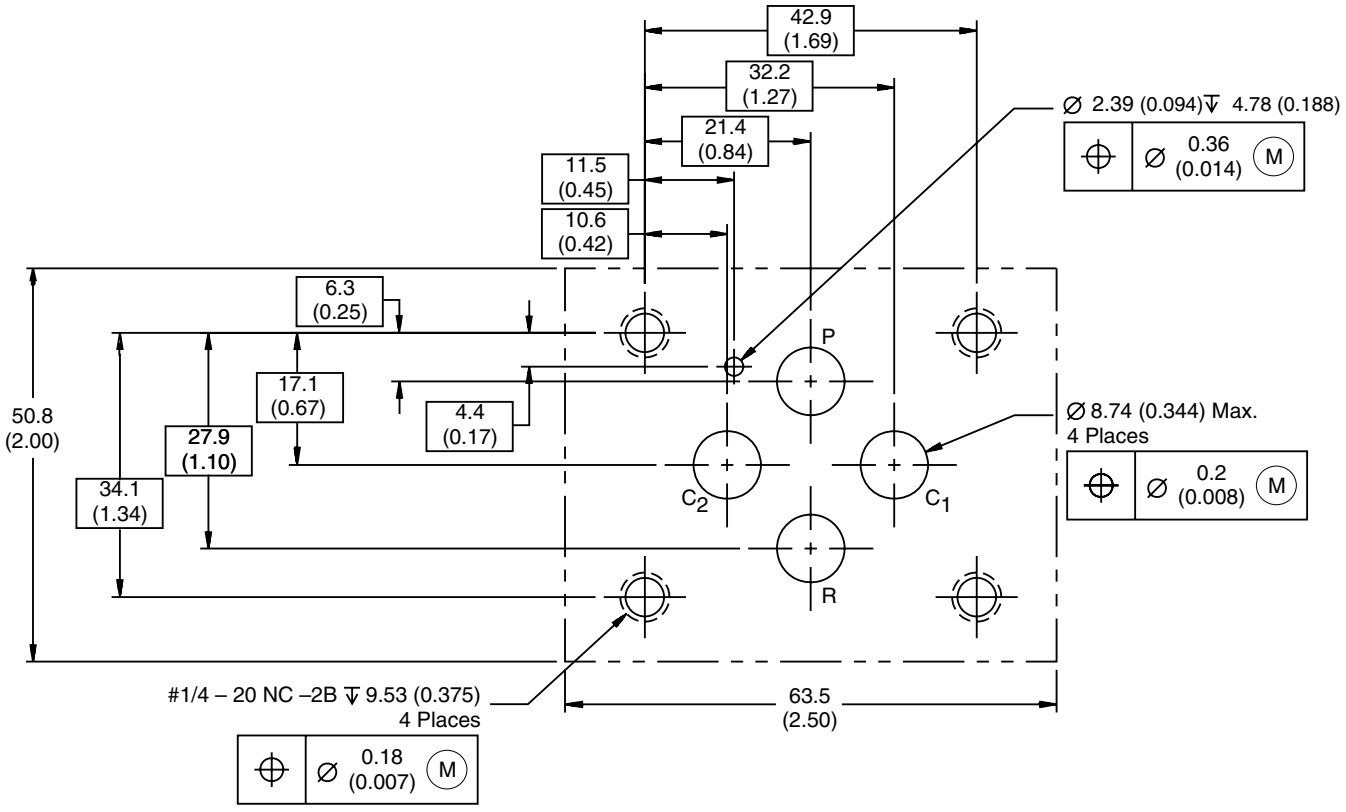


Connector over C1 port





Mounting Interface

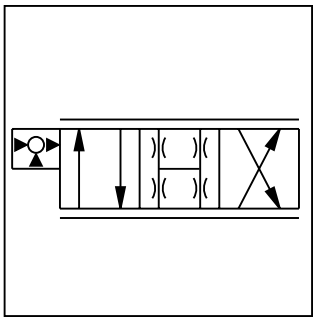


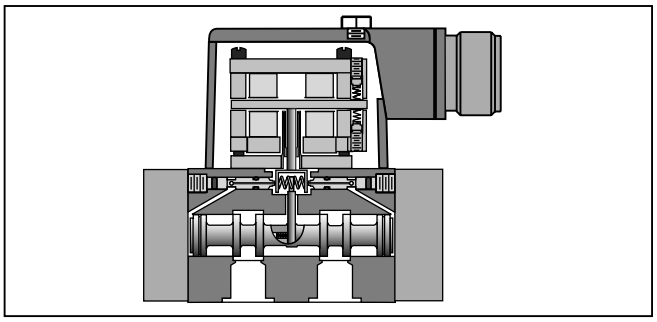
DY12.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY15 are two stage, 4-way, flapper and nozzle style servovalves. This valve is rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see next page).
- Survives high tank port pressures.

C

Specifications

Flow Rating @ 70 Bar (1000 PSID)	57, 75 and 95 LPM (15, 20 and 25 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.95 – 1.7 LPM (0.25 – 0.45 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 45 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 18 ms < 18 ms up to 75 LPM (20 GPM) < 20 ms up to 95 LPM (25 GPM)
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY15 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
15	57 LPM (15 GPM)
20	76 LPM (20 GPM)
25	95 LPM (25 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□ Factory Code for Special Options

Weight: 1.8 kg (3.9 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0600

Subplate: 55-0300-2 SAE-16 Side ports

Null Adjust Tool: 27-0210

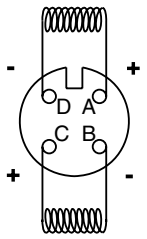
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

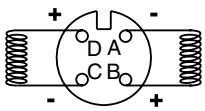
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

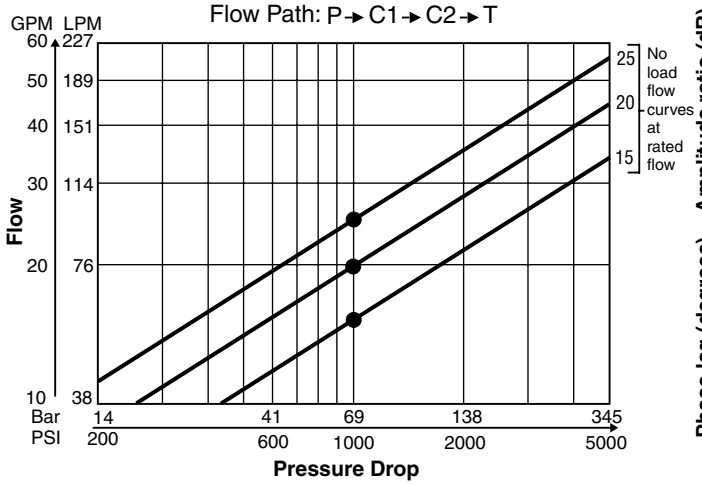


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

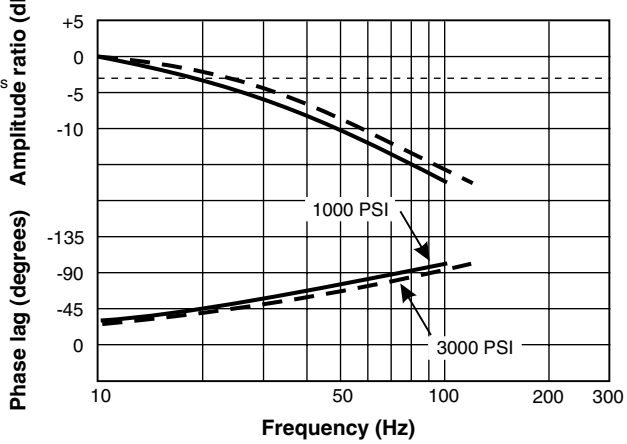
Performance Curves

DY15 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

DY15
All curves ± 40% Amplitude

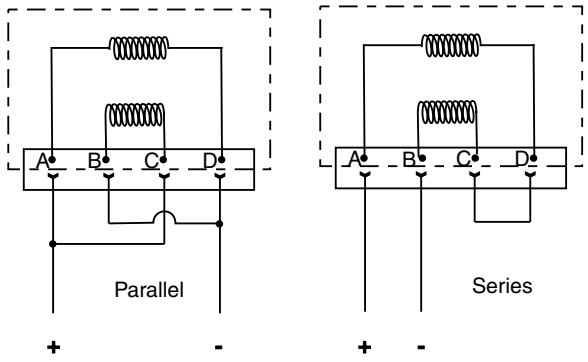


C

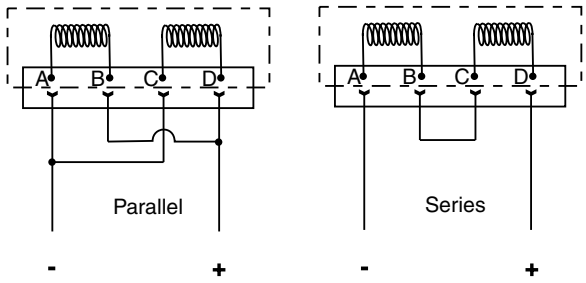
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



Option D

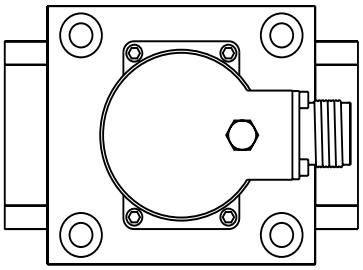


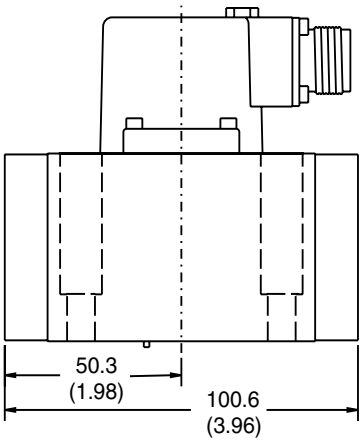
Polarity shown connects flow from P to C2 port.

C

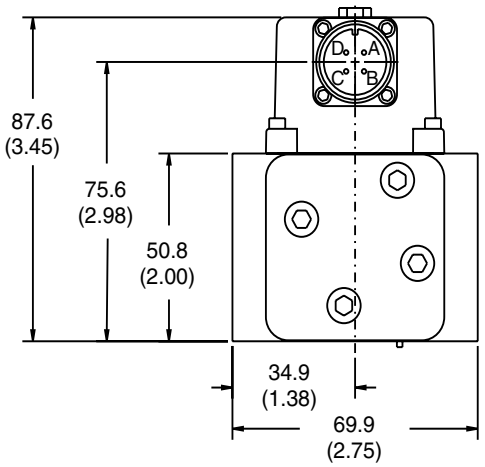
Dimensions

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

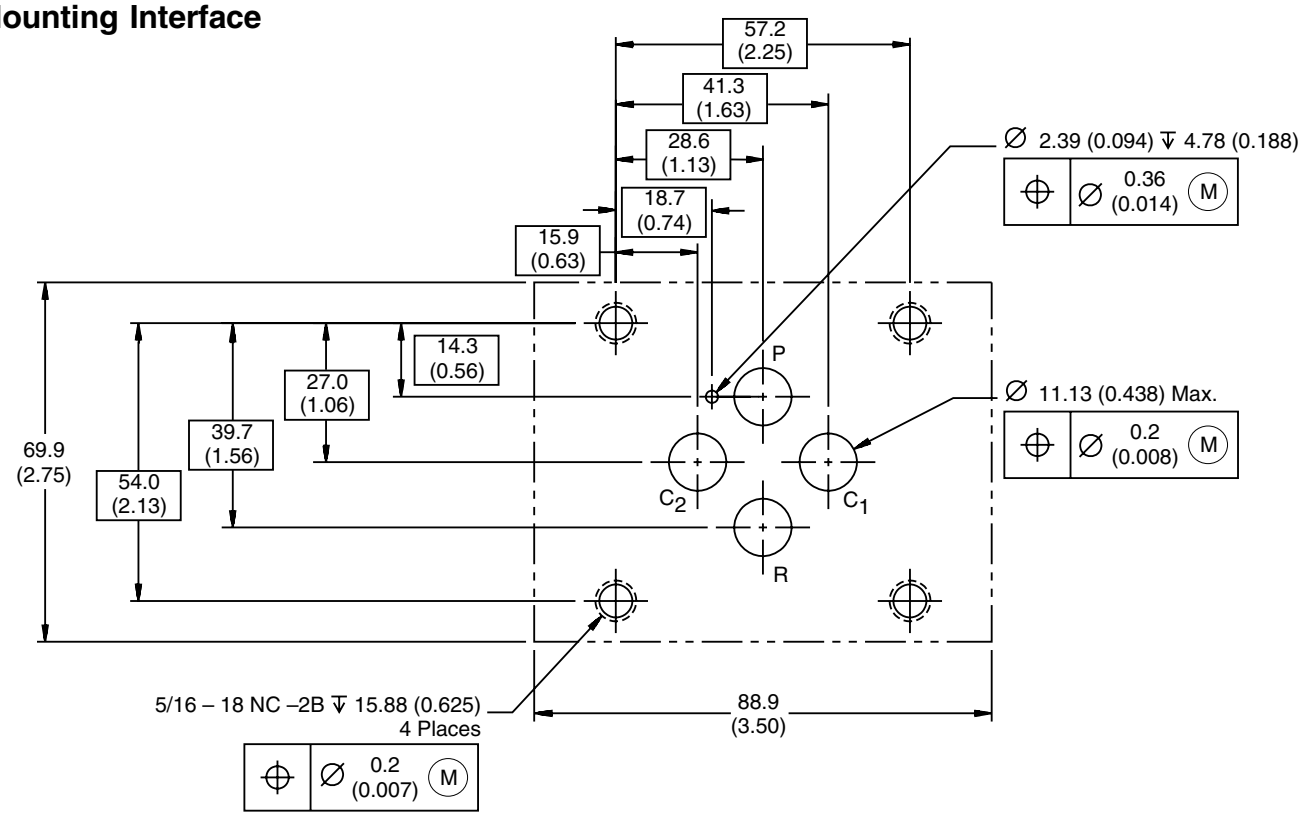




Connector over port C1



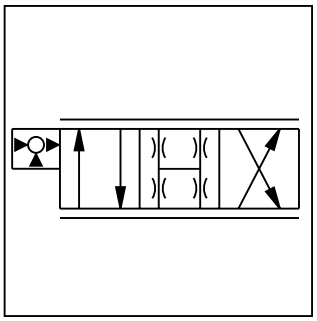
Mounting Interface

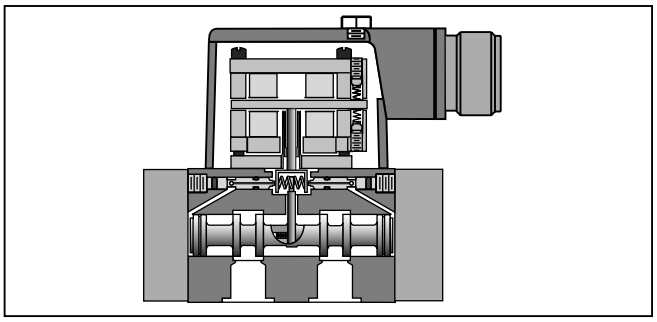


DY15.p65, dd

General Description

Series DY25 are two stage, 4-way, flapper and nozzle style servovalves. They have the same port pattern and body dimensions as the DY15, but use a higher force torque motor pilot. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction, and the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see next page).
- Survives high tank port pressures.

C

Specifications

Flow Rating @ 70 Bar (1000 PSID)	57 and 75 LPM (25 and 30 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.95 – 1.7 LPM (0.25 – 0.45 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 35 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 18 ms @ 95 LPM (25 GPM) < 20 ms @ 114 LPM (30 GPM)
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY25 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
R	750 ohm	30 mA	15 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
25	95 LPM (25 GPM)
30	114 LPM (30 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□ Factory Code for Special Options

Weight: 1.9 kg (4.2 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0600

Subplate: 55-0300-2 SAE-16 Side ports

Null Adjust Tool: 27-0210

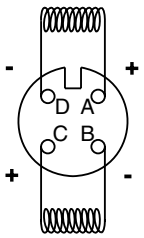
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95*, and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

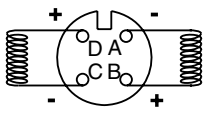
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

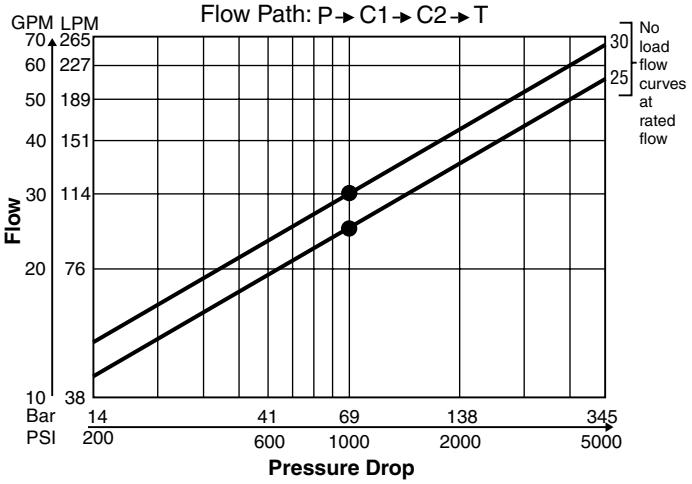


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

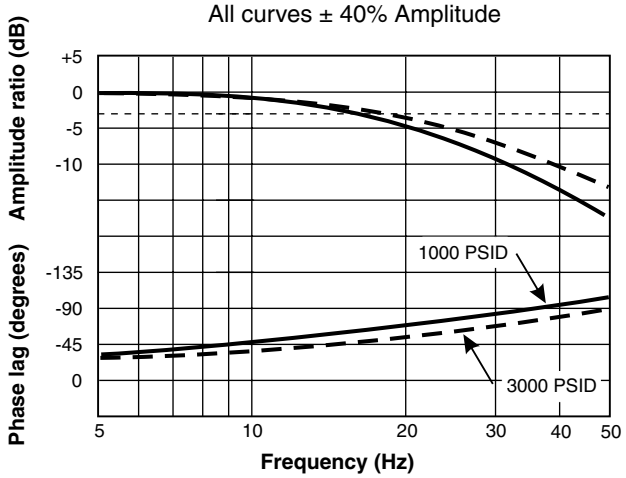
Performance Curves

DY25 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

DY25
All curves ± 40% Amplitude

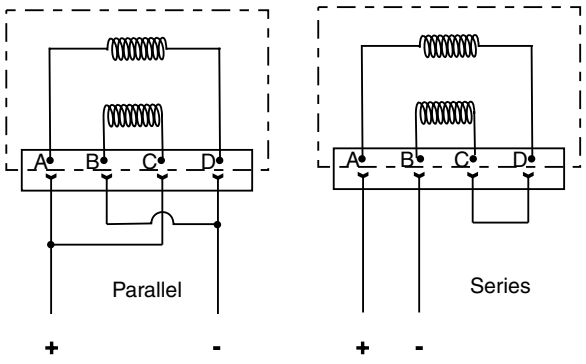


C

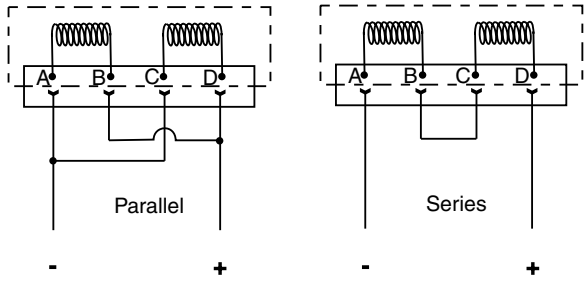
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



Option D

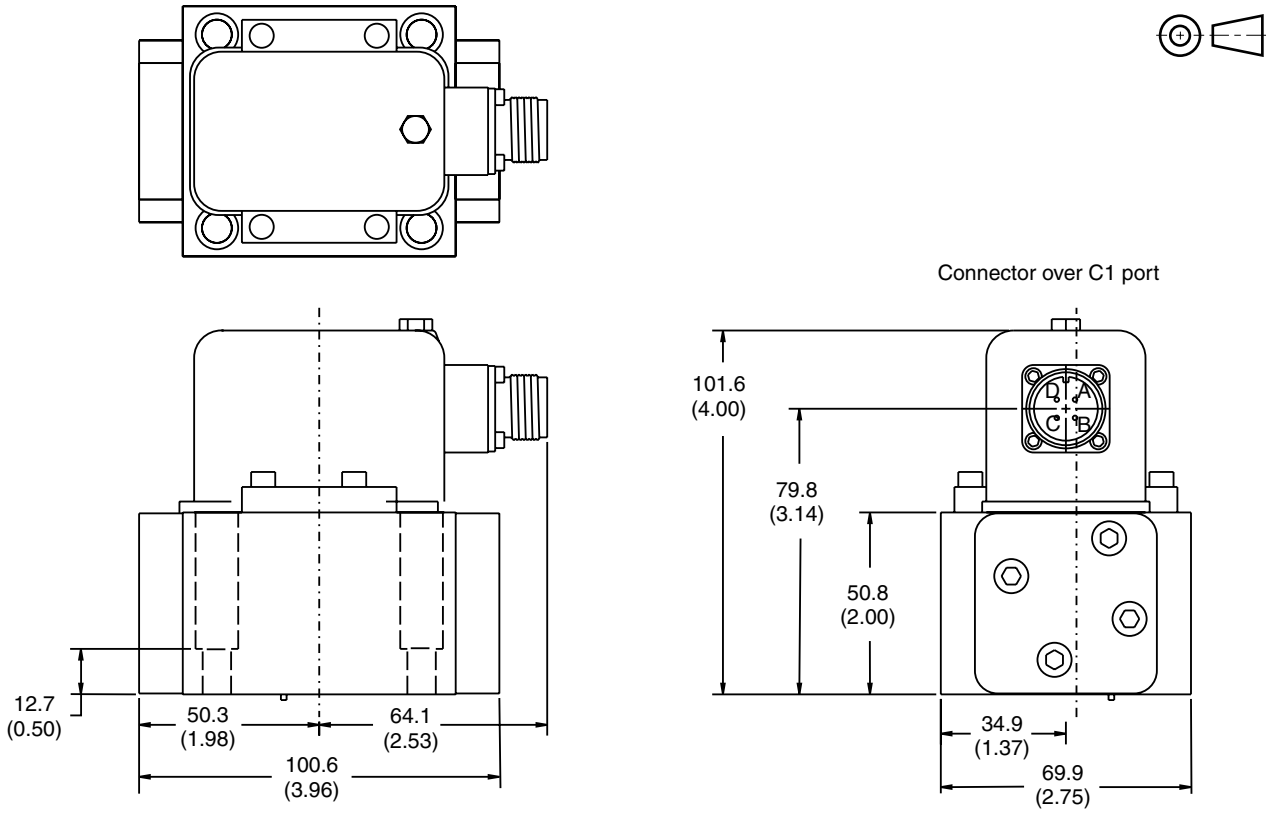


Polarity shown connects flow from P to C2 port.

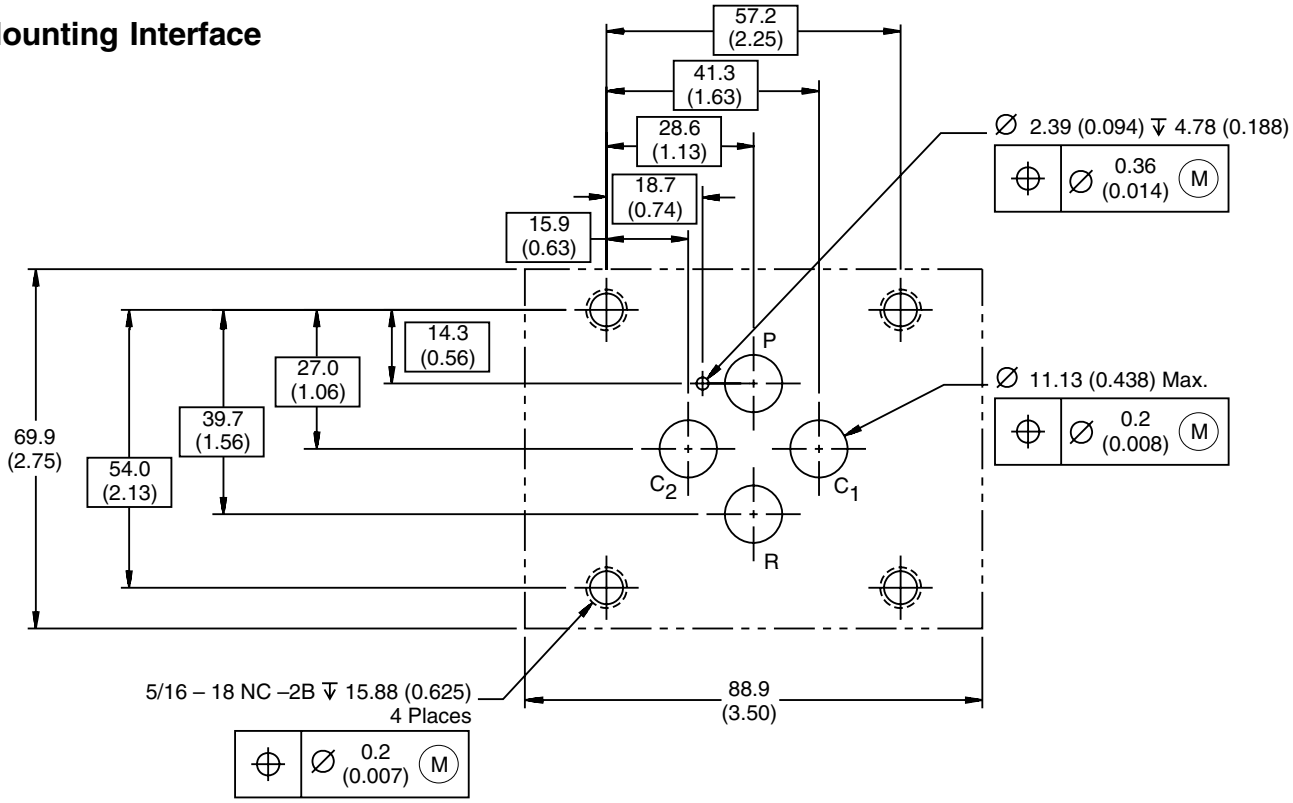
C

Dimensions

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



Mounting Interface

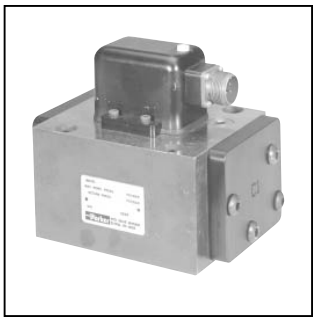


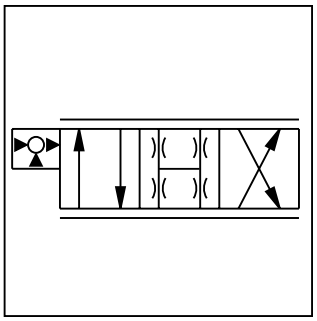
DY25.p65, dd

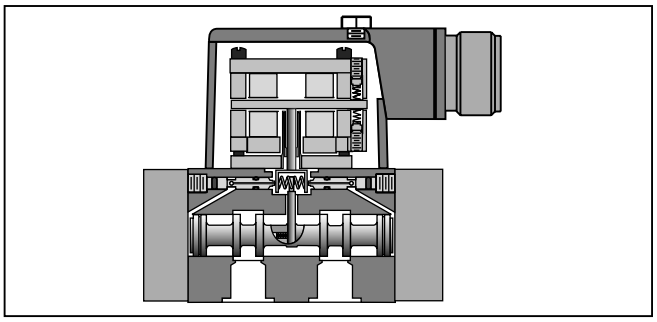
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY45 are two stage, 4-way, flapper and nozzle style servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction, and the optional stainless steel spool and body.







Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see mounting pattern).
- Survives high tank port pressures.

C

Specifications

Flow Rating @ 70 Bar (1000 PSID)	150, 190 and 225 LPM (40, 50 and 60 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	1.3 – 2.7 LPM (0.35 – 0.70 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 30 Hz at ±10% amplitude
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 25 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY45 — Series

□ — Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ — Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
R	750 ohm	30 mA	15 mA
Z	Special (specify)		

□ — Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ — Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ — Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ — Flows

Code	Description
40	150 LPM (40 GPM)
50	190 LPM (50 GPM)
60	225 LPM (60 GPM)

□ — Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

⌐ ⌐ ⌐ ⌐ ⌐ ⌐ — Factory Code for Special Options

Weight: .3 kg (16.0 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0700

Subplate: 55-0200-2 SAE-24 Side ports

Null Adjust Tool: 27-0210

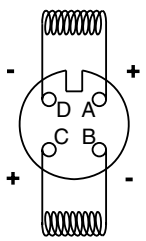
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

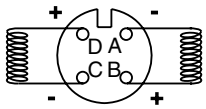
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

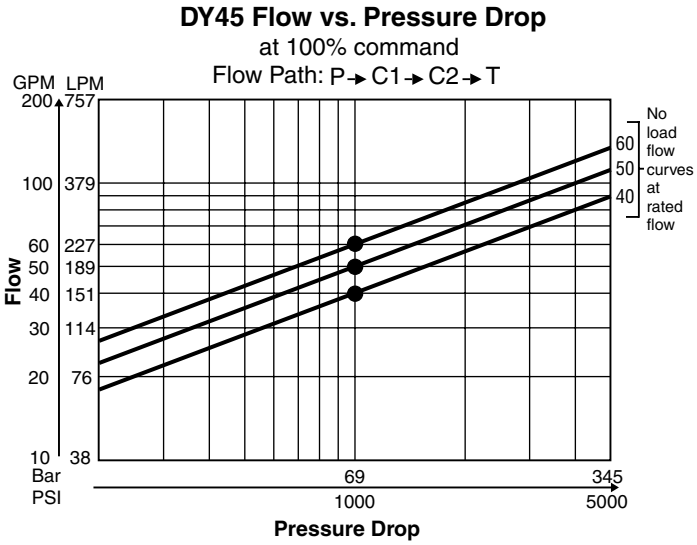
Wiring Option D



Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

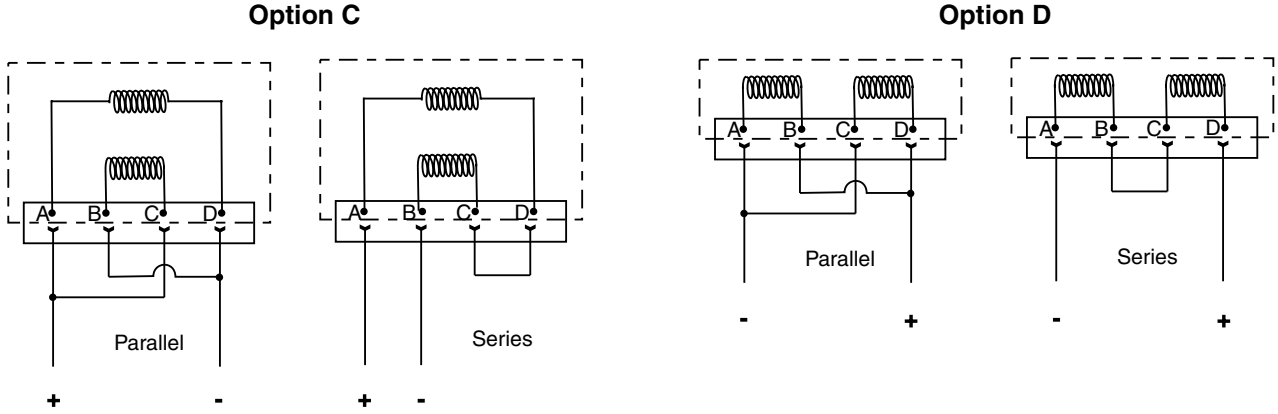
Performance Curves



C

Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

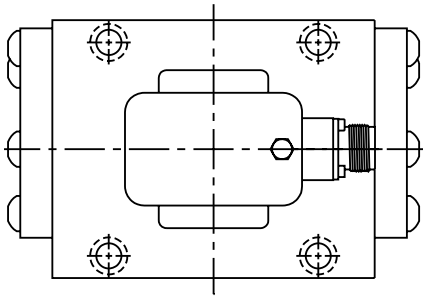


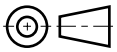
Polarity shown connects flow from P to C2 port.

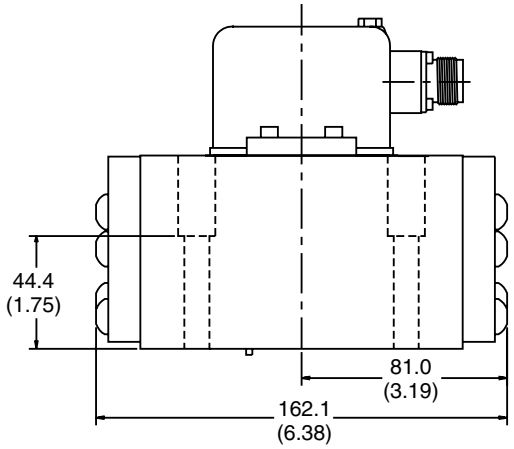
C

Dimensions

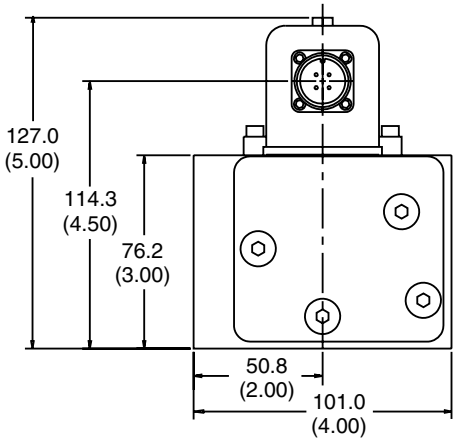
Inch equivalents for millimeter dimensions are shown in (**)



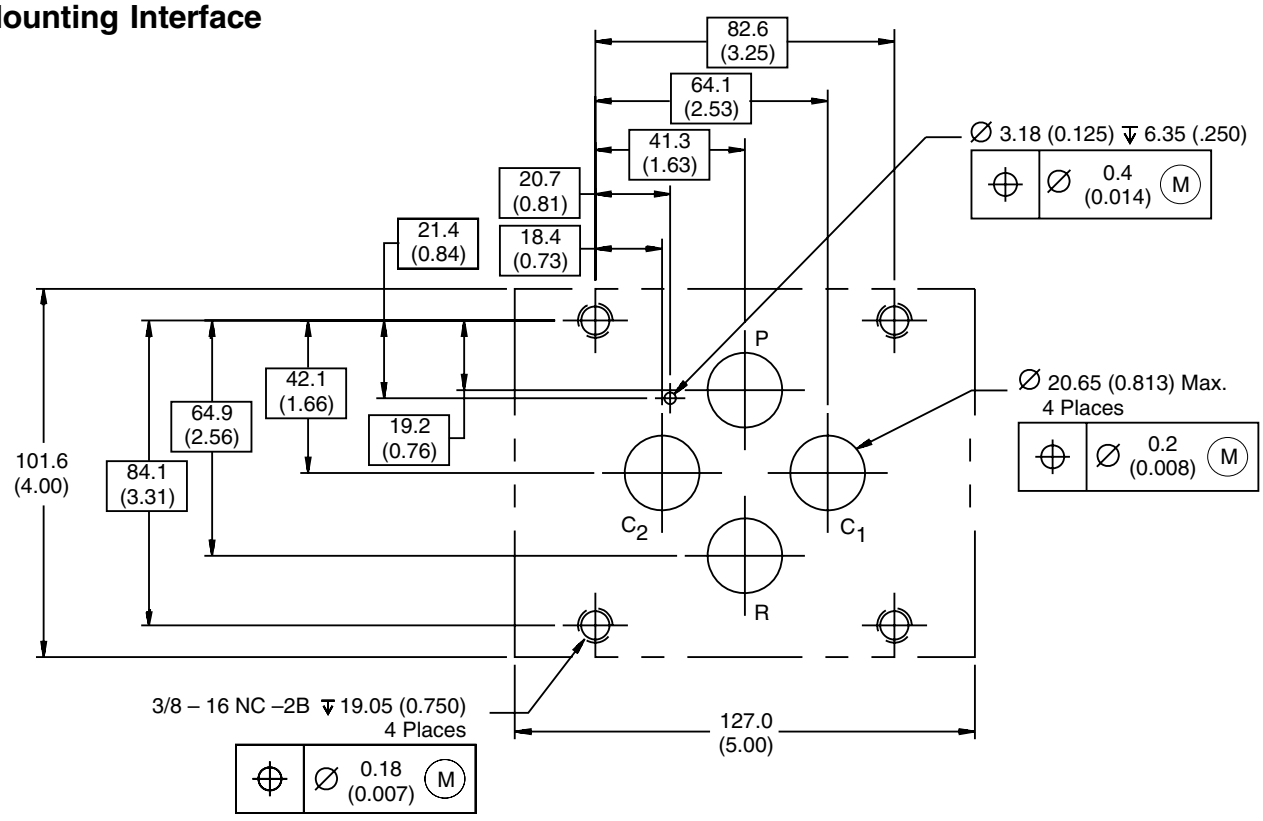




Connector over C1 port



Mounting Interface



DY45.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Contents

Drivers – Proportional Directional Valves

Series	Valve Application	Description	Page
PWD00A-400	D**FW, D*FB, WLL, RLL	Programmable, Min, Max, Ramps, Setpoints	D2 - D4
PWDXXA-40*	D**FS, D*FC, RLL*R	Programmable, Feedback, Min, Max, Ramps	D5 - D8
EW01104	D1FW	Adjustable; Min, Max, 2 ramps, 1 external ramp	D9 - D10
PW**404	D*FW, D*1FW, WLL, RLL	Adjustable; Min, Max, 2 ramps	D11 - D13
EW101	D**FS	Adjustable; 4 commands, 2 ramps	D14 - D15
EW102	D**FS	Basic driver	D16 - D17
EW104	D**FS	Adjustable; Min, Max, 2 ramps	D18 - D19

Drivers – Proportional Pressure Control Valves

Series	Valve Application	Description	Page
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ED102	DWE, DWU, RE*W	Basic driver	D26 - D27
ED104	DWE, DWU, RE*W	Adjustable; Min, Max, 2 ramps	D28 - D29

Drivers – Proportional Throttle Valves

Series	Valve Application	Description	Page
PCD00A-400	TDA, TEA	Programmable, Min, Max, Ramp	D20 - D23
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ET102	TDA	Basic driver ("L" Solenoid)	D32 - D33
ET104	TDA	Adjustable; Min, Max, 2 ramps ("L" Solenoid)	D34 - D35
ET105	TDA	Adjustable; Min, Max ("L" Solenoid)	D36 - D37
ET154	TDA, TEA	Adjustable, Min, Max ("M" Solenoid)	D38 - D39

Drivers – Servovalves

Series	Valve Application	Description	Page
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BD101	BD15/BD30/Dyval	Closed loop, PI, snap track	D58 - D59

Auxiliary Function Cards

Series	Valve Application	Description	Page
PZD00A-40*	all	Programmable, Signal Conditioning	D44 - D47
EZ150	all	Adjustable; 6 commands, 7 ramps	D48 - D49
EZ154	all	Adjustable; Min, Max, 2 ramps, 1 external ramp	D50 - D51
EZ155	all	Adjustable; 4 commands, 2 ramps, 1 external ramp	D52 - D53
EZ595	D*FP, D*FH, D*FX	Closed loop PID, DIN card	D54 - D56
BD101	D*FP, D*FH, D*FX, BD**	Closed loop PI, snap track	D58 - D59

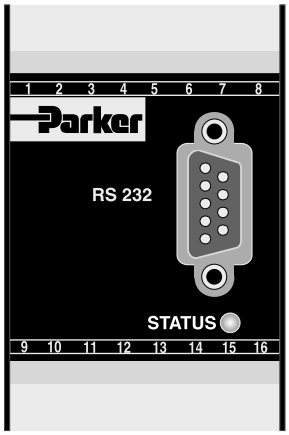
Power Supplies

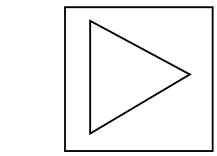
Series	Valve Application	Description	Page
PS15	all	±15 volt power supply	D60
PS24	all	24 volt power supply	D61
Card Holders	all	DIN Card holders	D62

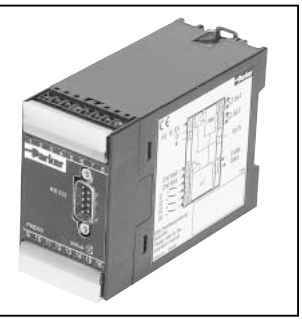
General Description

Series PWD00A-400 electronic module for driving open loop proportional valves is compact and easy to install with DIN rail mounting and plug-in terminals. The digital design allows for programmable parameters such as solenoid drive current, mins and maxs, and ramps. Profiles controlled by on-off logic signals can be configured through internal velocity setpoints and ramps. The module provides flexibility for different applications and repeatability from unit to unit. The module parameters are programmed with an RS-232 interface and user friendly software (ProPxD) with default values for the standard valves.

The PWD00A-400 module contains the functions required by typical open loop proportional valve applications (series D*FB, D*FW, D*1FW, WLL, RLL valves).







Features

- Programmable parameters.
- Analog or Profile Capability.
- RS-232 Interface.
- User friendly programming software.
- Plug-in terminals.
- Four independent ramps.
- Input Enable with Status indicator.
- Differential input on analog command.
- Compliant with European EMC Standards.

Specifications

General			
Model	Module package for snap-on mounting on EN 50022 rail	**Mounting Position**	Any
Package Material	Polycarbonate	**Ambient Temperature Range**	-20°C to +60°C (-4°F to +140°F)
Inflammability Class	V2 to V0 acc. UL 94	**Protection Class**	IP 20 acc. DIN 40050

Electrical			
Duty Ratio	100%	**Channel Recall Signal**	Off – 0 to 5.0 VDC; On – 8.5 to 30 VDC; Ri = 30K ohm
Supply Voltage	18 VDC to 30 VDC, ripple < 5% eff., surge free (29 VDC to 30 VDC for 24V coils)	**Status Signal**	Off – 0 to 0.5 VDC; On – Supply Voltage; rated max. 15 mA
Switch-on Current Typ.	22A for 0.2 mS	**Adjustment Ranges** Minimum Maximum Ramp Time Zero Offset Current	**preset** 0 to 50% 0 to 1000 50 to 100% 0 to 1000 0 to 32.5 s 0 to 32.5 +75 to -75% +1000 to -1000 0.8/3.5/2.7/1.8/1.3 A 0/1/2/3/4/5
Current Consumption Max.	2.0A		
Pre-fusing	2.5A medium lag		
Command Signal	+10 to 0 to -10 VDC, ripple < 0.01 % eff., surge free, Ri = 150K ohm **Do not input a command greater than ±10 VDC.**	**Interface**	RS 232C, DSub 9p. male for null modem cable
		EMC	EN 50081-2, EN 50082-2
Input Signal Resolution	0.025%	**Connection**	Screw terminals 0.2 to 2.5 mm², plug-in
Differential Input Voltage Maximum	30V for terminals 5 and 6 against PE (terminal 8)	**Cable Specification**	16 AWG overall braid shield for supply voltage and solenoids 20 AWG overall braid shield for sensor and signal
Enable Signal	Off – 0 to 5.0 VDC; On – 8.5 to 30 VDC; Ri = 30K ohm	**Cable Length**	50m (164 ft.)

Ordering Information

PWD — Electronic Module DC Valve

00 — Position Control Universal

A

—

400 — Module Type

Code	Description
400	Amplifier, MIN/MAX adjustable, UP/DOWN ramps, Command inputs

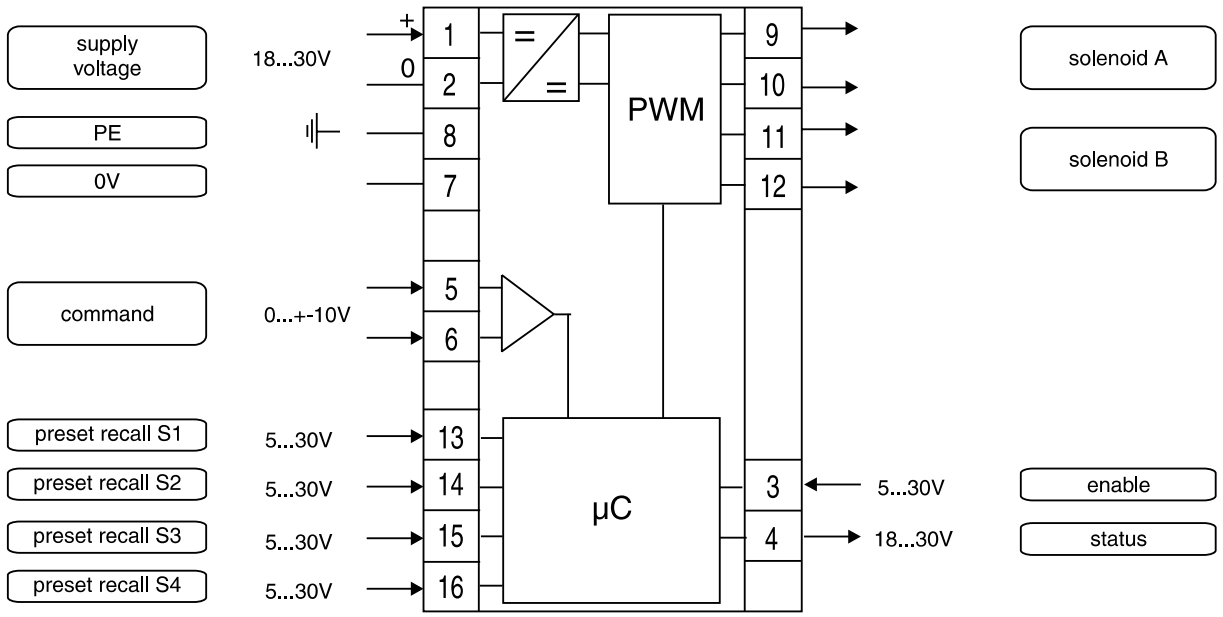
—

[ ] — Design Series

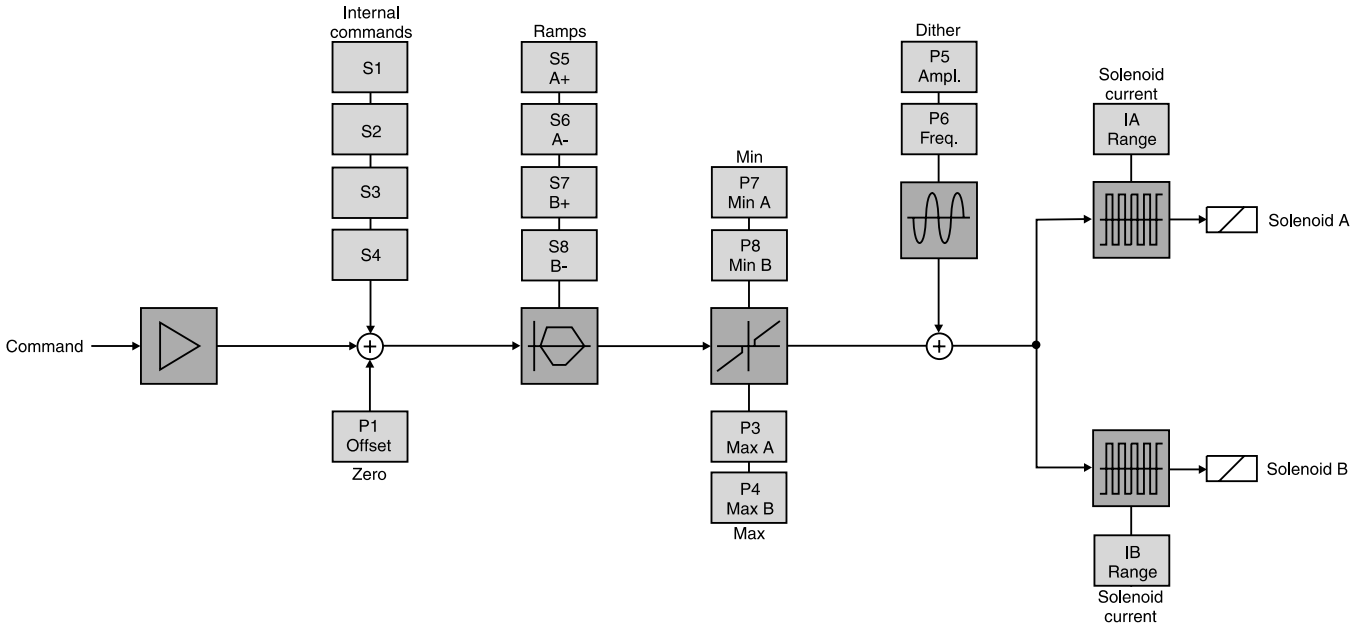
NOTE: Not required when ordering.

Weight: 160 g (0.35 lbs.)

Block Diagram



Signal Flow Diagram

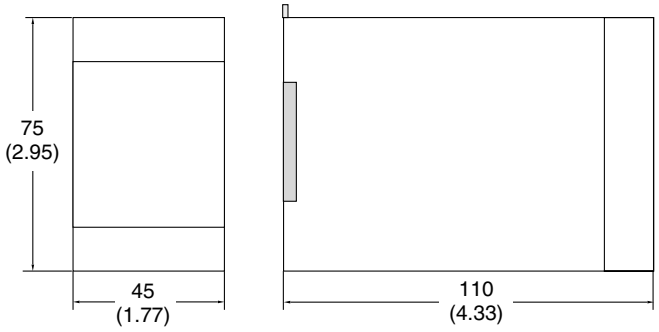


PWD00A-400.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Dimensions

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



D

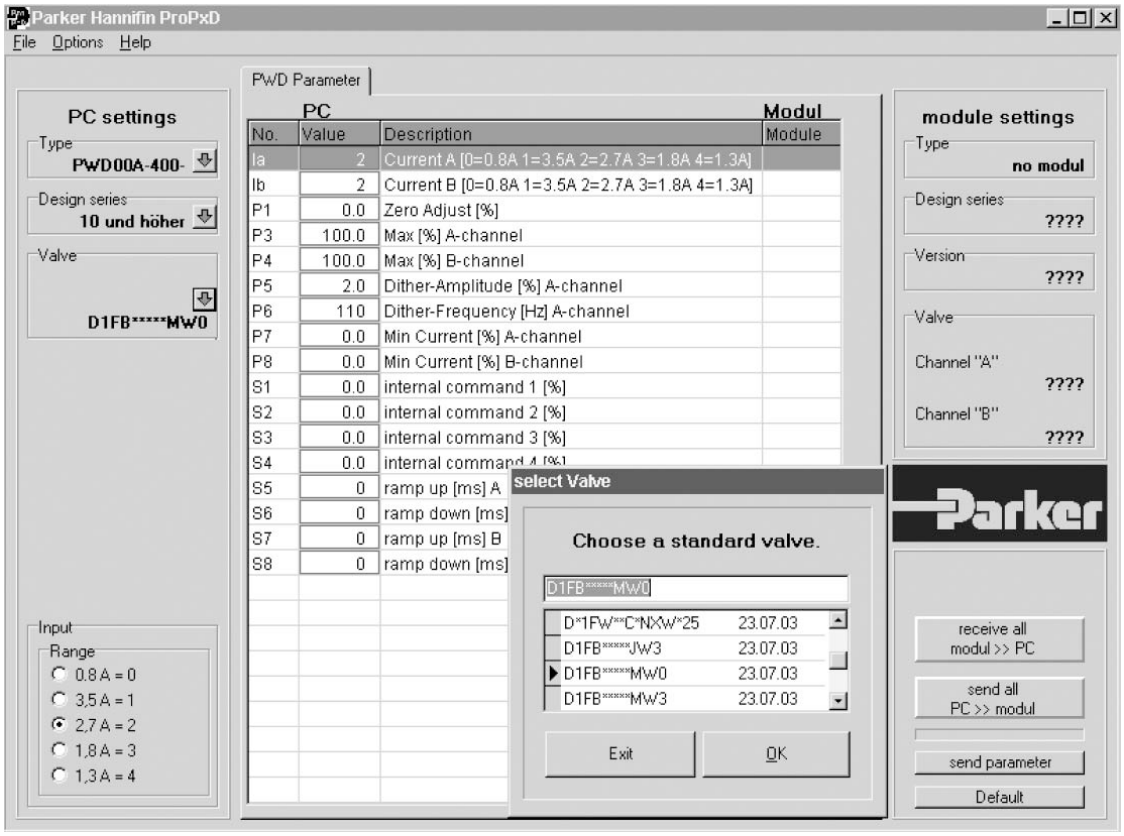
ProPxD Interface Program

The new ProPxD software permits user-friendly parameter setting for the electronic module series PCD, PWD and PZD.

Via the clearly arranged entry screen the parameters can be identified and modified. Storage of complete parameter sets to floppy or hard disk is possible as well as printout or record as a text file for further documentation. Stored parameter sets may be loaded anytime and transmitted to the electronic module in the same manner as the default parameters which are available for all standard valve series. Inside the electronic a nonvolatile memory stores the data with the option for recalling or modification.

Features

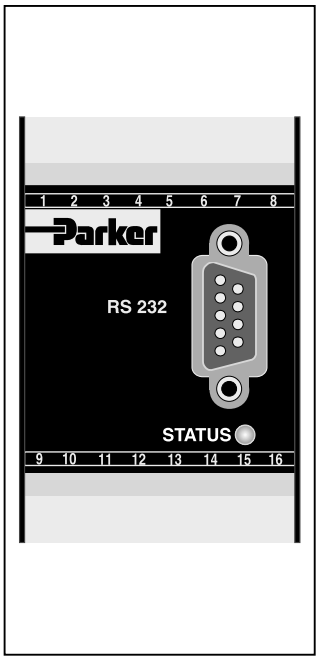
- User-friendly editing of all parameters.
- Default values for standard valves.
- Identification and documentation of parameter sets.
- Executable with all actual Windows® operating systems from Windows® 95 upwards.
- Simple communication between PC and electronic via serial interface RS-323 and nullmodem cable.

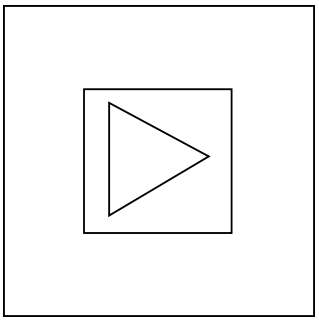


General Description

Series PWDXXA-40* electronic module for driving proportional valves with spool position feedback is compact and easy to install with DIN rail mounting and plug-in terminals. The digital design allows for programmable parameters such as solenoid drive current, mins, maxs, ramps and a range of position feedback signals. The module provides flexibility and repeatability from unit to unit. The module parameters are programmed with an RS-232 interface and user friendly software (ProPxD) with default values for standard valves.

The PWDXXA-40* module contains the functions required by typical internal closed loop proportional valve applications (series D*FC, D*1FS, RLL*R, WLL*R and TEL valves).



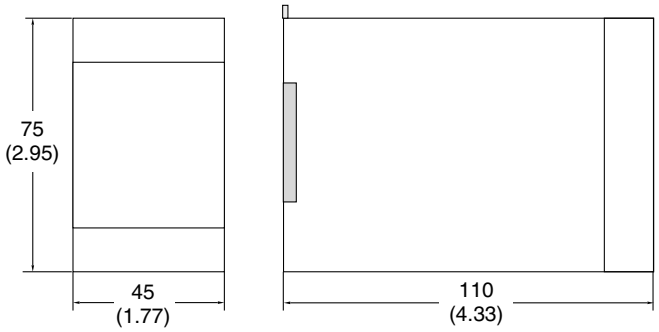


Features

- Interface and tuning for spool position feedback.
- Programmable parameters.
- ±10V, ± 20 mA, 4-20 mA position transducer input.
- RS-232 Interface.
- User friendly programming software.
- Plug-in terminals.
- Four independent ramps.
- Input Enable with Status indicator.
- Differential command input.
- Compliant with European EMC Standards.

Dimensions

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



Specifications

General			
Model	Module package for snap-on mounting on EN 50022 rail	**Mounting Position**	Any
Package Material	Polycarbonate	**Ambient Temperature Range**	-20°C to +60°C (-4°F to +140°F)
Inflammability Class	V2 to V0 acc. UL 94	**Protection Class**	IP 20 acc. DIN 40050
Electrical			
Duty Ratio	100%	**Status Signal**	Off – 0 to 0.5 VDC; On – Supply Voltage; rated max. 15 mA
Supply Voltage	18 VDC to 30 VDC, ripple < 5% eff., surge free	**Monitor Signal**	+10 to 0 to -10 VDC, rated max. 5 mA, signal resolution 0.4%
Switch-on Current Typ.	22A for 0.2 mS	**Adjustment Ranges**	Minimum 0 to 50% Maximum 50 to 100% Ramp Time 0 to 32.5 s Zero Offset +100 to -100% Current 1.3/2.7/3.5 A Initial Current 0 to 25%
Current Consumption Max.	2.0A		
Pre-fusing	2.5A medium lag		
Command Signal	+10 to 0 to -10 VDC, ripple < 0.01 % eff., surge free, Ri = 100K ohm +20 to 0 to -20 mA, ripple < 0.01 % eff., surge free, Ri = 200K ohm 4 to 12 to 20 mA, ripple < 0.01 % eff., surge free, Ri = 200 ohm < 3.6 mA = solenoid output off, > 3.8 mA = solenoid output on (acc. NAMUR NE43)	**Interface**	RS 232C, DSub 9p. male for null modem cable
		EMC	EN 50081-2, EN 50082-2
		Connection	Screw terminals 0.2 to 2.5 mm², plug-in
		Cable Specification	16 AWG overall braid shield for supply voltage and solenoids 20 AWG overall braid shield for sensor and signal
Input Signal Resolution	0.025%		
Differential Input Voltage Max.	30V for terminals 5 and 6 against PE (terminal 8)	**Cable Length**	50m (164 ft.)
Enable Signal	Off – 0 to 2.5 VDC; On – 5 to 30 VDC; Ri = 30K ohm		
Options			
Technology Function	Code 1 – Software adjustable transfer function with 10 compensation points for linearization of valve behavior.		

D

Ordering Information

PWD — Electronic Module DC Valve

XX — Position Control Universal

A

—

40 — Module Type

Code	Description
40	Amplifier, MIN/MAX adjustment, UP/DOWN ramps, Command input

□ — Technology Function

Code	Description
0	Standard
1	Linearization Option

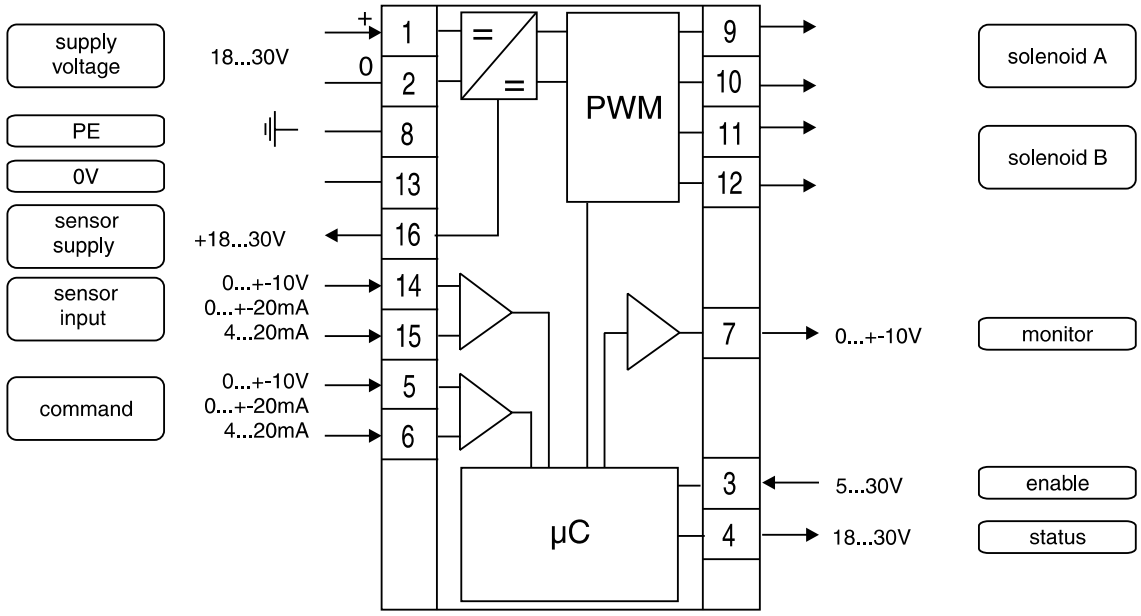
—

[ ] — Design Series

NOTE: Not required when ordering.

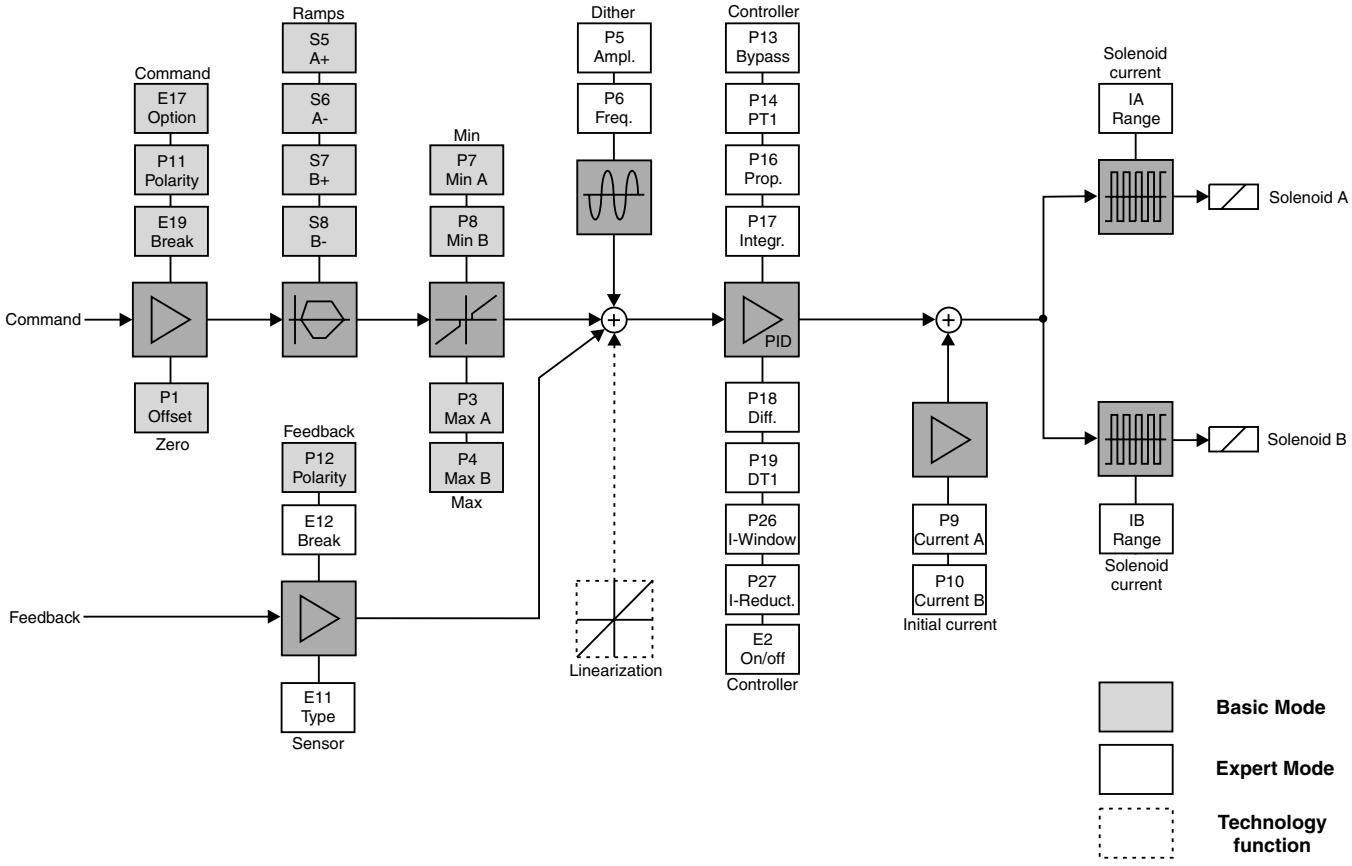
Weight: 160g (.35 lbs.)

Block Diagram



D

Signal Flow Diagram



ProPxD Interface Program

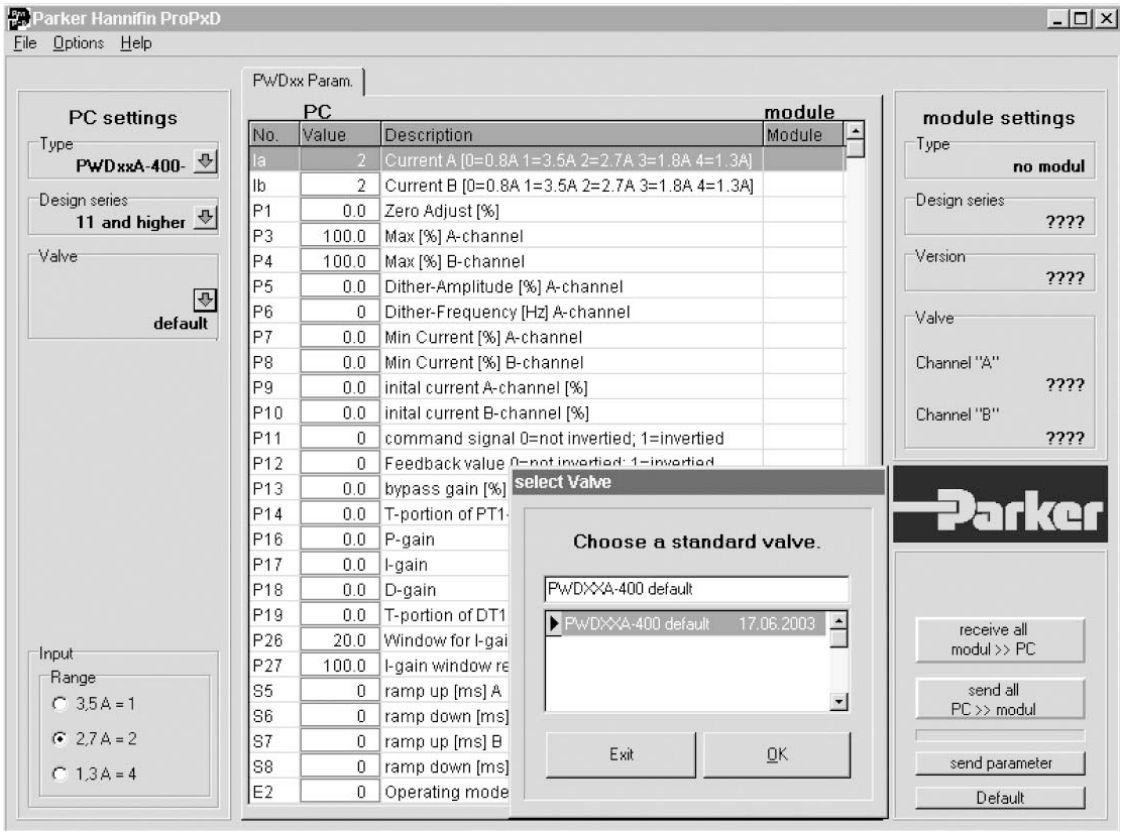
The new ProPxD software permits user-friendly parameter setting for the electronic module series PCD, PWD and PZD.

Via the clearly arranged entry screen the parameters can be identified and modified. Storage of complete parameter sets to floppy or hard disk is possible as well as printout or record as a text file for further documentation. Stored parameter sets may be loaded anytime and transmitted to the electronic module in the same manner as the default parameters which are available for all standard valve series. Inside the electronic a nonvolatile memory stores the data with the option for recalling or modification.

Features

- User-friendly editing of all parameters.
- Default values for standard valves.
- Identification and documentation of parameter sets.
- Executable with all actual Windows® operating systems from Windows® 95 upwards.
- Simple communication between PC and electronic via serial interface RS-323 and nullmodem cable.

D



General Description

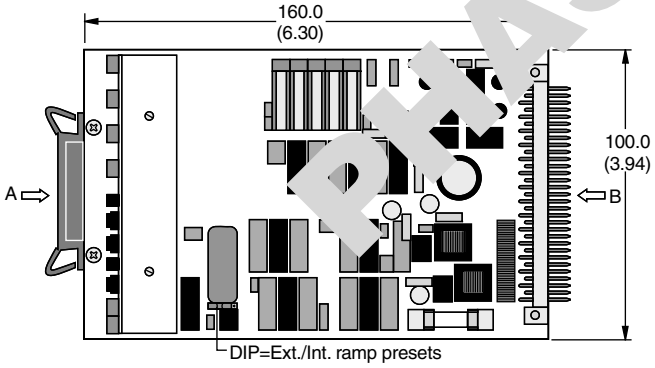
Series EW01104 electronic module is used to control non-feedback D1FW proportional directional valves. The module accepts a ±10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance.

Features

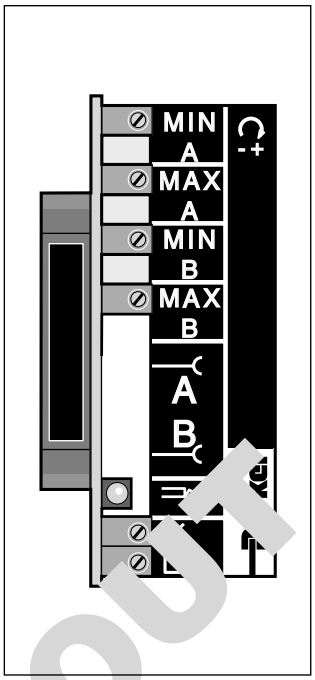
- Spool overlap range can be manipulated with MIN potentiometer, adjustable by feeding a constant set value of 0.2V.
- MAX limiting of spool stroke with full set value range. Can be set up after MIN has been set and feeding a constant set value of 10V.
- DIP — switch from internal ramp generation to external ramp supply.
- Pulsed low-loss amplifier power stage with supporting constant current control for constant, temperature-independent, solenoid forces.
- Dither generator with applied frequency to improve static characteristics.

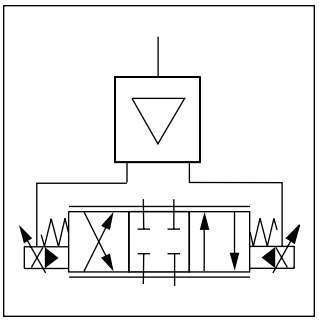
Dimensions

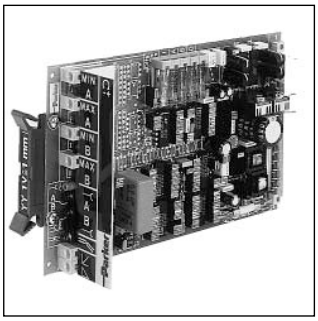
Inch equivalents for millimeter dimensions are shown in (**)



For new applications:
EW01104: Refer to PWD00A-400







Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Power Required	40 VA
Reference Outputs	±10 VDC @10 mA
Max. Solenoid Output Current	1.8A
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0-5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	24 medium lag, DIN 41571

Ordering Information

EW — Electronic Module Directional Valve

01 — Valve Size

Code	Valve Size	Mounting Pattern
01	*D1FW	NG6

*Solenoid K-12V

104 — Module Type

Code	Description
104	Amplifier, adjustable, MIN/MAX-limiting, UP/DOWN ramps

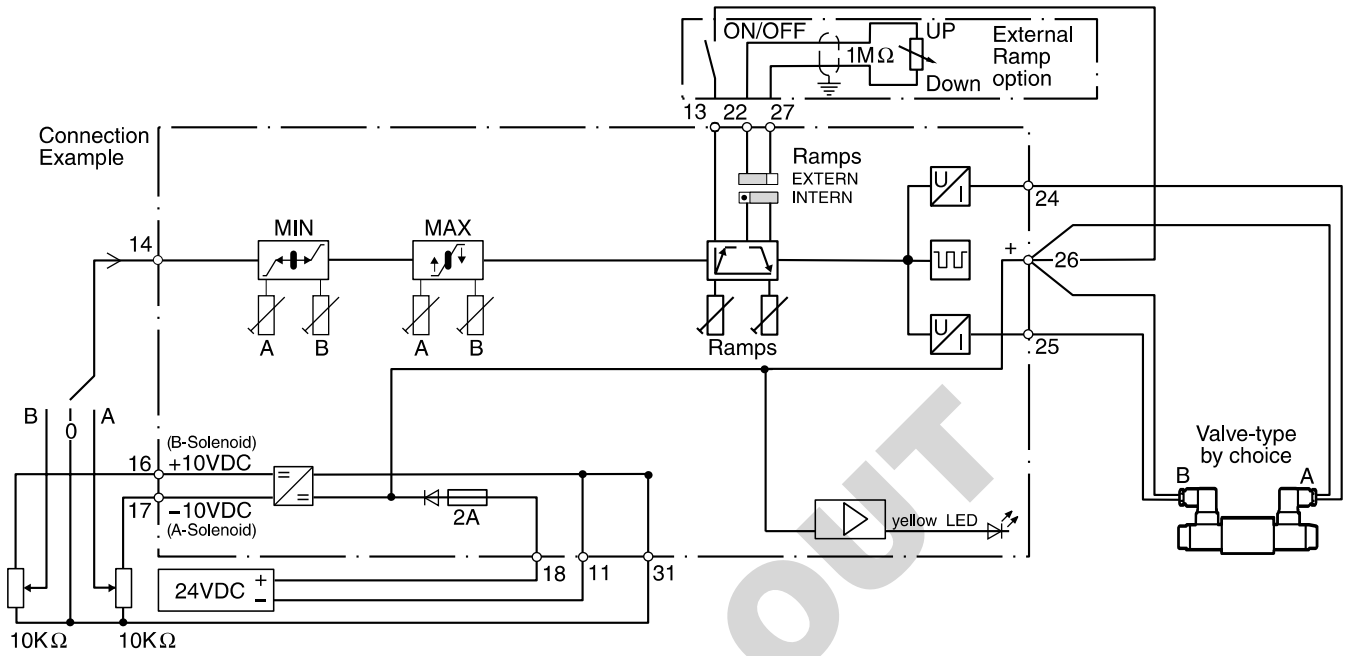
Design Series

NOTE: Not required when ordering.

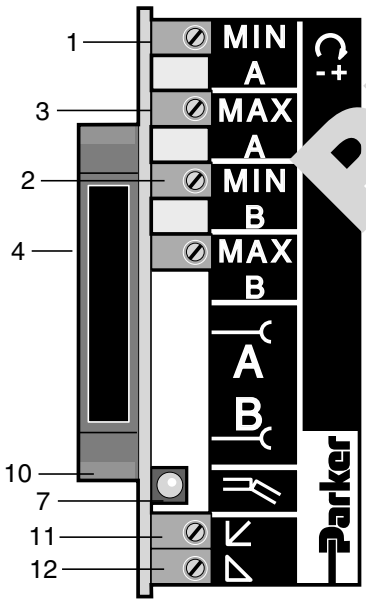
EW01104.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1–2 MIN limiting potentiometers for A and B sides

3–4 MAX limiting potentiometers for A and B sides

7 Yellow LED for:
- correct voltage supply

10 Blue grip strip

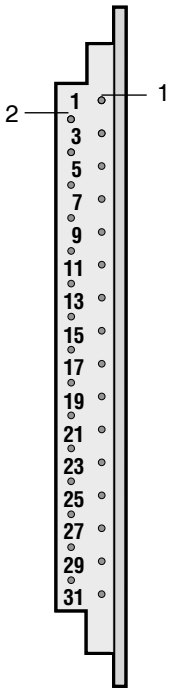
11 UP ramp potentiometer

12 DOWN ramp potentiometer

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



11 Reference potential 0V supply

13 Input ramp disable

14 Input command voltage 0...+/-10 VDC

16 Output +10V reference

17 Output -0V reference

18 Input 24 VDC supply

22 Input external ramp option

24 Output control solenoid B

25 Output control solenoid A

26 Output control solenoid A+B with possibility for external switch connection

27 Input external ramp option

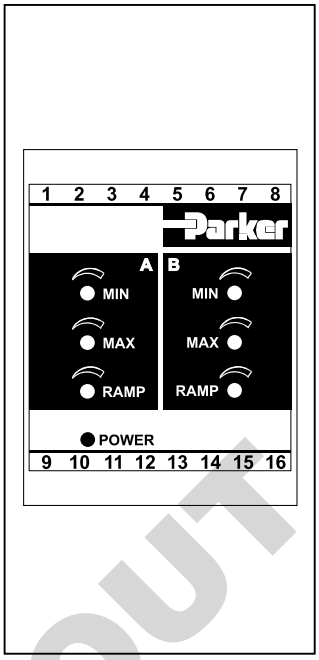
31 Reference potential 0V set value

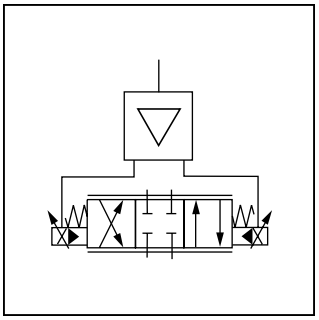
EW01104.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series PW**404 electronic module is used to control non-feedback D*FW and D*1FW proportional directional valves. The module accepts a ±10 volt or a ±20 mA command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. There is also a soft shift mode where on-off signals can trigger the module to command the attached valve to smoothly shift to a predetermined command position.



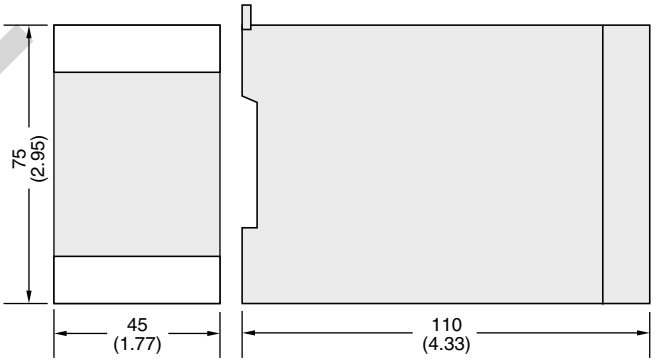


Features

- Driver for all D*FW and D*1FW proportional valves.
- Standard DIN rail package – EN 5022 rail mount.
- Differential command input (voltage or current).
- Adjustable Ramp generator.
- MIN adjustments for spool deadband compensation.
- MAX adjustments for maximum flow adjustment.
- Soft shift mode — user selectable.
- Detachable terminal strips.

Dimensions

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



Specifications

Package	DIN rail mount – EN 5022
Power Supply	30 VDC maximum, refer to “Valve Applications – Solenoid” for minimum voltage, 5% ripple max.
Current Consumption	3.5 amps max., 200 mA more than max. operating current. Refer to “Valve Applications — Solenoid” for rated solenoid current.
Command Signal	0 ± 10 VDC or 0 ± 20 mA user selectable
Command Polarity	Pin ‘5’ more positive than pin ‘6’ energizes ‘sol B’ (pins 11, 12)
Reference V. Outputs	10 VDC and -10 VDC; ±5%, 10 mA max.
Soft Shift Inputs **logic ‘off’** **logic ‘on’**	 0 to 5 VDC 11.5 to 30 VDC, 15 mA (max. load)
Soft Shift Polarity	Pin ‘15’ triggers ‘solenoid B’ Pin ‘16’ triggers ‘solenoid A’

Max. Output Current	See Ordering Information
Dither Frequency @ Amplitude	100 Hz @ 6% of rated current
Ramp Time	Adjustable; 0 to 3 seconds
Ambient Temperature	-20°C to 60°C (-20°F to 140°F)
Electrical Connection	Screw-in terminals, removable
Shielded Cable	Supply connections and solenoids 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Cable Length	50 M (162 feet) max.
Cable Capacitance	130 pf/M between conductors, max.
EMC Compatibility	EN 50081-2, EN 50082-2, EN 55011, ENV 50140, EN61000-4-4, EN50204, EN61000-4-5, EN61000-4-2, EN61000-4-6

Ordering Information

PW — Packaged Module DC Valves

□ — Maximum Current

Code	Description
18	1.8A
25	2.5A
35	3.5A

A —

404 — Module Type

Code	Description
404	Amplifier, adjustable, MIN/MAX-limiting, UP/DOWN ramps

⌐ ¬ — Design Series

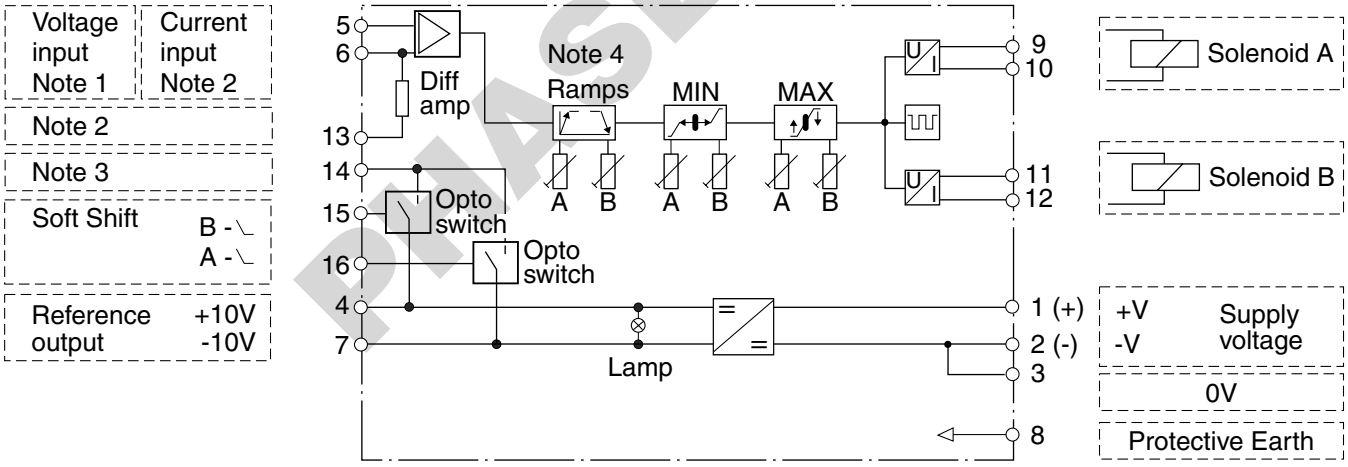
NOTE: Not required when ordering.

For new applications:
PW404: Refer to PWD00A-400**

D

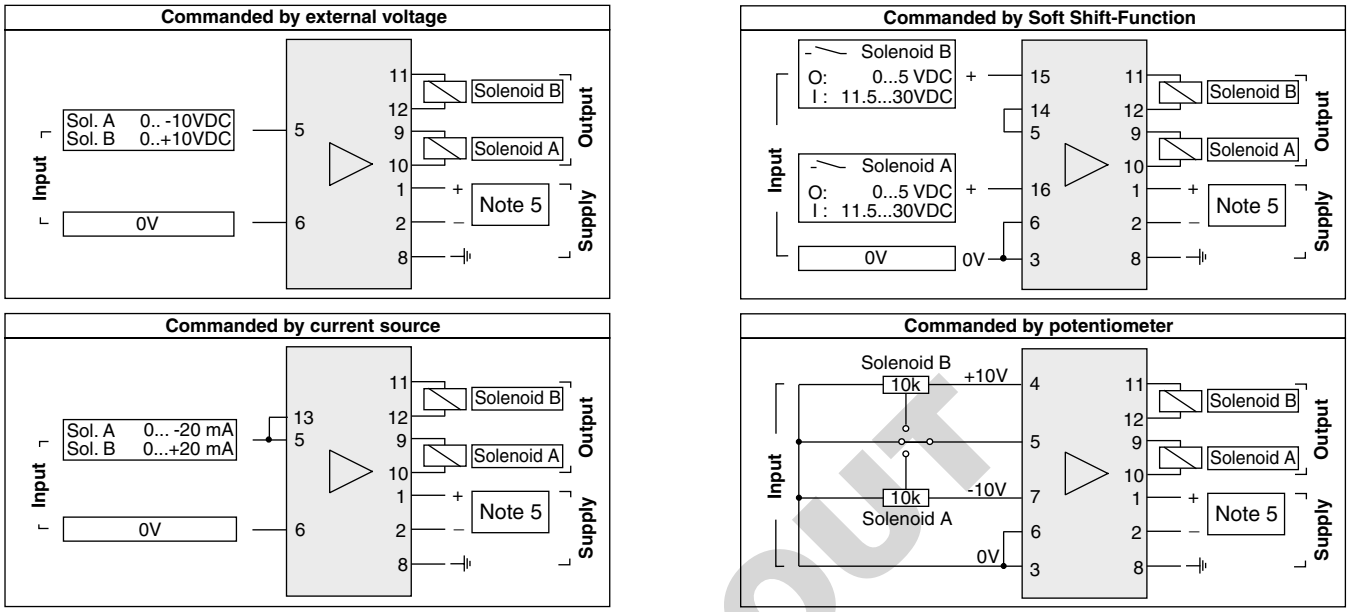
PHASE OUT

Block Diagram



Note 1: For voltage command inputs (±10V), use pins 5 and 6. Refer to command polarity specifications.
Note 2: For current command inputs (±20 mA), connect pins 5 and 13, and apply current command signal to pins 5 and 6. Refer to command polarity specifications.
Note 3: For soft-shift mode, connect pins 5 and 14. "On" signal to pin 15 triggers "solenoid B"; "On" signal to pin 16 triggers "solenoid A". Adjust actuator speed with 'MAX' potentiometers, ramp times for soft shift with 'RAMP' potentiometers. Adjust 'MIN' potentiometers as required. Refer to specifications for required voltage levels.
Note 4: There are two ramp potentiometers. Ramp A adjusts both the acel and decel rate for "solenoid A". Ramp B adjusts both the acel and decel rate for "solenoid B".

Wiring Diagram



Note 5: Refer to Power Supply specificaton.

Valve Applications — Solenoid

Series PW*404 electronic module is used to control non-feedback one and two stage proportional valves. Refer to the chart below to determine the correct module current rating required for your valve application.

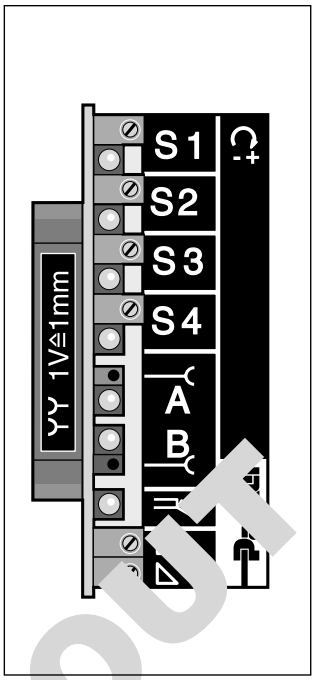
Valve Type	Code	Solenoid Rated Voltage (volts)	Solenoid Rated Current (amps)	PW Module (order code)	Supply Voltage Range (volts DC)
D1FW	K	12	1.8	PW18A-404	17.5 to 30
	M	9	2.5	PW25A-404	14.5 to 30
D3FW	K	12	2.5	PW25A-404	17.5 to 30
D*1FW	L	6	2.5	PW25A-404	11.5 to 30
	X	16	1.3	PW18A-404	21.5 to 30

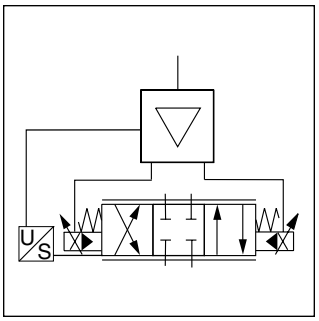
General Description

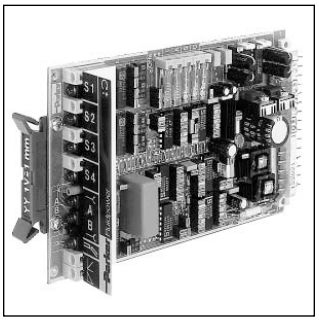
Series EW101 electronic module is used to control pilot operated D**FS proportional directional valves with main stage spool position feedback. The module accepts up to 4 on/off input signals which select one of four speeds set by potentiometer adjustments on the card. Two ramp adjustments provide control of actuator acceleration and deceleration.

Features

- Modulated valve-spool control by 4 selectable set values, adjustable from 0 to 100% and UP/DOWN ramp potentiometers.
- DIP-switch from internal ramp generation to external ramp setting.
- Pulsed low-loss amplifier power stage with supporting constant current control for consistent temperature-independent solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis of spool stroke by means of diagnostic sockets as well as LEDs for indicating working conditions.

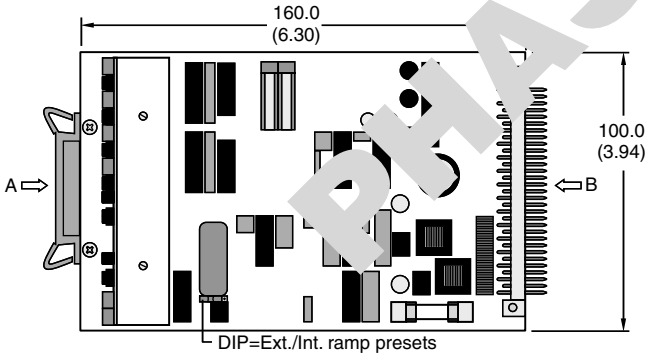






Dimensions

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



For new applications:
EW101: Refer to PWDXXA-400

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Power Required	40 VA
Reference Outputs	±10 VDC @10 mA
Max. Solenoid Output Current	1.3A
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0-5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Transducer + Command Signals: 0.5 sq. mm (20 AWG)
Fuse	24 medium lag, DIN 41571/5x20 mm

Ordering Information

EW — Electronic Module Directional Valve

□ — Valve Size

Code	Valve Size	Mounting Pattern	Valve Spool Stroke	
10	D31FS	NG10	±5.0 mm	(0.20 in.)
16	D41FS	NG16	±6.0 mm	(0.24 in.)
25	D81FS	NG25	±9.3 mm	(0.37 in.)
26	D91FS	NG25	±9.3 mm	(0.37 in.)
32	D111FS	NG32	±15.0 mm	(0.59 in.)

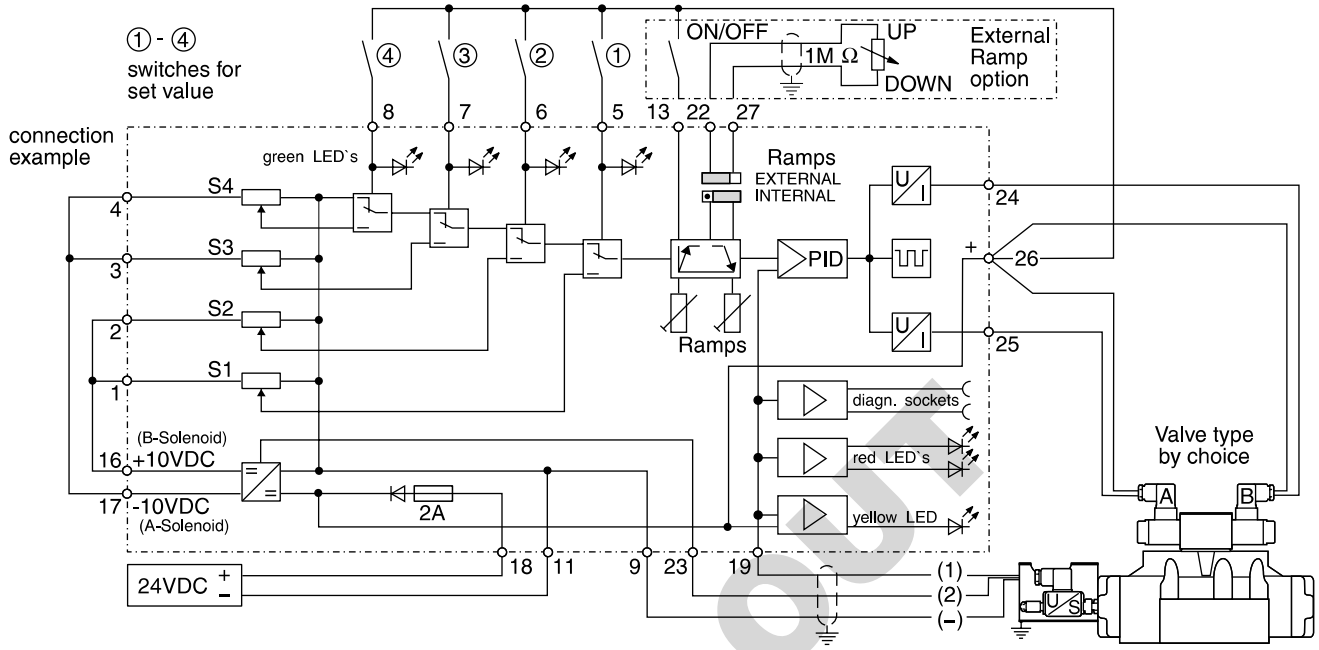
101 — Module Type

Code	Description
101	Amplifier, 4 Command Channels, UP/DOWN ramps

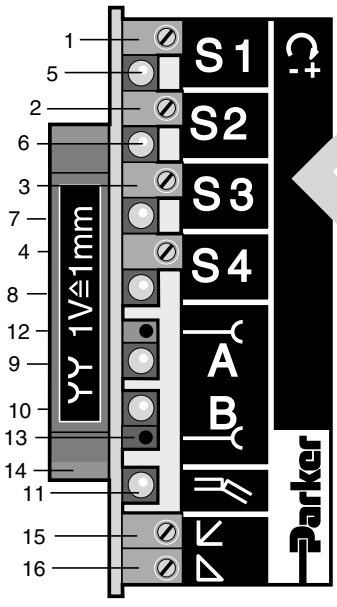
Design Series

NOTE: Not required when ordering.

Block Diagram



Operating and Diagnostic Elements (Elevation A)



Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

1–4 Set value potentiometer S1–S4

5–8 Green LED's for:
- channel activity of the set value

9–10 Red LED's for:
- Stroke direction indication

11 Yellow LED for:
- correct voltage supply
- correct transducer connection

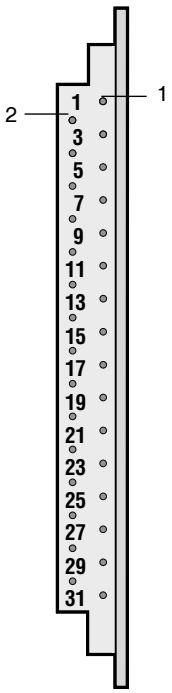
12 Red socket for spool diagnostic

13 Black socket for spool diagnostic (0V potential)

14 Blue grip strip with reference information for measured values on the measuring sockets 15 UP ramp potentiometer

16 DOWN ramp potentiometer

Connector (Elevation B)



1 Input preselect direction, channel 1
2 Input preselect direction, channel 2
3 Input preselect direction, channel 3
4 Input preselect direction, channel 4
5 Input set value lock on, channel 1
6 Input set value lock on, channel 2
7 Input set value lock on, channel 3
8 Input set value lock on, channel 4
9 Reference potential 0V transducer
11 Reference potential 0V supply
13 Input ramp disable
16 Output +10V reference
17 Output -10V reference
18 Input 24 VDC supply
19 Input transducer signal
22 Input external ramp option
23 Output, transducer supply
24 Output control solenoid B
25 Output control solenoid A
26 Output common solenoid A+B with possibility for external switch connection
27 Input external amp option

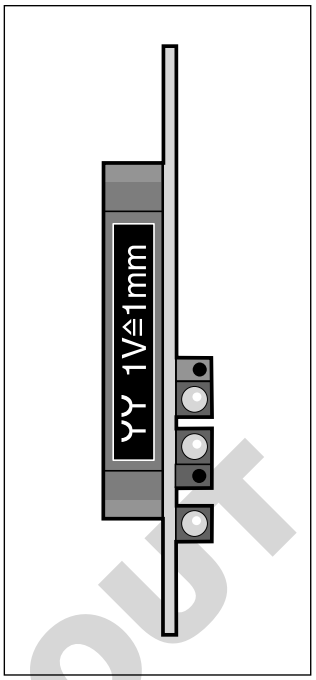
D

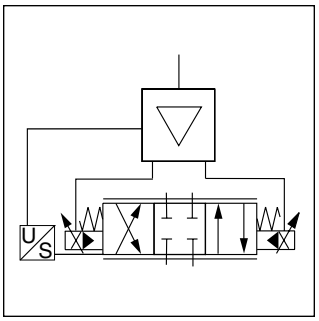
General Description

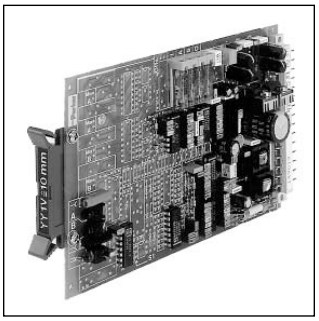
Series EW102 electronic module is used to control pilot operated D**FS proportional directional valves with main stage spool position feedback. The module accepts a ±10 volt command signal where spool position is controlled by a closed loop PID circuit on the module.

Features

- Conversion of externally supplied (+/-) set value signals into appropriate valve spool strokes.
- Can be combined with EZ150 or external control program for signal processing.
- Pulsed low-loss amplifier power stage with supporting constant current control for consistent temperature-independent solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis of spool stroke by means of diagnostic sockets as well as LEDs for indicating working conditions.





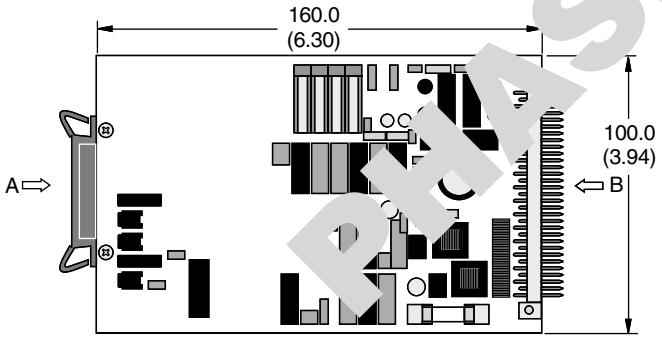


Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Command Signal	0 to ±10 VDC
Power Required	40 VA
Reference Outputs	±10 VDC @10 mA
Max. Solenoid Output Current	1.3A
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	Not available
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Transducer + Command Signals: 0.5 sq. mm (20 AWG)
Fuse	24 medium lag, DIN 41571/5x20mm

Dimensions

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



For new applications:
EW102: Refer to PWDXXA-400

Ordering Information

EW — Electronic Module Directional Valve

□ — Valve Size

Code	Valve Size	Mounting Pattern	Valve Spool Stroke	
10	D31FS	NG10	±5.0 mm	(0.20 in.)
16	D41FS	NG16	±6.0 mm	(0.24 in.)
25	D81FS	NG25	±9.3 mm	(0.37 in.)
26	D91FS	NG25	±9.3 mm	(0.37 in.)
32	D111FS	NG32	±15.0 mm	(0.59 in.)

102 — Module Type

Code	Description
102	Amplifier — Basic

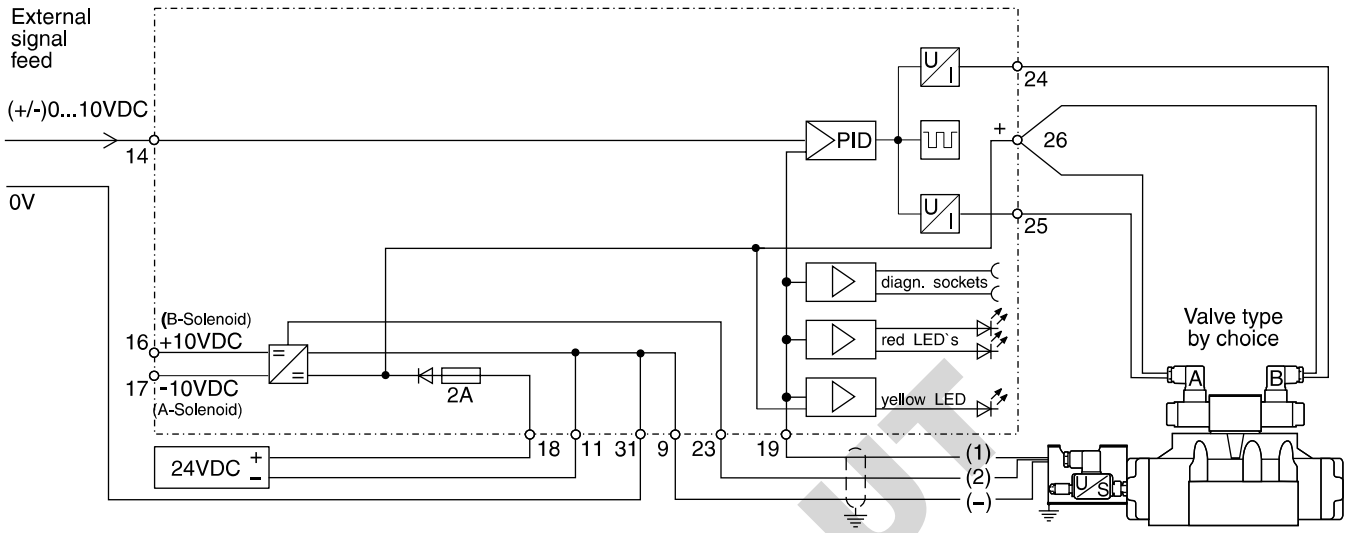
⌐ ¬ / L ⌋ — Design Series

NOTE: Not required when ordering.

EW102.p65, dd

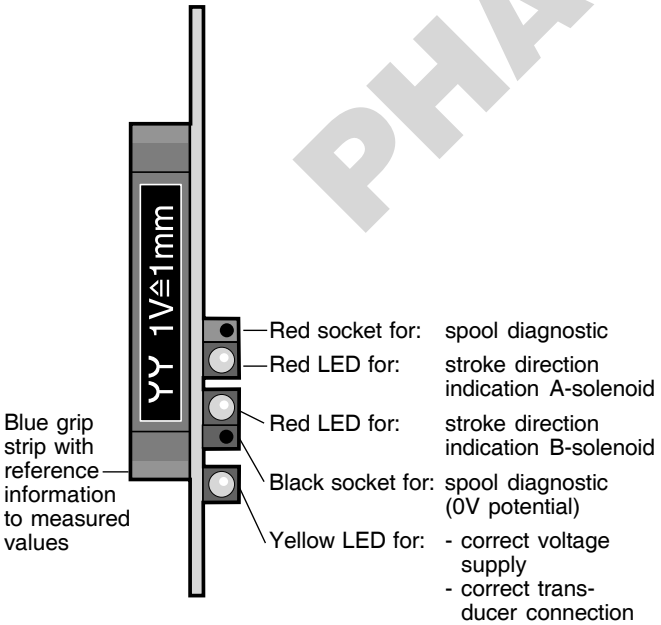
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



D

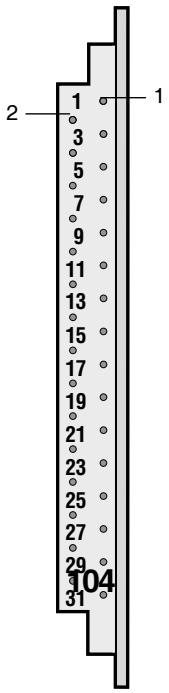
Operating and Diagnostic Elements (Elevation A)



Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



9 Reference potential 0V Transducer
11 Reference potential 0V supply
14 Input command voltage 0...+/-10 VDC
16 Output +10V reference
17 Output -10V reference
18 Input 24 VDC supply
19 Input transducer signal
23 Output transducer supply
24 Output control solenoid B
25 Output control solenoid A
26 Output common solenoid A+B
31 Reference potential 0V set value

EW102.p65, dd

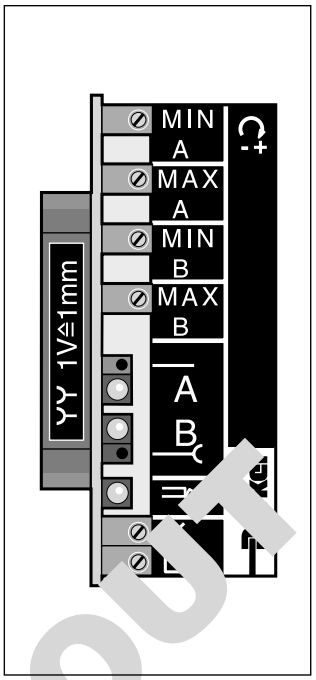
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

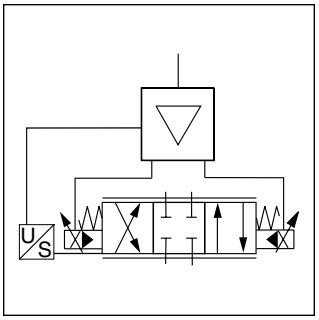
General Description

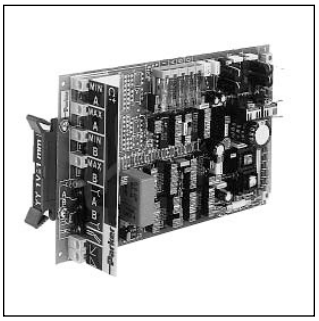
Series EW104 electronic module is used to control pilot operated D**FS proportional directional valves with main stage spool position feedback. The module accepts a ±10 volt command signal where spool position is controlled by a closed loop PID circuit on the module.

Features

- Spool overlap range can be manipulated with MIN potentiometer, adjustable by feeding a constant set value of 0.2V.
- MAX limiting of spool stroke with full set value range. Can be set up after MIN has been set and feeding a constant set value of 10V.
- DIP-switch from internal ramp generation to external ramp supply.
- Pulsed low-loss amplifier power stage with supporting constant current control for consistent temperature-independent solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis of spool stroke by means of measuring sockets as well as LEDs for indicating working conditions.

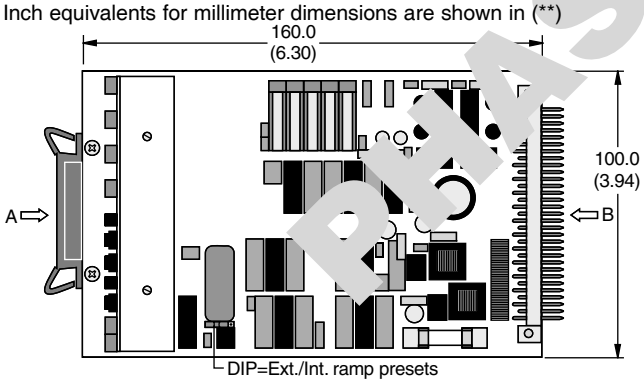






Dimensions

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



For new applications:
EW104: Refer to PWDXXA-400

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Power Required	40 VA
Reference Outputs	±10 VDC @10 mA
Max. Solenoid Output Current	1.3A
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Transducer + Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Ordering Information

EW — Electronic Module Directional Valve

□ — Valve Size

Code	Valve Size	Mounting Pattern	Valve Spool Stroke	
10	D31FS	NG10	±5.0 mm	(0.20 in.)
16	D41FS	NG16	±6.0 mm	(0.24 in.)
25	D81FS	NG25	±9.3 mm	(0.37 in.)
26	D91FS	NG25	±9.3 mm	(0.37 in.)
32	D111FS	NG32	±15.0 mm	(0.59 in.)

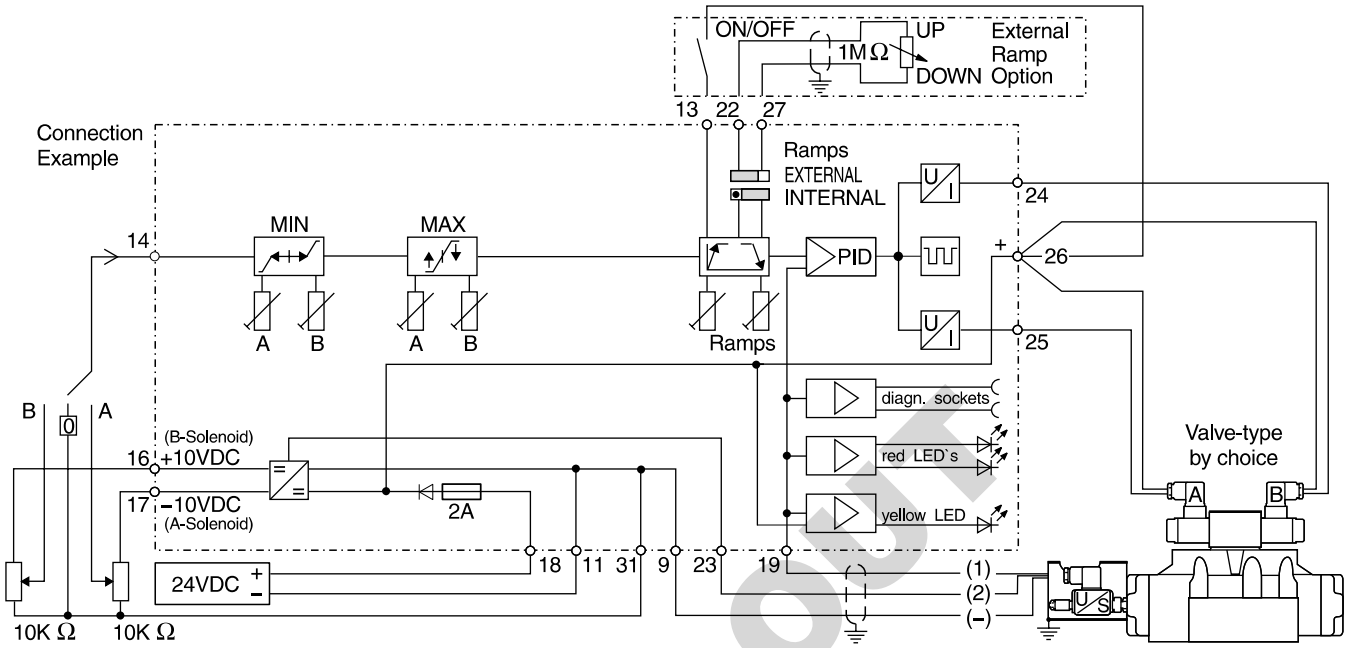
104 — Module Type

Code	Description
104	Amplifier, adjustable, MIN/MAX-limiting Up/Down ramps

Design Series

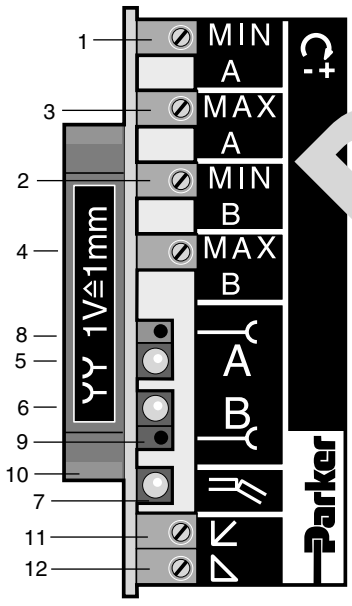
NOTE: Not required when ordering.

Block Diagram



D

Operating and Diagnostic Elements (Elevation A)



1–2 MIN limiting potentiometers for A and B sides

3–4 MAX limiting potentiometers for A and B sides

5–6 Red LEDs for: stroke direction indication

7 Yellow LED for:
- correct voltage supply,
- correct connection of transducer

8 Red socket for spool diagnostic

9 Black socket for spool diagnostic (0V potential)

10 Blue grip strip with reference information for measured values on the measuring sockets.

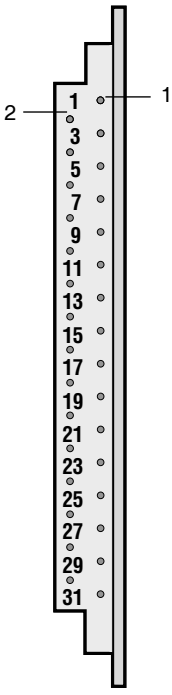
11 UP ramp potentiometer

12 DOWN ramp potentiometer

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



9 Reference potential 0V Transducer
11 Reference potential 0V supply
13 Input ramp disable
14 Input command voltage 0...+/-10 VDC
16 Output +10V reference
17 Output -10V reference
18 Input 24 VDC supply
19 Input transducer signal
22 Input external ramp option
23 Output transducer supply
24 Output control solenoid B
25 Output control solenoid A
26 Output control solenoid A+B with possibility for external switch connection
27 Input external ramp option
31 Reference potential 0V set value

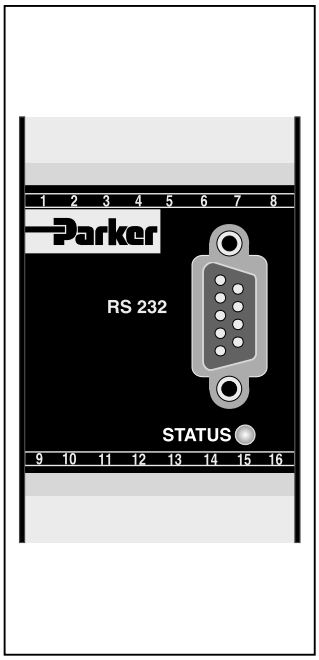
EW104.p65, dd

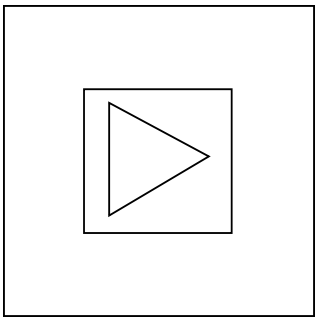
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series PCD00A-400 electronic module for driving proportional pressure control and proportional throttle valves is compact and easy to install with DIN rail mounting and plug-in terminals. The module is designed to drive two coils independent of each other. The digital design allows for programmable parameters such as solenoid drive current, mins, maxs, ramps and setpoints. The module provides flexibility and repeatability from unit to unit. The module parameters are programmed with an RS-232 interface and user friendly software (ProPxD) with default values for standard valves.

The PCD00A-400 module contains the functions required by typical pressure control and throttle valve applications (series RE*W, PE*W, DSAE, VBY, VMY, TDA, and TEA valves).





Features

- Two independent valve drivers.
- Ramps, Setpoints, Mins, Maxs.
- 5 output current selections.
- Programmable parameters.
- RS-232 Interface.
- User friendly programming software.
- Plug-in terminals.
- Compliant with European EMC Standards.

Specifications

General			
Model	Module package for snap-on mounting on EN 50022 rail	**Mounting Position**	Any
Package Material	Polycarbonate	**Ambient Temperature Range**	-20°C to +60°C (-4°F to +140°F)
Inflammability Class	V2 to V0 acc. UL 94	**Protection Class**	IP 20 acc. DIN 40050

Electrical			
Duty Ratio	100%	**Status Signal**	Off – 0 to 0.5 VDC; On – Us; rated max. 15 mA
Supply Voltage	18 VDC to 30 VDC, ripple < 5% eff., surge free* (29 VDC to 30 VDC for 24 V coils)	**Adjustment Ranges**	**preset**
		Minimum	0 to 50% 0 to 1000
		Maximum	50 to 100% 0 to 1000
		Ramp Time	0 to 32.5 s 0 to 32.5
		Current	0.8/3.5/2.7/1.8/1.3 A 0/1/2/3/4/5
Switch-on Current Typ.	22A for 0.2 mS	**Interface**	RS 232C, DSub 9p. male for null modem cable
Current Consumption Max.	5.0A	**EMC**	EN 50081-2, EN 50082-2
Pre-fusing	6.3A medium lag	**Connection**	Screw terminals 0.2 to 2.5 mm², plug-in
Command Signal	0 to +10 VDC, ripple < 0.01 % eff., surge free, Ri = 150K ohm	**Cable Specification**	16 AWG overall braid shield for supply voltage and solenoids 20 AWG overall braid shield for sensor and signal
Input Signal Resolution	0.025%	**Cable Length**	50m (164 ft.)
Differential Input Voltage Max.	30V for terminals 5 and 6 against PE (terminal 8)		
Enable Signal	Off – 0 to 5.0 VDC; On – 8.5 to 30 VDC; Ri = 30K ohm		
Channel Recall Signal	Off – 0 to 5.0 VDC; On – 8.5 to 30 VDC; Ri = 30K ohm		

Ordering Information

PCD — Electronic Module Pressure/Throttle Valves

00 — Without Position Control Universal

A —

400 — Module Type

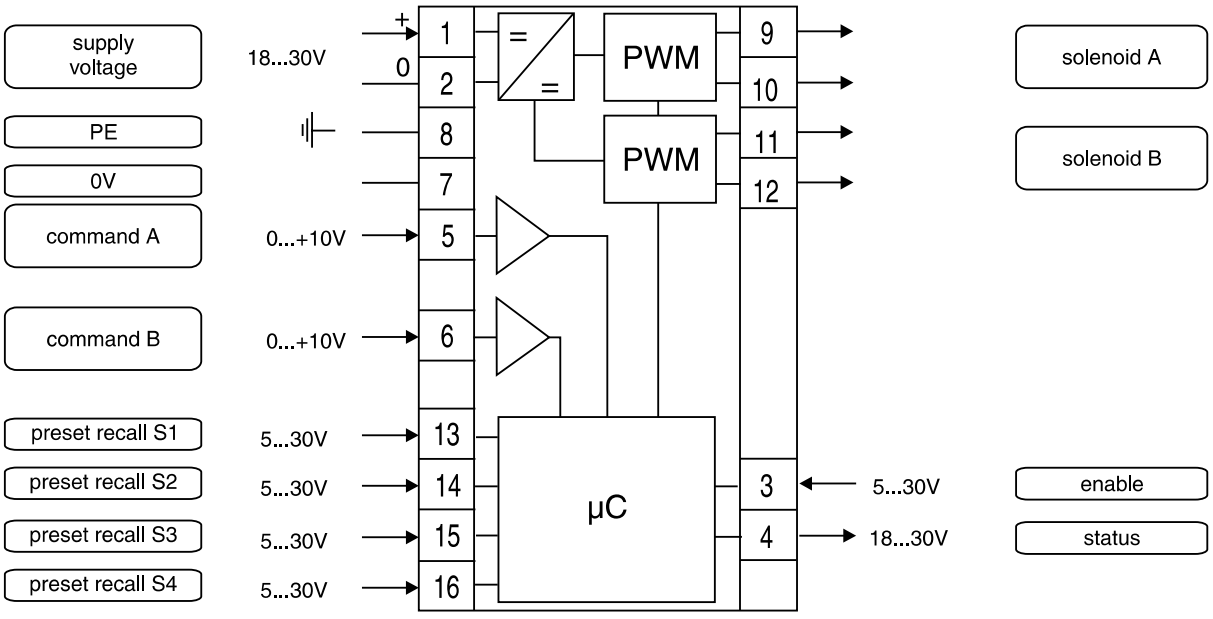
[ ] — Design Series
NOTE: Not required when ordering.

Weight: 160 g (0.35 lbs.)

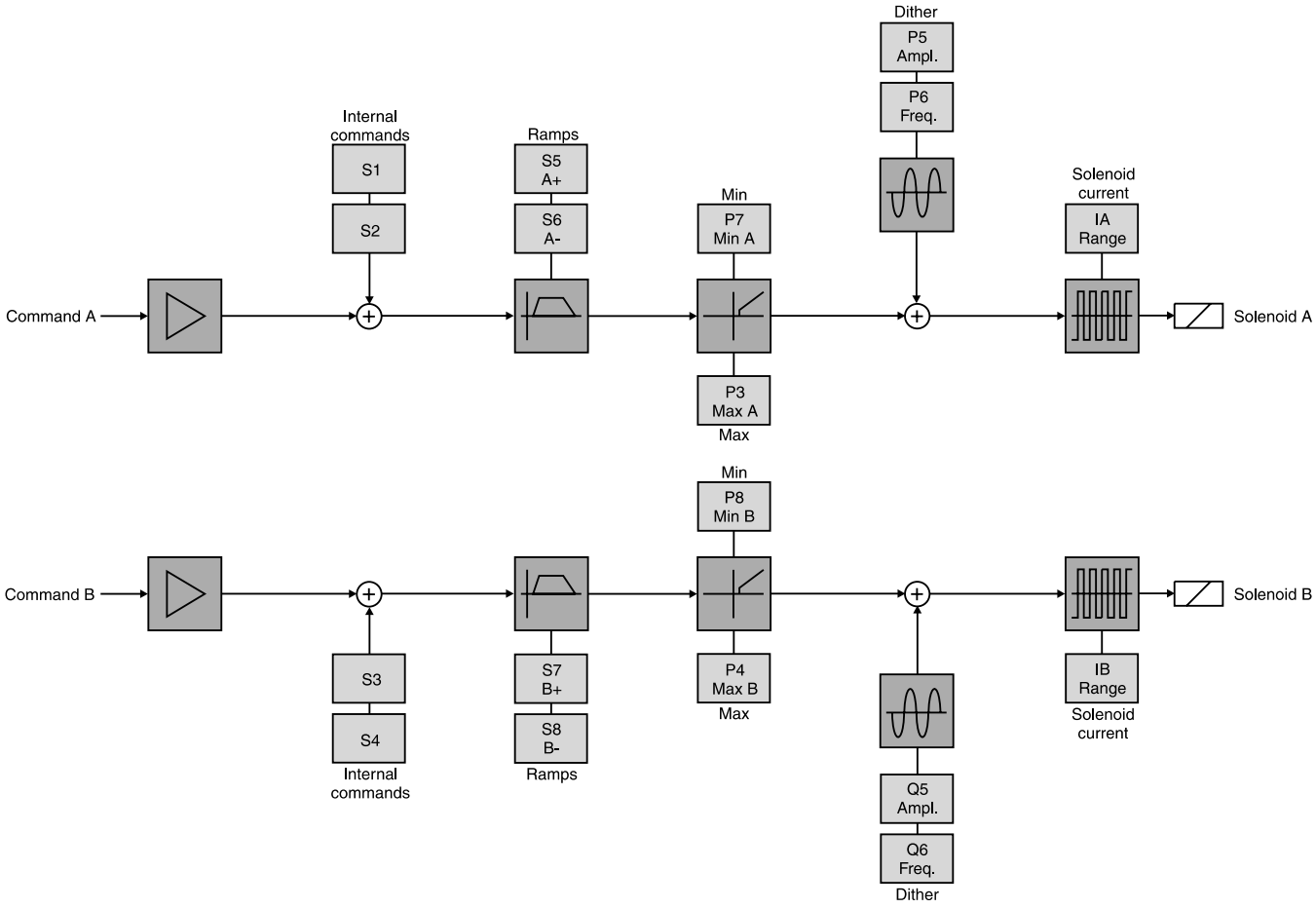
Code	Description
400	2 Amplifiers, MIN/MAX-adjustment, UP/DOWN ramps, Command inputs, 4 Command signal presets

D

Block Diagram

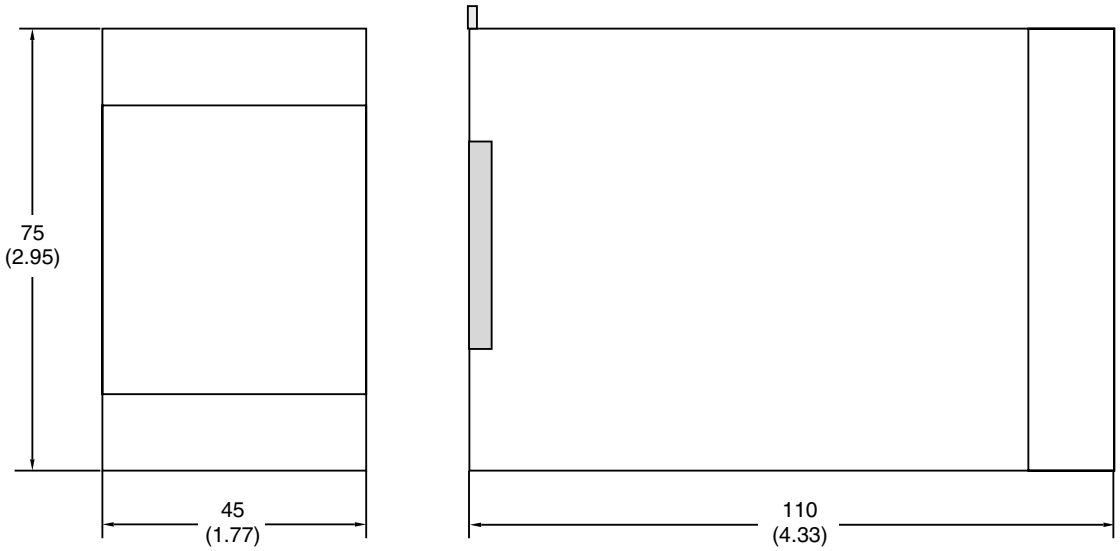


Signal Flow Diagram



Dimensions

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



ProPxD Interface Program

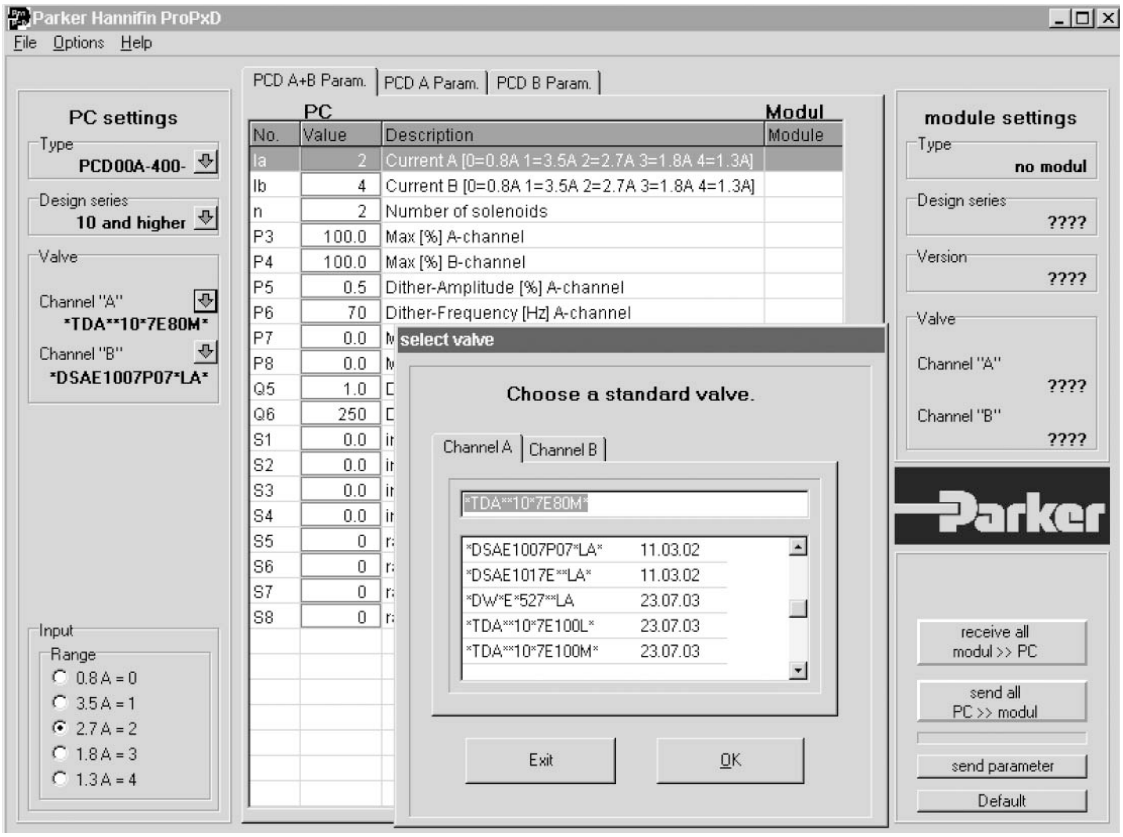
The new ProPxD software permits user-friendly parameter setting for the electronic module series PCD, PWD and PZD.

Via the clearly arranged entry screen the parameters can be identified and modified. Storage of complete parameter sets to floppy or hard disk is possible as well as printout or record as a text file for further documentation. Stored parameter sets may be loaded anytime and transmitted to the electronic module in the same manner as the default parameters which are available for all standard valve series. Inside the electronic a nonvolatile memory stores the data with the option for recalling or modification.

Features

- User-friendly editing of all parameters.
- Default values for standard valves.
- Identification and documentation of parameter sets.
- Executable with all actual Windows® operating systems from Windows® 95 upwards.
- Simple communication between PC and electronic via serial interface RS-323 and nullmodem cable.

D

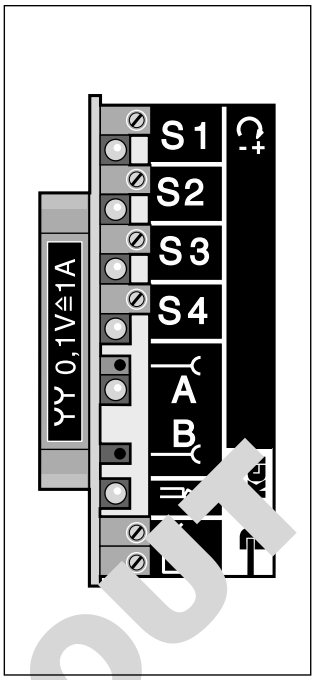


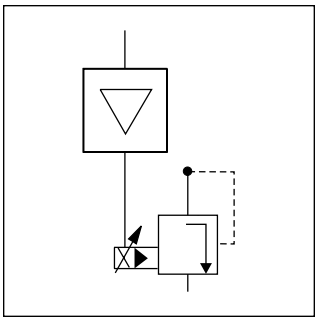
General Description

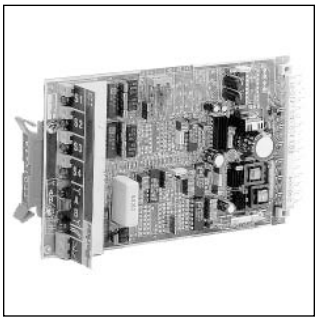
Series ED101 electronic module is used to control DSA/DWE/DWU pressure control valves. The module accepts up to 4 on/off input signals which select one of four pressures set by potentiometer adjustments on teh card. Two ramp adjustments provide smooth transition between selected pressures.

Features

- Modulated output signals to the solenoid through 4 selectable set-values, and ramp potentiometer adjustable from 0 to 100%.
- DIP switch from internal ramp generation to external ramp setting.
- Pulsed low-loss amplifier power stage with supporting constant current control for constant temperature-independent solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis of spool stroke by means of diagnostic sockets as well as LEDs for indicating working conditions.

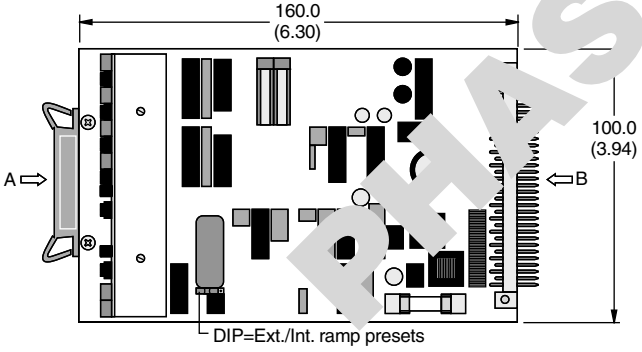






Dimensions

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



For new applications:
ED101: Refer to PCD00A-400

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC
Input Select Voltage	5 to 30 VDC
Reference Outputs	+10 VDC @10 mA
Max. Solenoid Output Current	1.3A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Ordering Information

ED — Electronic Module Pressure Valve

For:
DSA
DWE
DWU
RE**W

00

101 — Module Type

Code	Description
101	Amplifier, 4 command channels, Up/Down ramps

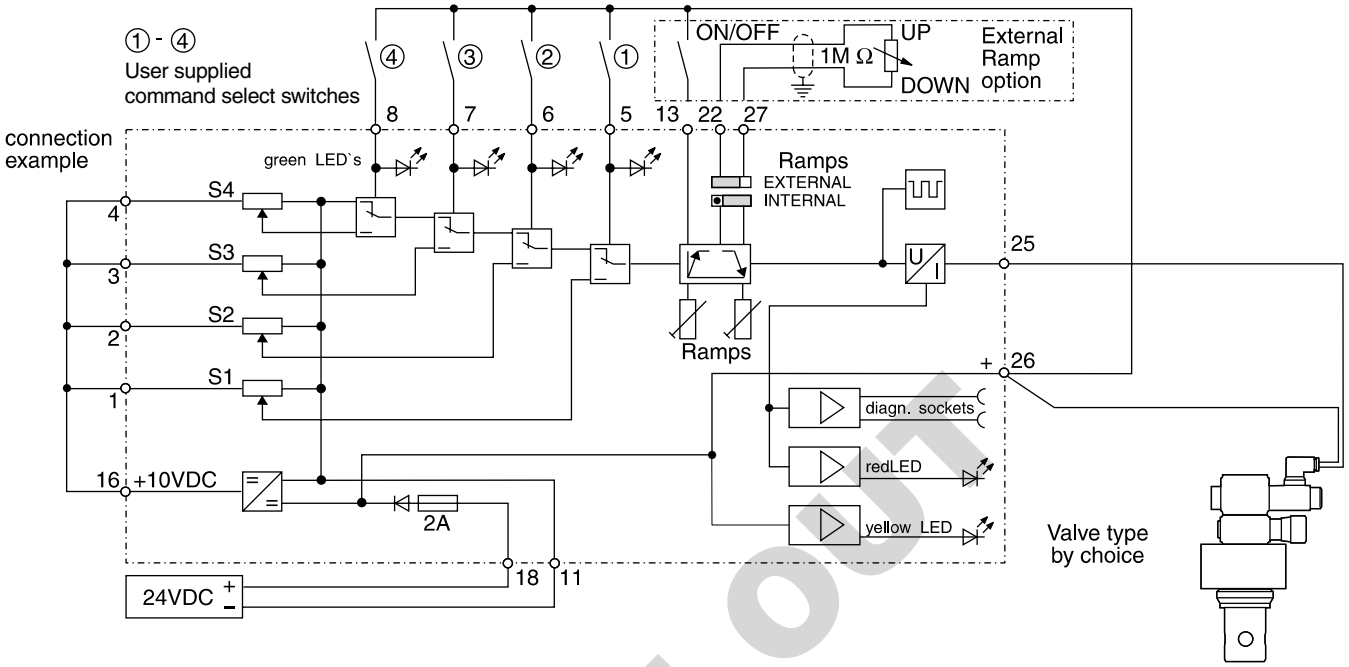
Design Series

NOTE: Not required when ordering.

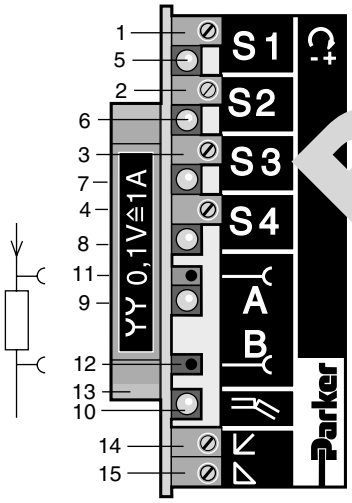
ED101.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1–4 Set value potentiometer S1–S4

5–8 Green LEDs for:
- channel activity of the set values

9 Red LED (A) for:
- function indicater control solenoid (B not used here)

10 Yellow LED for:
- correct voltage supply

11 Red socket for current diagnostic

12 Black socket for current diagnostic

13 Red grip strip with reference information for measured values on the diagnostic sockets

14 UP ramp potentiometer

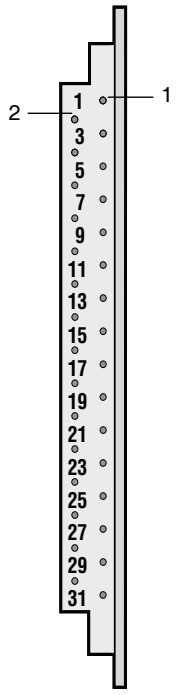
15 DOWN ramp potentiometer

Only potential-free measuring equipment to be used

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



1 Input preselection channel 1
2 Input preselection channel 2
3 Input preselection channel 3
4 Input preselection channel 4
5 Input set value lock on channel 1
6 Input set value lock on channel 2
7 Input set value lock on channel 3
8 Input set value lock on channel 4
11 Reference potential 0V supply
13 Input ramp disable
16 Output +10V reference
18 Input 24 VDC supply
22 Input ramp set external
25 Output control solenoid
26 Output control solenoid
27 Input external ramp option

ED101.p65, dd

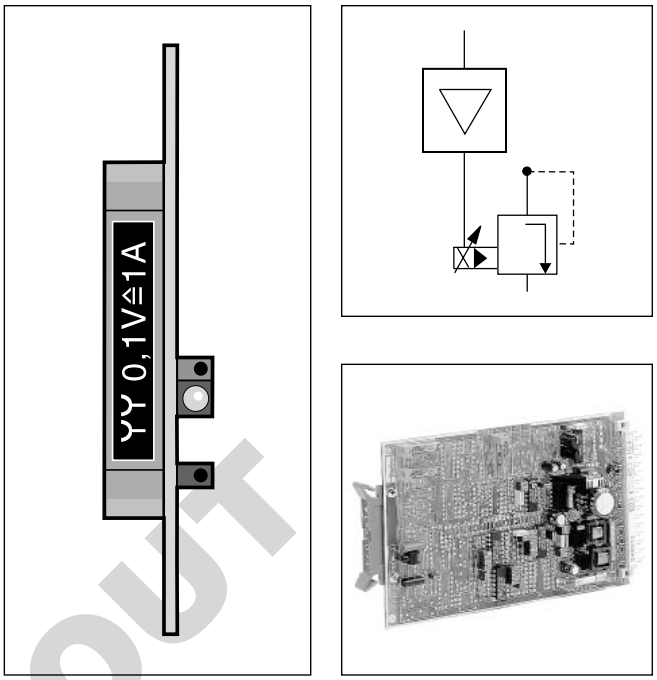
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series ED102 electronic module is used to control DSA/DWE/DWU pressure control valves. The module accepts a 0 to 10 volt command signal and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance.

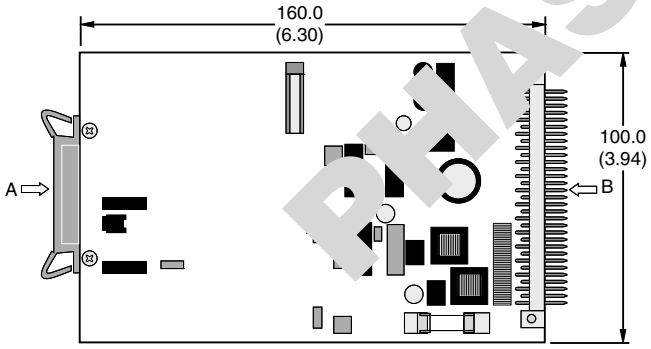
Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- Pulsed amplifier power stage with constant current control.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as LEDs for indicating working conditions.



Dimensions

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



For new applications:
ED102: Refer to PCD00A-400

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC
Reference Outputs	+10 VDC @10 mA
Max. Solenoid Output Current	1.3A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Ordering Information

ED — Electronic Module Pressure Valve

For:
DSA
DWE
DWU
RE**W

00

102 — Module Type

Code	Description
102	Amplifier — Basic

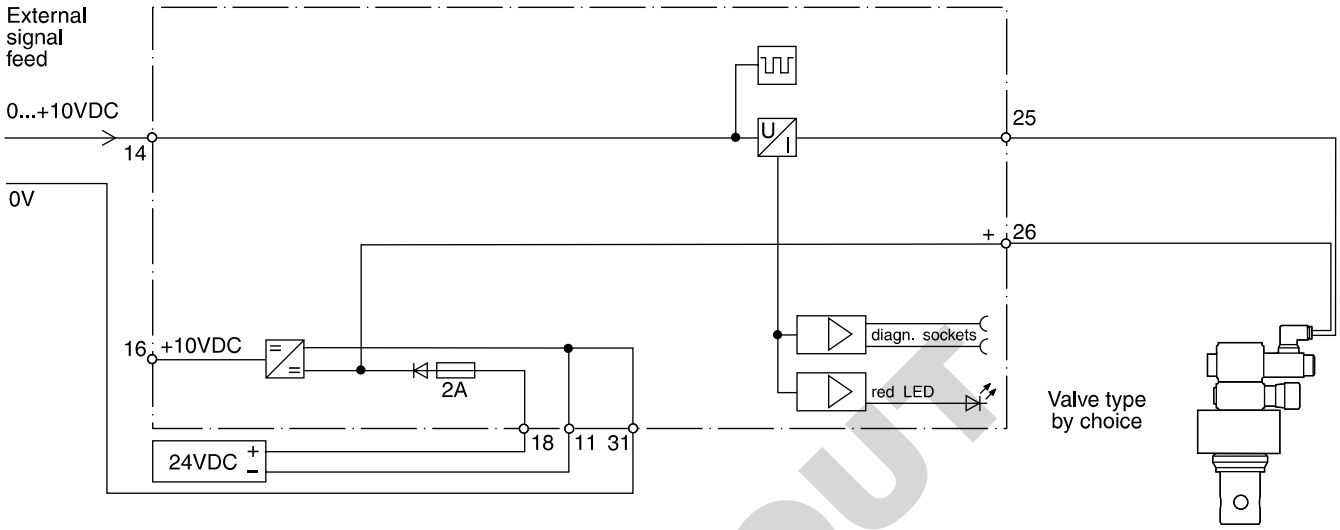
Design Series

NOTE: Not required when ordering.

ED102.p65, dd

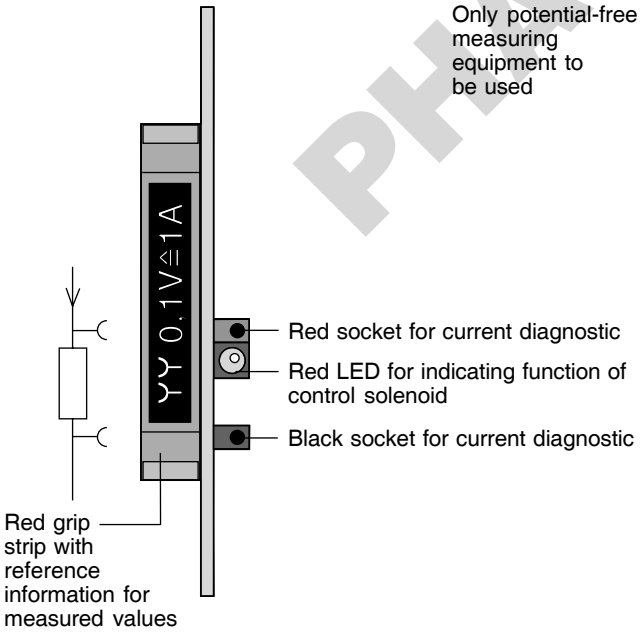
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



D

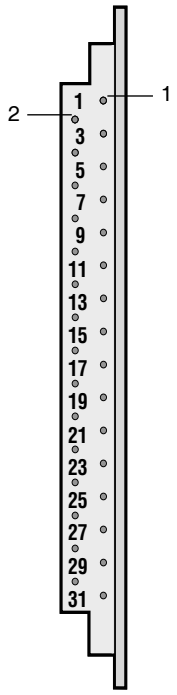
Operating and Diagnostic Elements (Elevation A)



Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



11 Reference potential 0V supply
14 Input command voltage 0...+10 VDC
16 Output +10V reference
18 Input 24 VDC supply
25 Output control solenoid
26 Output control solenoid
31 Reference potential 0V set value

ED102.p65, dd

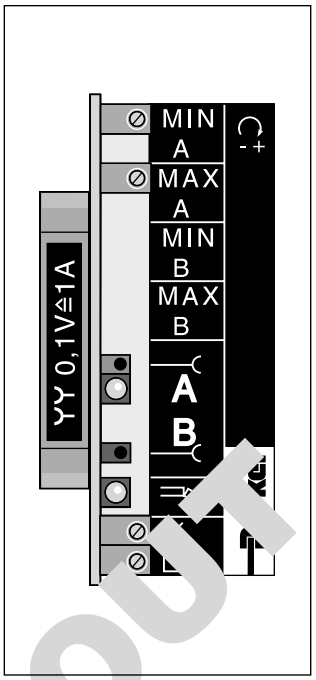
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

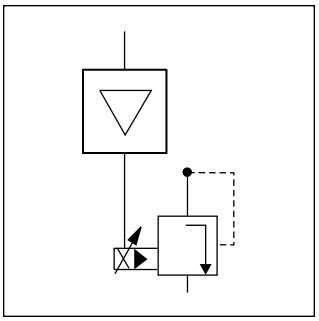
General Description

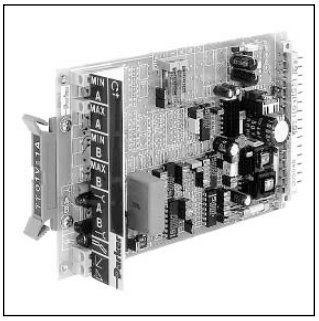
Series ED104 electronic module is used to control DSA/DWE/DWU pressure control valves. The module accepts a 0 to 10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Two ramp adjustments provide smooth transition between selected pressures. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance.

Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- DIP switch from internal ramp generation to external ramp setting.
- MIN/MAX limiters for matching the working range to the full set value range.
- Pulsed low-loss amplifier power stage with supporting constant current control for consistent, temperature-independent, solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as LEDs for indicating working conditions.

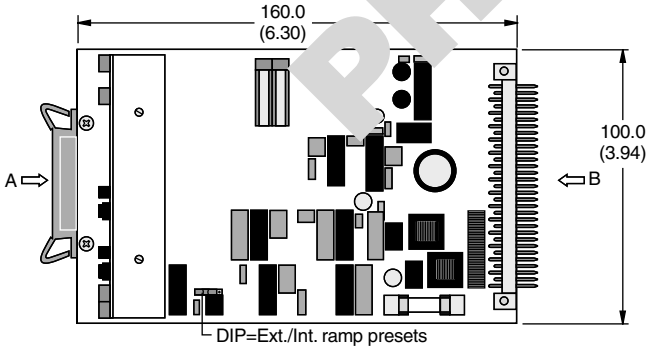






Dimensions

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



Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Power Required	40 VA
Reference Outputs	+10 VDC 10 mA
Max. Solenoid Output Current	1.3A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

For new applications:
ED104: Refer to PCD00A-400

Ordering Information

ED — Electronic Module Pressure Valve

For:
DSA
DWE
DWU

00

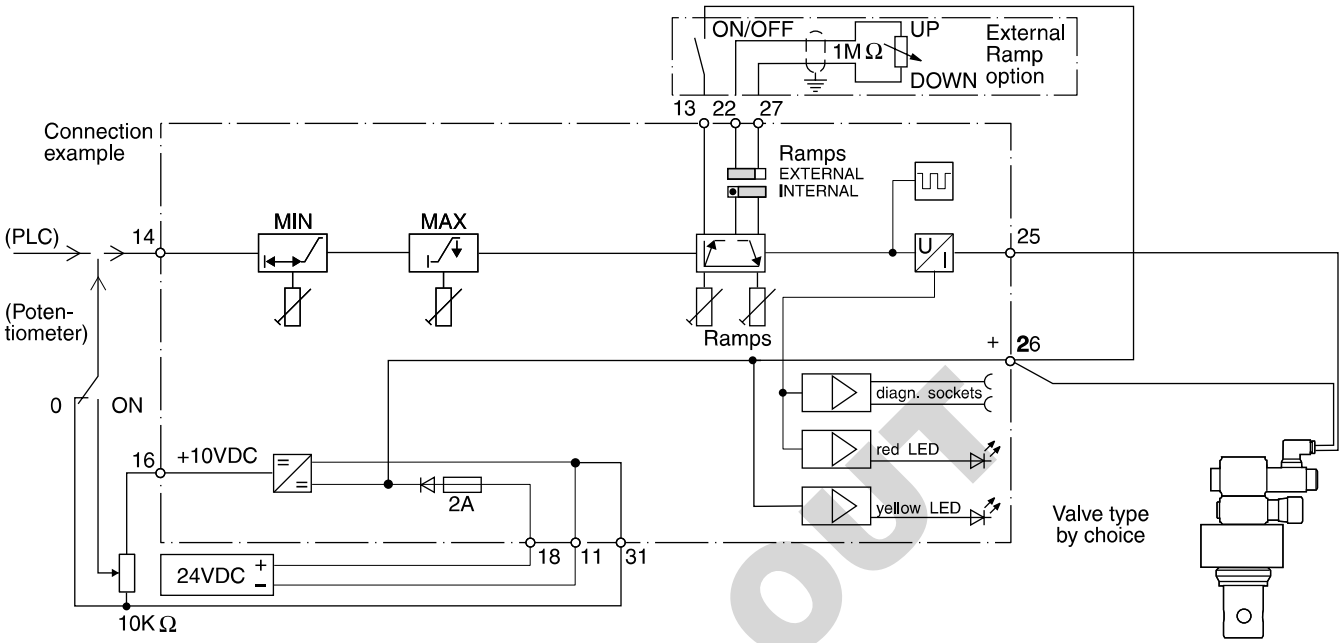
104 — Module Type

Code	Description
104	Amplifier, adjustable MIN/MAX-limits, Up/Down Ramps

Design Series

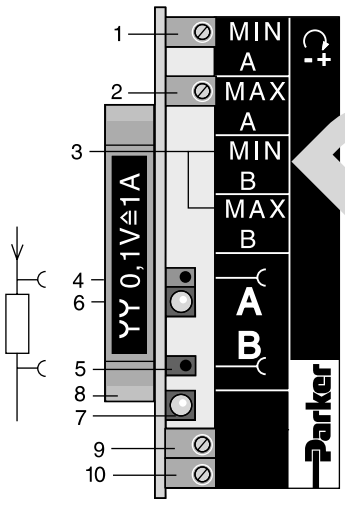
NOTE: Not required when ordering.

Block Diagram



D

Operating and Diagnostic Elements (Elevation A)



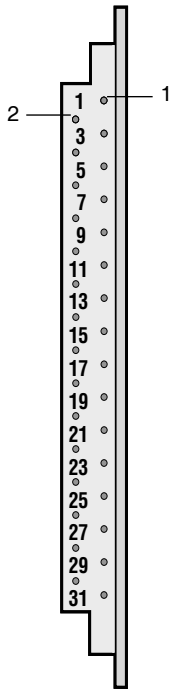
1 MIN-limiting for matching the lowest pressure
2 MAX-limiting for matching the highest pressure
3 Not used
4 Red socket for current diagnostic
5 Black socket for current diagnostic
6 Red LED (A) for:
- function indicator control solenoid
- (B unused here)
7 Yellow LED for:
- correct voltage supply
8 Red grip strip with reference information for measured values on the diagnostic sockets
9 UP ramp potentiometer
10 Down ramp potentiometer

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Only potential-free measuring equipment to be used

Connector (Elevation B)



11 Reference potential 0V supply
13 Input ramp disable
14 Input command voltage 0 to +10 VDC
16 Output +10V reference
18 Input 24 VDC supply
22 Input external ramp option
25 Output control solenoid
26 Output control solenoid
27 Input external ramp option
31 Reference potential 0V set value

ED104.p65, dd

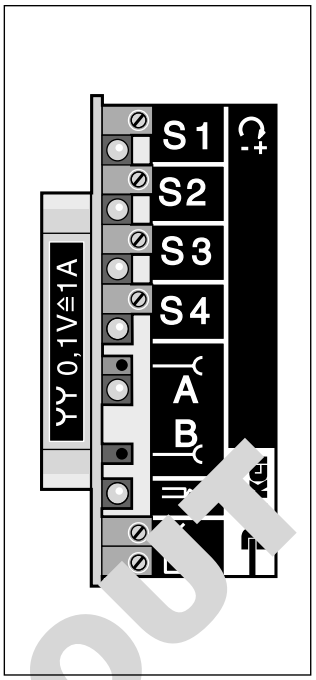
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

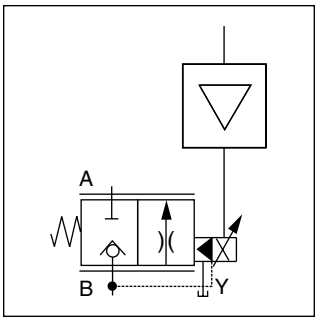
General Description

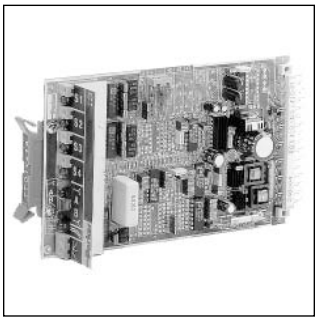
Series ET101 electronic module is used to control non-feedback TDA and TEA proportional throttle valves configured with the 'L' solenoid option. For valves configured with the 'M' solenoid option, refer to ET154. The module accepts up to 4 on/off input signals which select one of four speeds set by potentiometer adjustments on the card. Two ramp adjustments provide control of actuator acceleration and deceleration.

Features

- Modulated output signals to the control solenoid through four selectable set-values and ramp potentiometers, adjustable from 0 to 100%.
- DIP switch from internal ramp generation to external ramp setting.
- Pulsed low loss amplifier power stage with supporting constant current control for constant, temperature-independent, solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as LEDs for indicating working conditions.





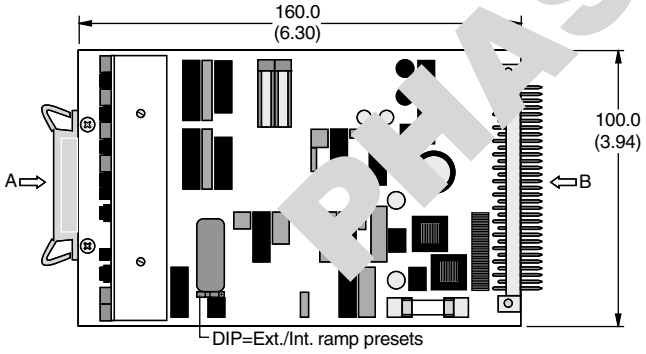


Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Reference Outputs	+10 VDC 10 mA
Max. Solenoid Output Current	1.05A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Dimensions

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



For new applications:
ET101: Refer to PCD00A-400

Ordering Information

ET — Electronic Module Pressure Valve

□ — Valve Size

Code	Valve	Sol.
00	TDA...LAF E16 to E50	35mm
00	TEA...LAF E16 to E50	35mm
99	TDA...LAF E63 to E100	60mm
99	TEA...LAF E63 to E100	60mm

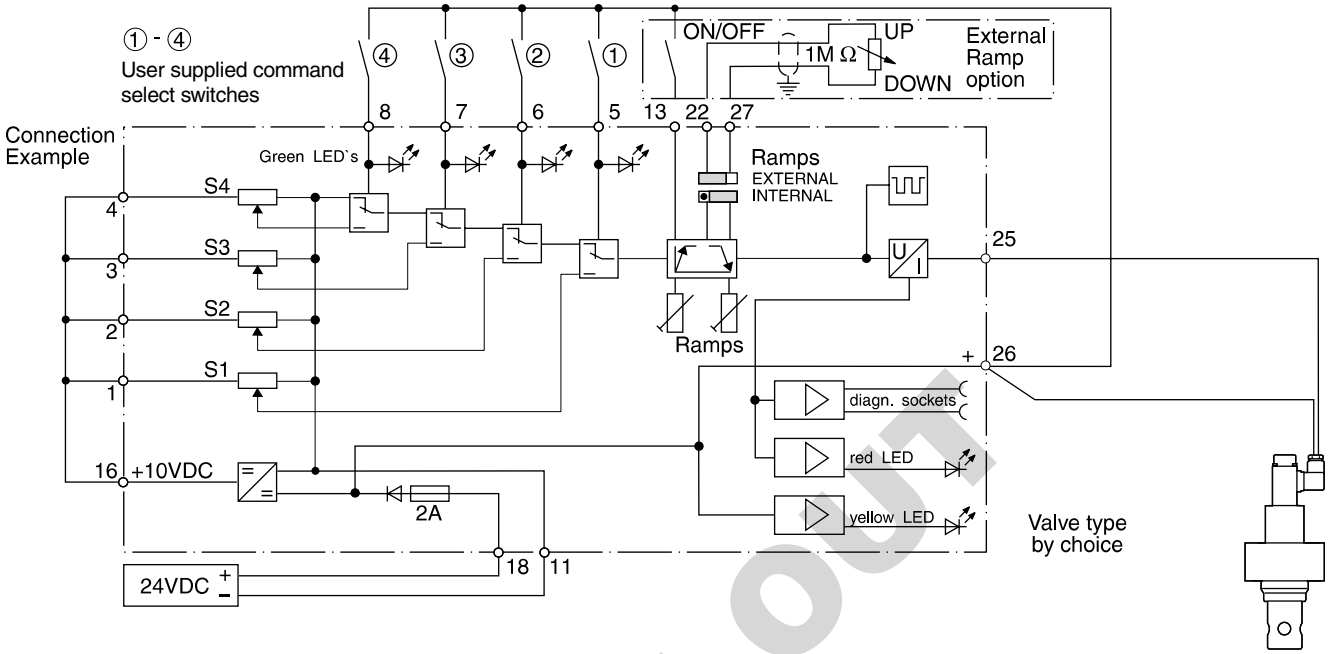
101 — Module Type

Code	Description
101	Amplifier, 4 command channels, Up/Down ramps for valves with 'L' solenoid option

[ ] — Design Series

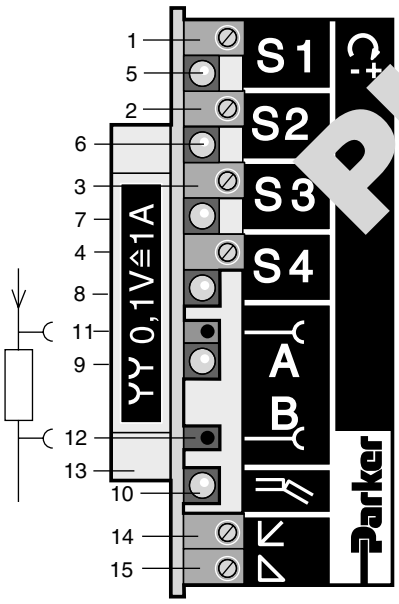
NOTE: Not required when ordering.

Block Diagram



D

Operating and Diagnostic Elements (Elevation A)



1–4 Set value potentiometers S1–S4

5–8 Green LED's for:
- channel activity of the set values

9 Red LED (A) for:
- function indicator control solenoid
- (B not used)

10 Yellow LED for:
- correct voltage supply

11 Red socket for current diagnostic

12 Black socket for current diagnostic

13 Green grip strip with reference information for measured values

14 UP ramp potentiometer

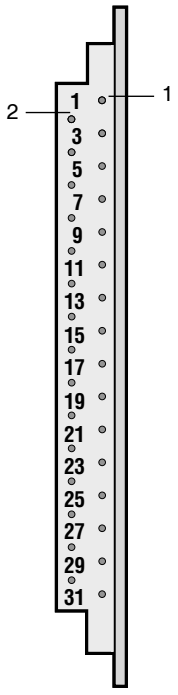
15 DOWN ramp potentiometer

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Only potential-free measuring equipment to be used

Connector (Elevation B)



1 Input preselection channel 1
2 Input preselection channel 2
3 Input preselection channel 3
4 Input preselection channel 4
5 Input set value lock on channel 1
6 Input set value lock on channel 2
7 Input set value lock on channel 3
8 Input set value lock on channel 4
11 Reference potential 0V supply
13 Input ramp disable
16 Output +10V reference
18 Input 24 VDC supply
22 Input external ramp option
25 Output control solenoid
26 Output control solenoid
27 Input external ramp option

ET101.p65, dd

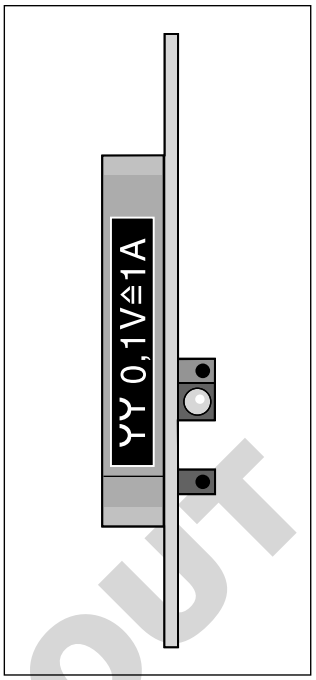
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

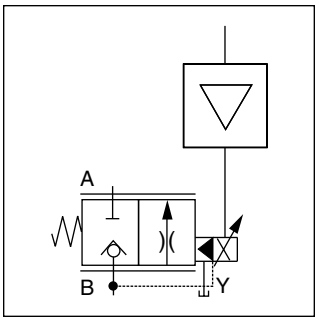
General Description

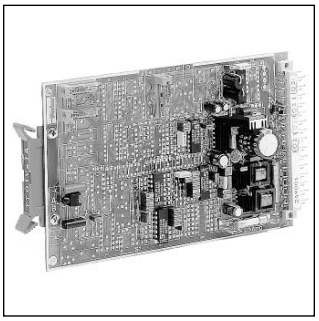
Series ET102 electronic module is used to control TDA and TEA proportional throttle valves configured with the 'L' solenoid option. For valves configured with the 'M' solenoid option, refer to ET154. The module accepts a 0 to 10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance.

Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- Pulsed amplifier power stage with constant current control.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as light diodes for indicating working conditions.





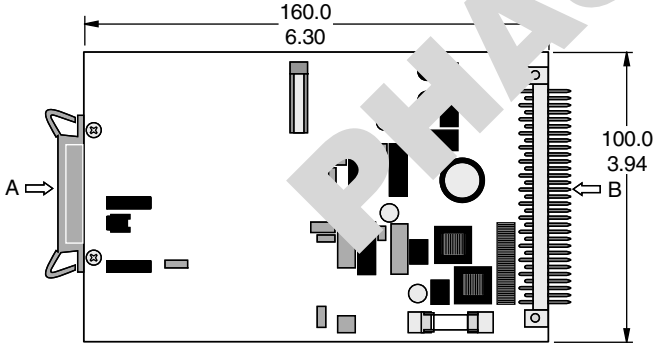


Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Select Voltage	5 to 30 VDC
Reference Outputs	+10 VDC 10 mA
Max. Solenoid Output Current	1.05A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	Not available
Shielded Cable Connections	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20mm

Dimensions

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



For new applications:
ET102: Refer to PCD00A-400

Ordering Information

ET — Electronic Module Pressure Valve

☐ — Valve Size

Code	Valve	Sol.
00	TDA...LAF E16 to E50	35mm
00	TEA...LAF E16 to E50	35mm
99	TDA...LAF E63 to E100	60mm
99	TEA...LAF E63 to E100	60mm

102 — Module Type

Code	Description
102	Amplifier — Basic for valves with 'L' solenoid option

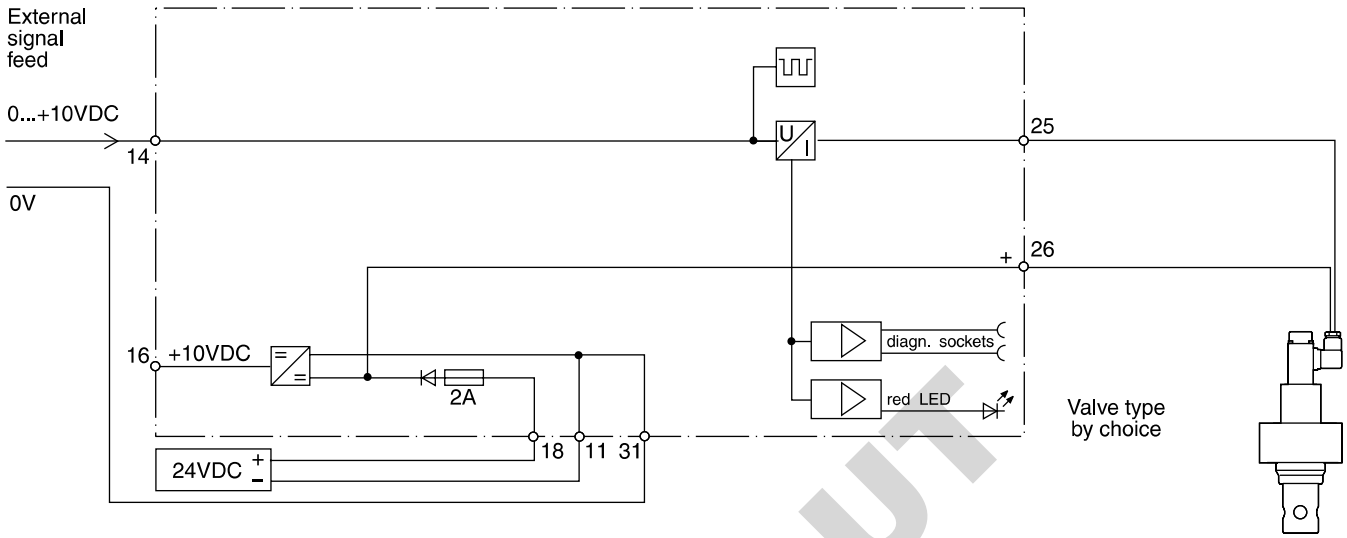
⌐ ¬ — Design Series

NOTE: Not required when ordering.

ET102.p65, dd

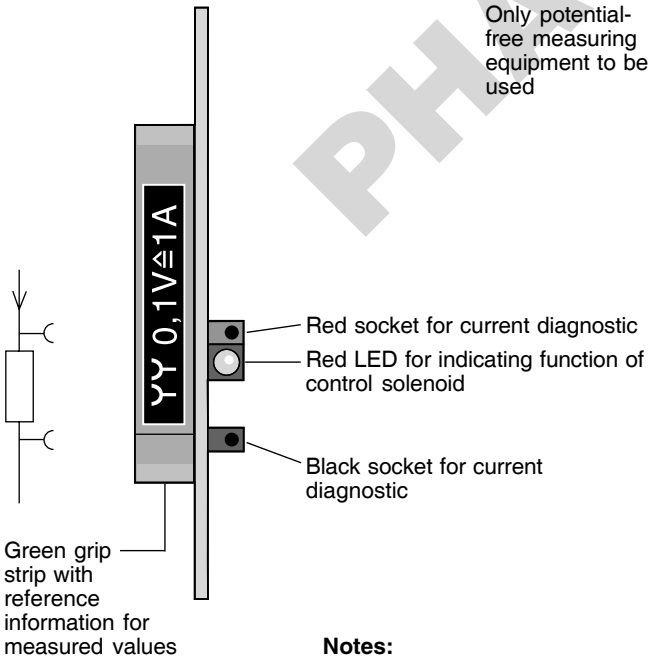
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



D

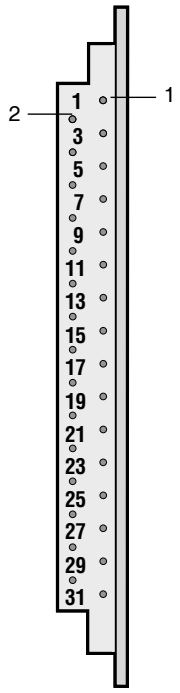
Operating and Diagnostic Elements (Elevation A)



Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



11 Reference potential 0V supply
14 Input command voltage 0...+10VDC
16 Output +10V reference
18 Input 24 VDC supply
25 Output control solenoid
26 Output control solenoid
31 Reference potential 0V set value

ET102.p65, dd

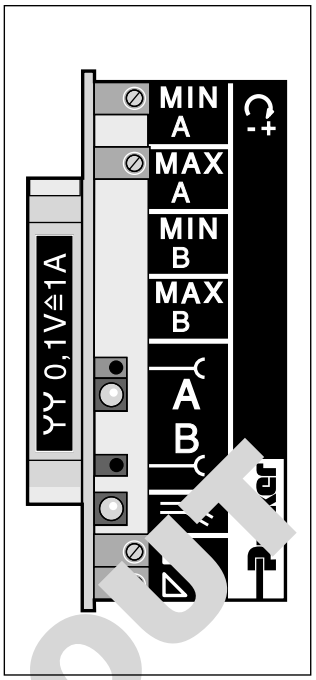
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

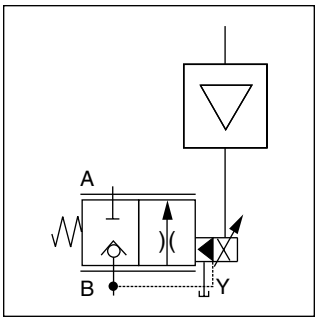
General Description

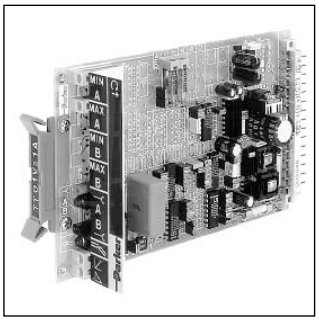
Series ET104 electronic module is used to control TDA and TEA proportional throttle valves configured with the 'L' solenoid option. For valves configured with the 'M' solenoid option, refer to driver card ET154. The module accepts a 0 to 10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance. Two ramp adjustments provide control of actuator acceleration and deceleration.

Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- DIP switch from internal ramp generation to external ramp setting.
- MIN/MAX limiters for matching the working range to the full set value range.
- Pulsed low-loss amplifier power stage with supporting constant current control for constant, temperature-independent, solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as LEDs for indicating working conditions.

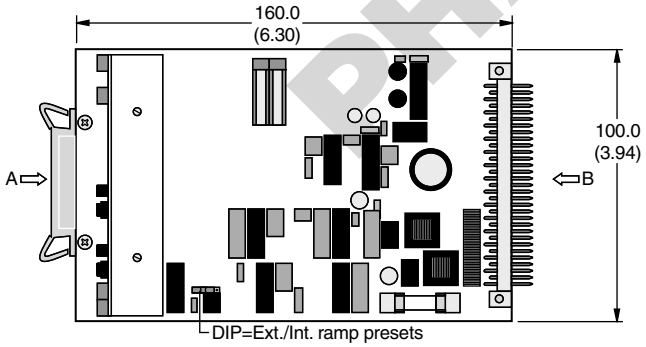






Dimensions

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



For new applications:
ET104: Refer to PCD00A-400

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC
Input Select Voltage	5 to 30 VDC
Reference Outputs	+10 VDC 10 mA
Max. Solenoid Output Current	1.05A with set value 10V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0 to 5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Ordering Information

ET — Electronic Module Pressure Valve

Valve Size

Code	Valve	Sol.
00	TDA...LAF E16 to E50	35mm
00	TEA...LAF E16 to E50	35mm
99	TDA...LAF E63 to E100	60mm
99	TEA...LAF E63 to E100	60mm

104 — Module Type

Code	Description
104	Amplifier, adjustable MIN/MAX limits, UP/DOWN ramps for valves with 'L' solenoid option

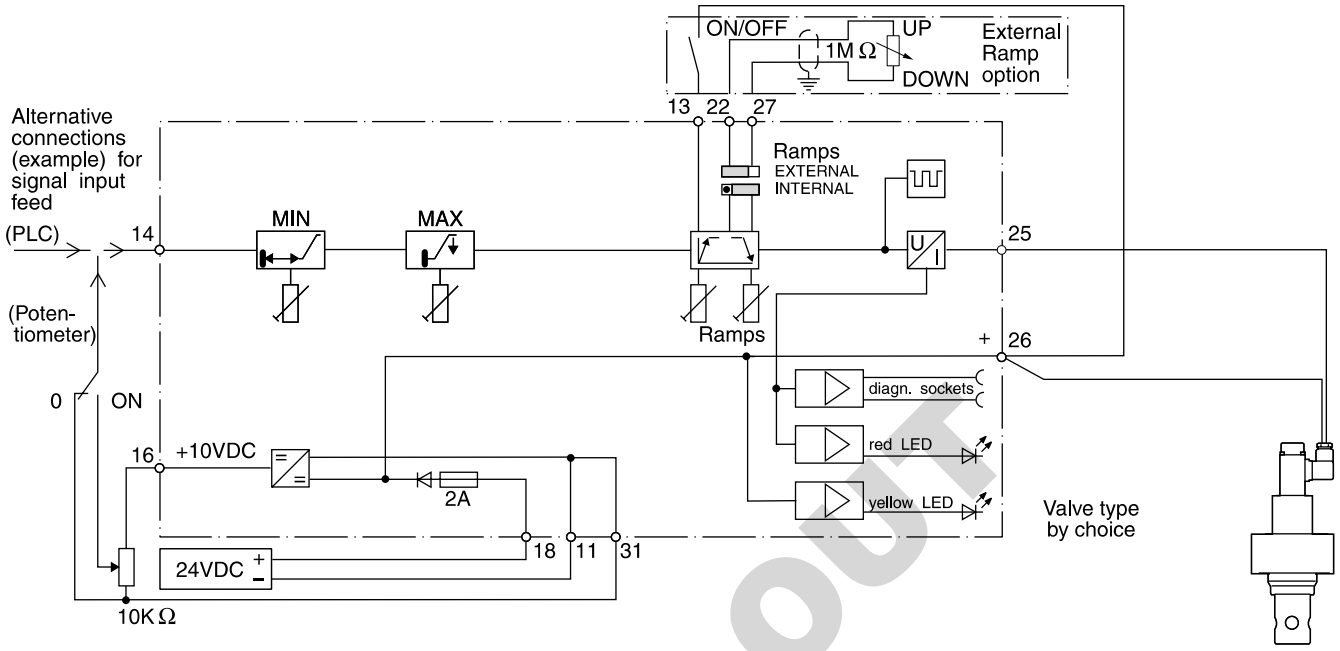
Design Series

NOTE:
Not required when ordering.

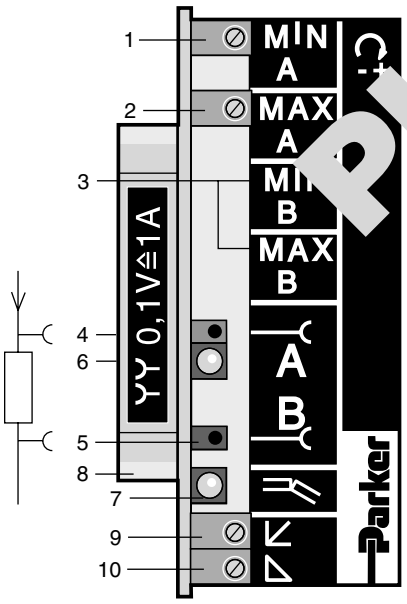
ET104.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1 MIN limiter for matching the smallest throttle aperture

2 MAX limiter for matching the largest throttle aperture

3 not used

4 Red socket for current diagnostic

5 Black socket for current diagnostic

6 Red LED (A) for:
- function indicator control solenoid
- (B not used)

7 Yellow LED for:
- correct voltage supply

8 Green grip strip with reference information for measured values

9 UP ramp potentiometer

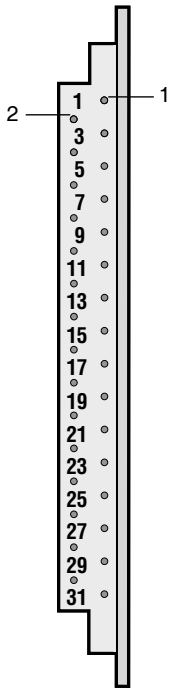
10 DOWN ramp potentiometer

Only potential-free measuring equipment to be used

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



11 Reference potential 0V supply

13 Input ramp disable

14 Input command voltage 0...+10 VDC

16 Output +10V reference

18 Input 24 VDC supply

22 Input external ramp option

25 Output control solenoid

26 Output control solenoid

27 Input external ramp option

31 Reference potential 0V set value

ET104.p65, dd

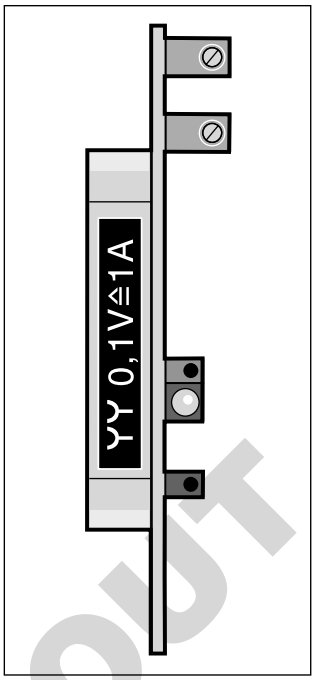
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

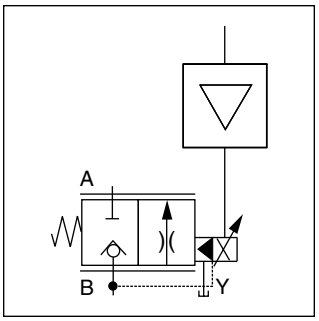
General Description

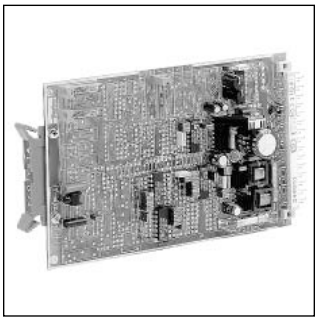
Series ET105 electronic module is used to control TDA and TEA proportional throttle valves configured with the 'L' solenoid option. For valves configured with the 'M' solenoid option, refer to ET154. The module accepts a 0 to 10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance.

Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- MIN/MAX limiters for matching the working range to the full set value range.
- Pulsed low-loss amplifier power stage with supporting constant current control for constant, temperature-independent, solenoid forces.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of diagnostic sockets as well as LEDs for indicating working conditions.





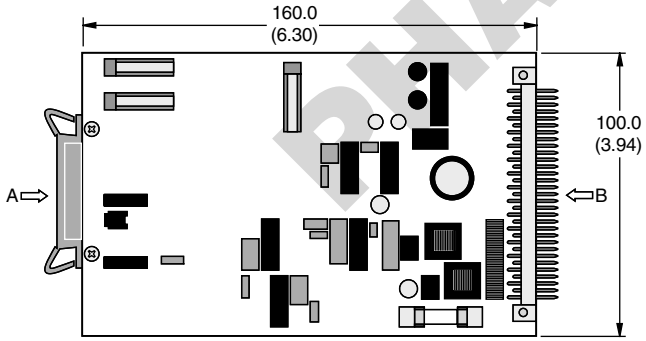


Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	40 VA
Command Signal	0 to +10 VDC
Reference Outputs	+10 VDC 10 mA
Max. Solenoid Output Current	1.05A at 10V set value
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	Not available
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Dimensions

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



For new applications:
ET105: Refer to PCD00A-400

Ordering Information

ET
Electronic Module Pressure Valve

□
Valve Size

Code	Valve	Sol.
00	TDA...LAF E16 to E50	35mm
00	TEA...LAF E16 to E50	35mm
99	TDA...LAF E63 to E100	60mm
99	TEA...LAF E63 to E100	60mm

105
Module Type

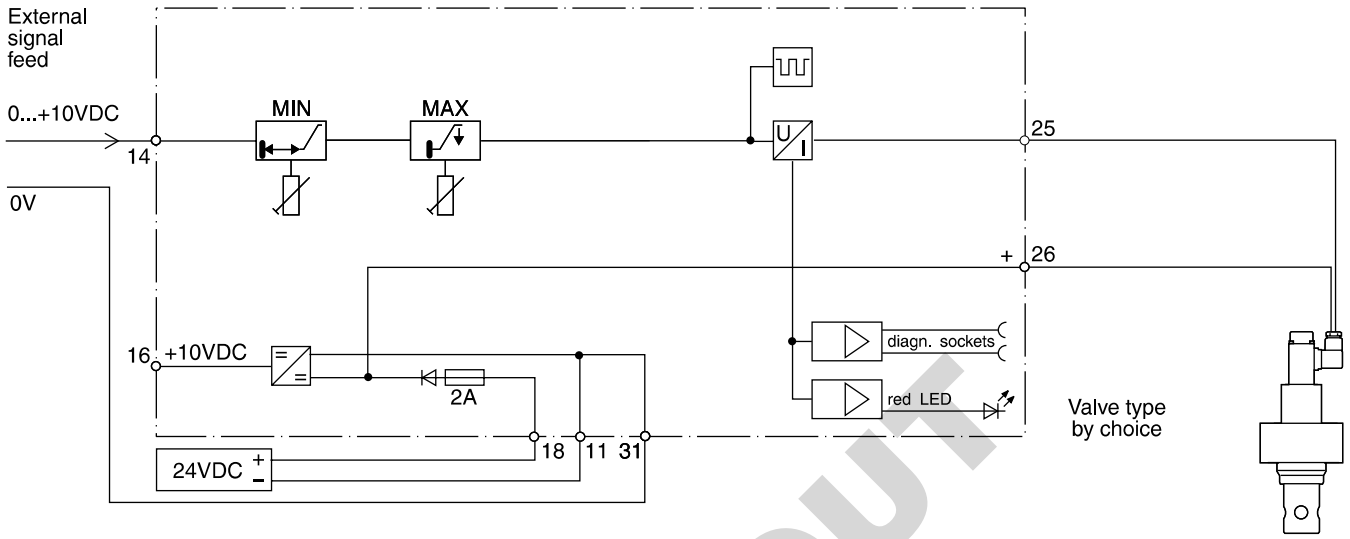
Code	Description
105	Amplifier, adjustable MIN/MAX limits for valves with 'L' solenoid option

⌐ ¬
└ ┘
Design Series
NOTE: Not required when ordering.

ET105.p65, dd

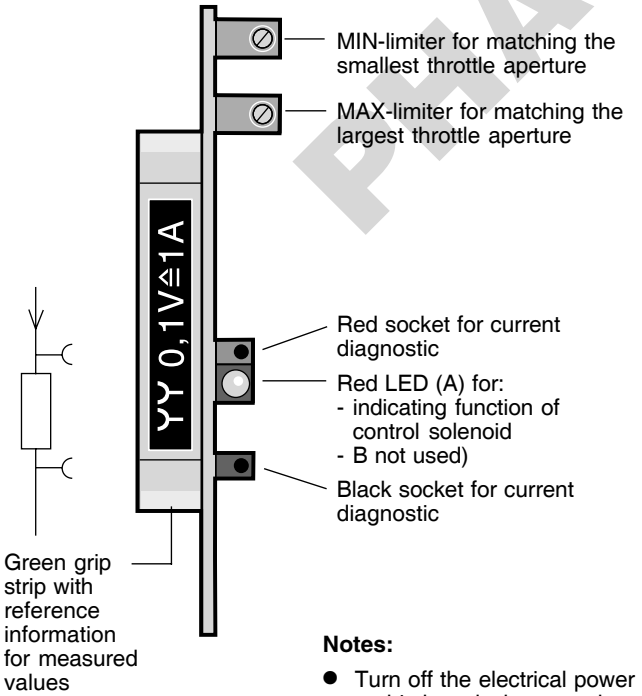
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



D

Operating and Diagnostic Elements (Elevation A)

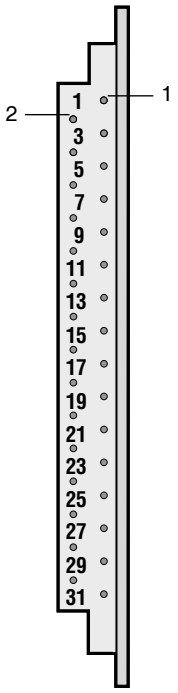


Only potential-free measuring equipment to be used

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



11 Reference potential 0V supply
14 Input command voltage 0...+10 VDC
16 Output +10V reference
18 Input 24 VDC supply
25 Output control solenoid
26 Output control solenoid
31 Reference potential 0V set value

ET105.p65, dd

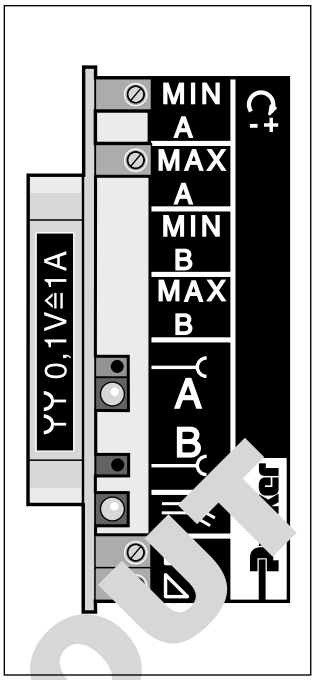
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

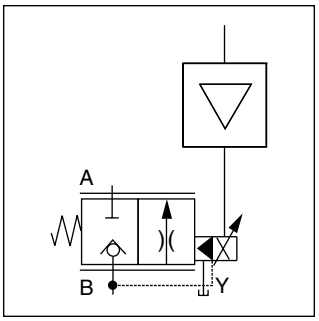
General Description

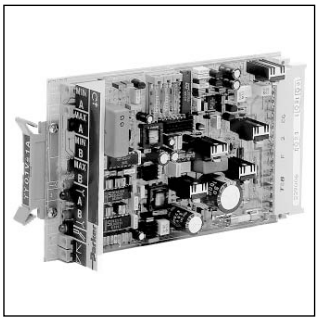
Series ET154 electronic module is used to control TDA and TEA proportional throttle valves configured with the 'M' solenoid option. For valves configured with the 'L' coil option, refer to driver card ET10*. The module accepts a 0 to 10 volt command signal, and produces a proportionally linear output current used to drive the valve's proportional solenoid. Note that the linearity of the valve itself determines the linearity of the system. Refer to the specific valve data for actual linearity performance. Two ramp adjustments provide control of actuator acceleration and deceleration.

Features

- Processing and amplification of the externally supplied positive set-values into output signals for the control solenoid.
- Can be combined with EZ150 or external programmable control.
- MIN/MAX limiters for matching the working range to the full set value range.
- Pulsed low-loss and very fast amplifier power stage with supporting constant current control.
- Dither generator with applied frequency to improve static characteristics.
- Diagnosis by means of measuring sockets as well as LEDs for indicating working conditions.
- DIP switch from internal ramp generation to external ramp setting.





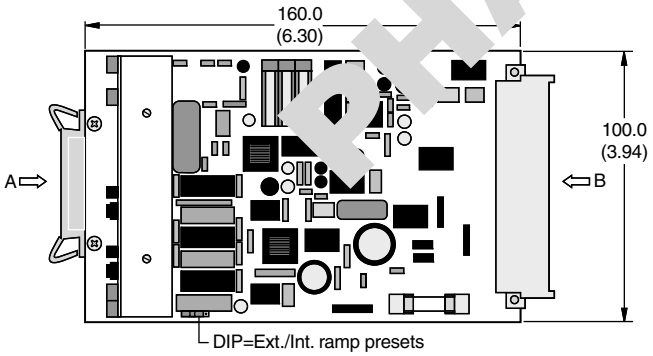


Specifications

Connection	48 Pole Male Connector, DIN 41612F
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Current Required	3.5A max.
Command Signal	0 to +10 VDC
Max. Solenoid Output Current	2.6A at 10V set value
Reference Output	+10 VDC 10 mA
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0-5 seconds adjustable
Shielded Cable Connection	Supply connections + valve: 1.5 sq. mm (16 AWG) Command Signals: 0.5 sq. mm (20 AWG)
Fuse	1.6A medium lag, DIN 41571/5x20 mm

Dimensions

Inch equivalents for millimeter dimensions are shown (*)



For new applications:
ET154: Refer to PCD00A-400

Ordering Information

ET
Electronic Module
Pressure Valve

Valve Size

Code	Valve	Sol.
00	TDA...MAF E16 to E50	35mm
00	TEA...MAF E16 to E50	35mm
99	TDA...MAF E63 to E100	60mm
99	TEA...MAF E63 to E100	60mm

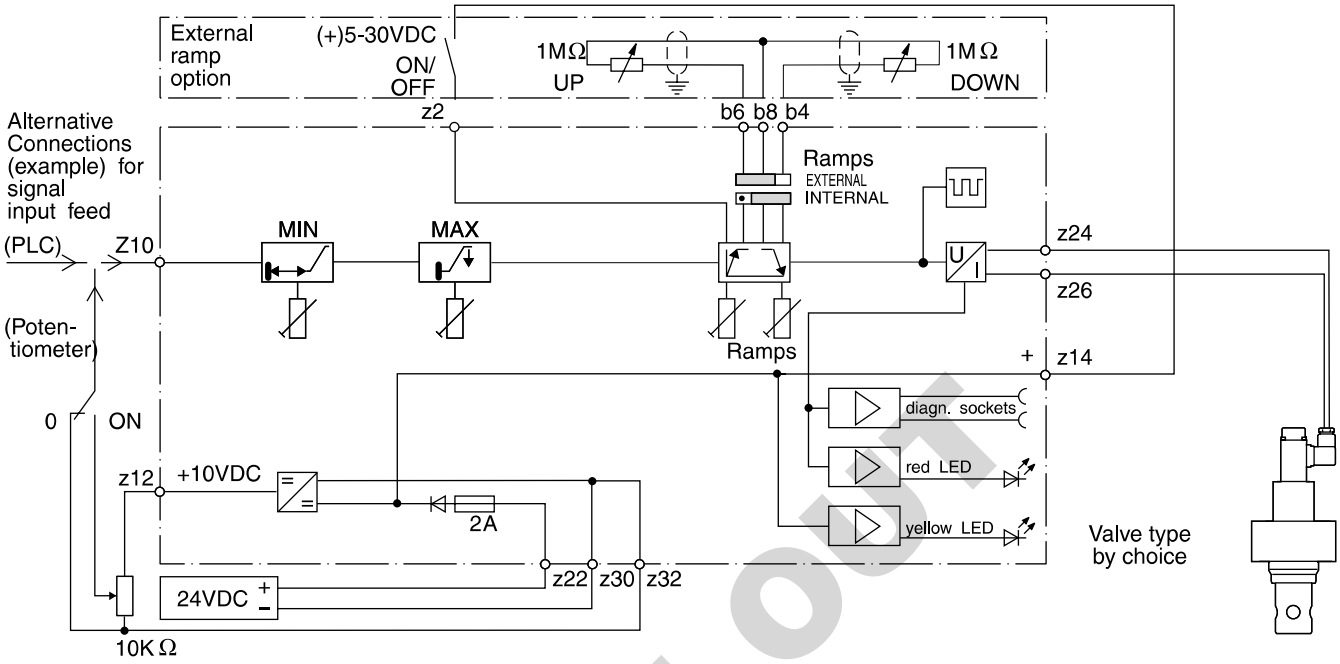
154
Module Type

Code	Description
154	Amplifier, adjustable, MIN/MAX limits UP/DOWN ramps. For valves with 'M' solenoid option.

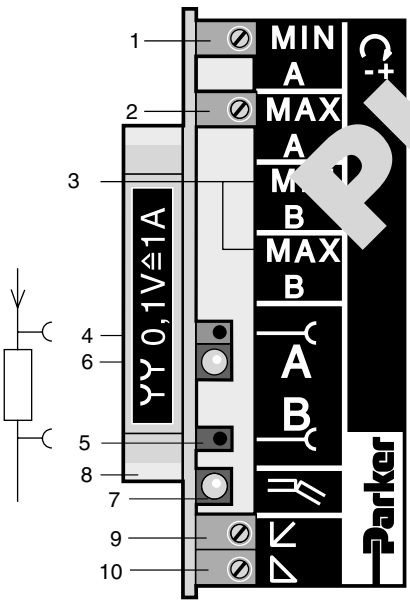
Design Series

NOTE:
Not required when ordering.

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1 MIN-limiter for matching the smallest throttle aperture

2 MAX-limiter for matching the largest throttle aperture

3 (B-information are not used here)

4 Red socket for current diagnostic

5 Black socket for current diagnostic

6 Red LED (A) for:
- function indicator control solenoid
- (B not used)

7 Yellow LED for:
- correct voltage supply

8 Green grip strip with reference information for measured values

9 UP ramp potentiometer

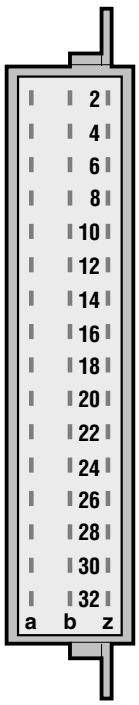
10 DOWN ramp potentiometer

Only potential-free measuring equipment to be used

Notes:

- Turn off the electrical power to this board whenever the hydraulic supply to the valve is not on.
- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



z2 Ramp disable
z10 Input (+) 0...10V
z12 Output (+) 10V reference
z14 Output 24 VDC ramp disable
z22 Input 24 VDC supply
z24 Output control solenoid
z26 Output control solenoid
z30 Reference potential 0V set-value
z32 Reference potential 0V supply

ET154.p65, dd, an

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series BD90/95 servo amplifiers are high performance amplifiers designed to work with Series BD and DY servovalves. The amplifiers are packed with many desirable features that make them extremely versatile performers in motion control systems.

Features

- **Voltage or Current Commands —** The user has the option of command input ranges of either ±14 VDC or ±28 mA.
- **Two Differential Input Feedback Amplifiers —** Both inner and outer loops have Proportional-Integral-Derivative gain.
- **Built-in Power Supply —** The BD90 has its own power supply with inputs rated at either 115 VAC or 230 VAC.
- **Dither Circuitry —** The user can select either the on-board 60 Hz dither circuit, or input his own external dither frequency.
- **Reference Power Supply —** A reference suply voltage of ±15 VDC @ 350 mA, and ±10 VDC @ 50 mA.
- **External Logic Shutdown —** Allows the user to shut down the output to the valve by applying an external voltage signal.
- **Convenient Mounting —** The BD90/95 mounts in a convenient standard “Snap-Trac” mount.
- **Plug-in Terminal Strips —** This feature makes it unnecessary to remove the wires from the terminal strip.

Ordering Information

BD — Servo Amplifier for BD Series and DY (>15mA) Series Servovalves

Input Power

Code	Description
90	115 VAC
95*	±15 VDC

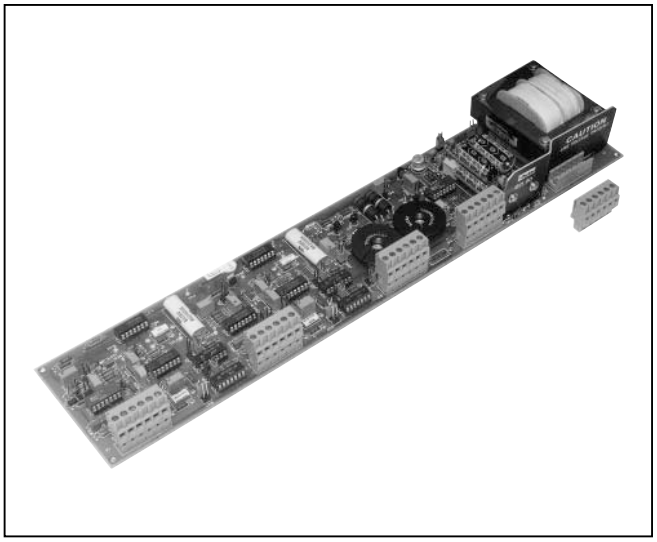
* For power supply, use #PS15, Bipolar, 15 VDC

BD90/95 Connector 1000177

Snap-Trac BD90 830007-15

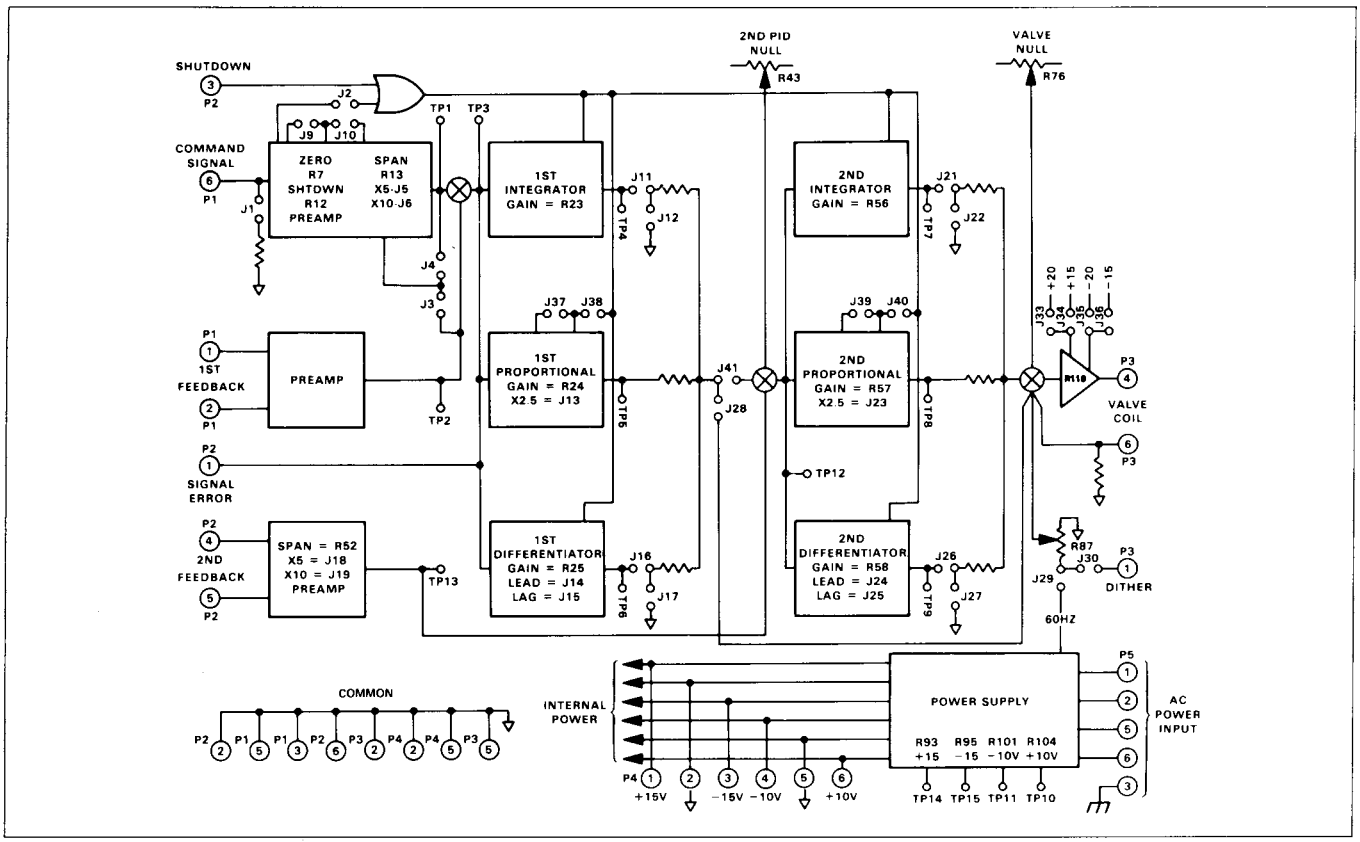
BD95 830007-11.25

Snap-Trac is included with delivery

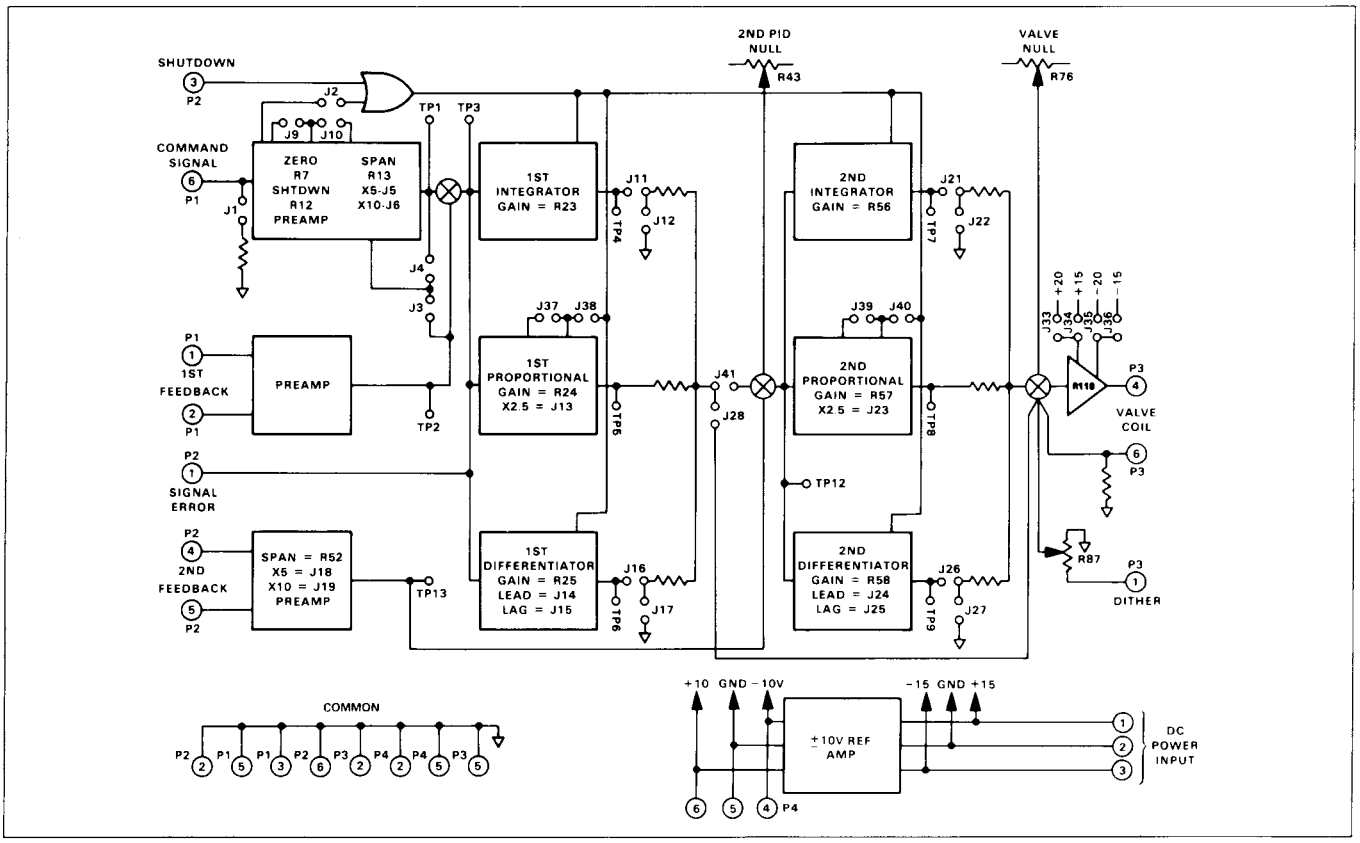


Specifications

Power Supply	BD90 – 115 VAC or 230 VAC @ 30 VA, 50/60 Hz BD95 – ±15 VDC @ 350 mA
Command Signal Range	±14 VDC, ± 28 mA
Input Impedance on Command Terminals	100k ohm minimum
Input Impedance on Feedback Terminals	50K ohm minimum
Current Output	15 to 150 mA $I_{coil} \times R_{coil} \leq 12.5V$ (BD90: up to 200 mA with J33 and J35)
Operating Temperature Range	0°C to 70°C (32°F to 158°F)
Reference Voltage	±15 VDC @ 350 mA
Supplies	±10 VDC @ 50 mA
External Logic Shutdown Voltage Required	+4 to +10 VDC, sink input
Shutdown Input Impedance	10K ohm
Protection Class	Open, not rated



BD90 Servo Amplifier



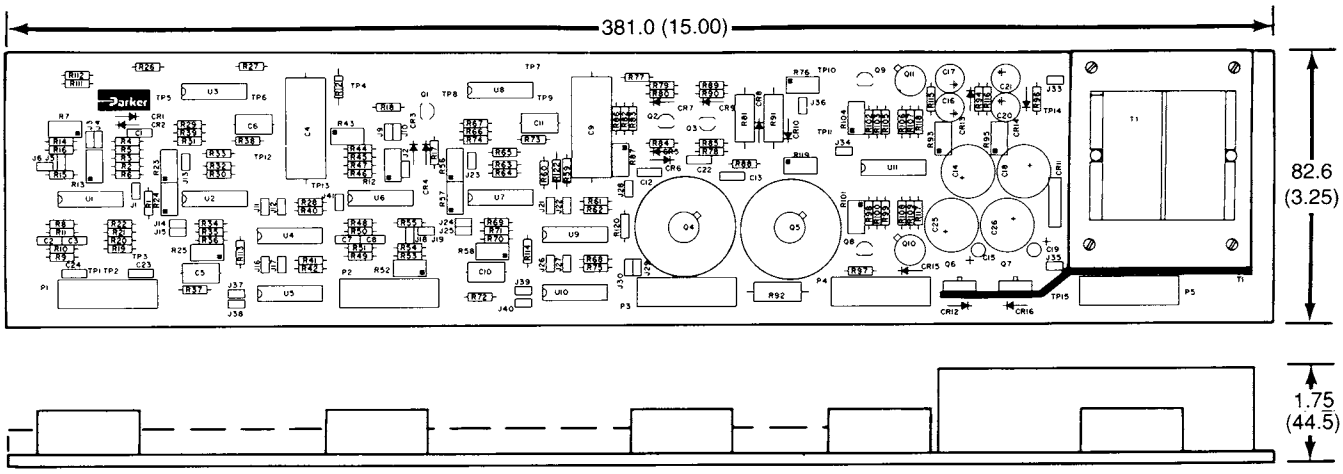
BD95 Servo Amplifier

BD90_BD95.p65, dd

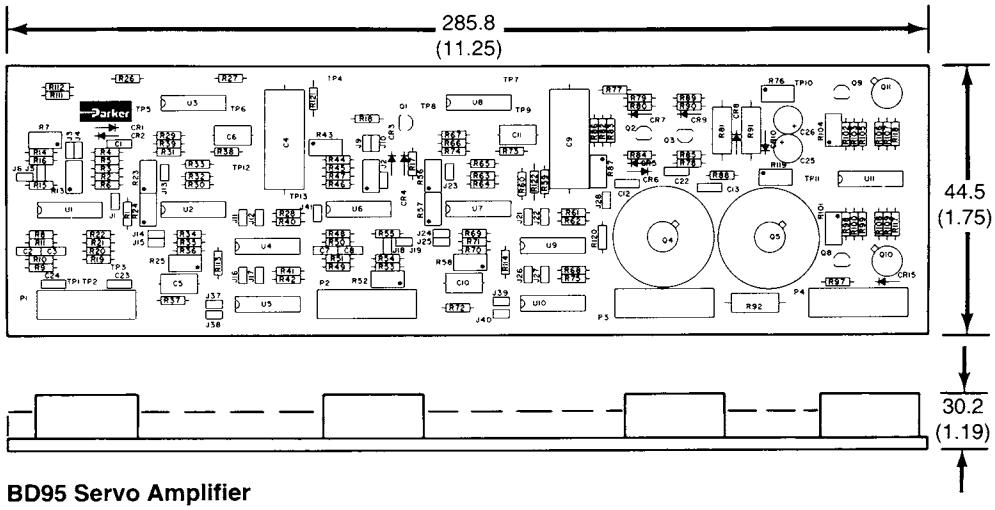
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Dimensions

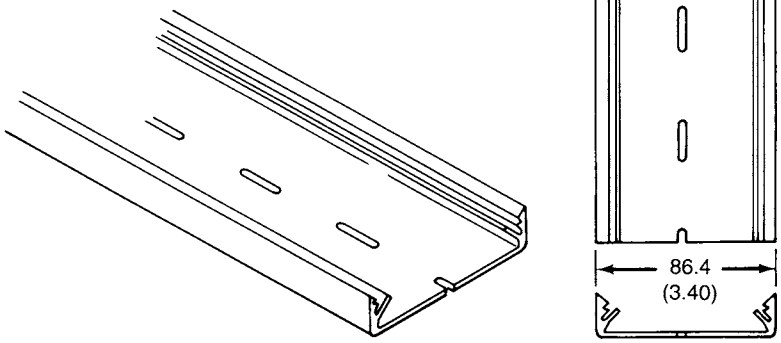
Inch equivalents for millimeter dimensions are shown in (**)



BD90 Servo Amplifier



BD95 Servo Amplifier



Snap-Trac is included with delivery

General Description

Series BD101 is an accessory card designed to solve a variety of common system problems. It is available in both ±15 VDC and 24 VDC versions.

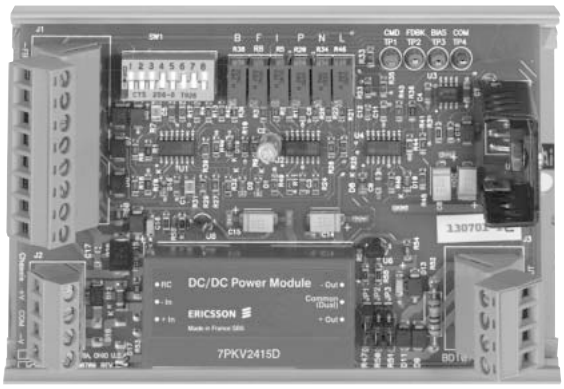
This card can function as a current driver for the BD servo valves. Maximum current outputs of ±30 mA, ±60 mA, ±100 mA and ±150 mA are jumper configurable.

Closed loop options are switch selectable with integral and proportional control. Feedback scaling, input bias, and gain adjustments are provided. Outputs currents up to ±150 mA or voltage output of ±10 VDC are available.

Current command of ±20 mA can be converted to ±10 VDC.

Features

- Open loop current driver for up to ±150 mA.
- ±20 mA input to ±10 VDC output option.
- Closed loop option with proportional and/or integral control.
- ±10 VDC reference voltages available.
- Available in ±15 VDC and +24 VDC versions.
- Differential inputs provide better noise immunity.
- Scaling and bias available on input signals.



Specifications

Power Supply Input	BD101-15 ±15 VDC @ 200 mA BD101-24 24 VDC Nominal (22-28 VDC) @ 250 mA
CMD and FDBK Inputs **Voltage** **Current**	Differential Inputs ±10 VDC max. 100K ohm input impedance ±20 mA max switch configurable 499 ohm input impedance
Reference Voltages	±10 VDC @ 10 mA
Current Output	±30 mA, ±60 mA, ±l00 mA, or ±150 mA Fixed up to ±150 mA Adjustable Icoil Rcoil ≤12.5 V
Voltage Output	±10 VDC @ 10 mA 1000 ohm output impedance
Operating Temperature Range (Ambient)	BD101-15: 0°C to 70°C (32°F to 158°F) BD101-24: 0°C to 70°C (32°F to 158°F) (≤ 100 mA load) 0°C to 55°C (32°F to 131°F) (> 100 mA load)
Size	82.6mm (3.25") wide x 127mm (5.00") long x 38.1mm (1.5") high
Mounting	Snap-Trac Parker PN 830007-5.25

Ordering Information

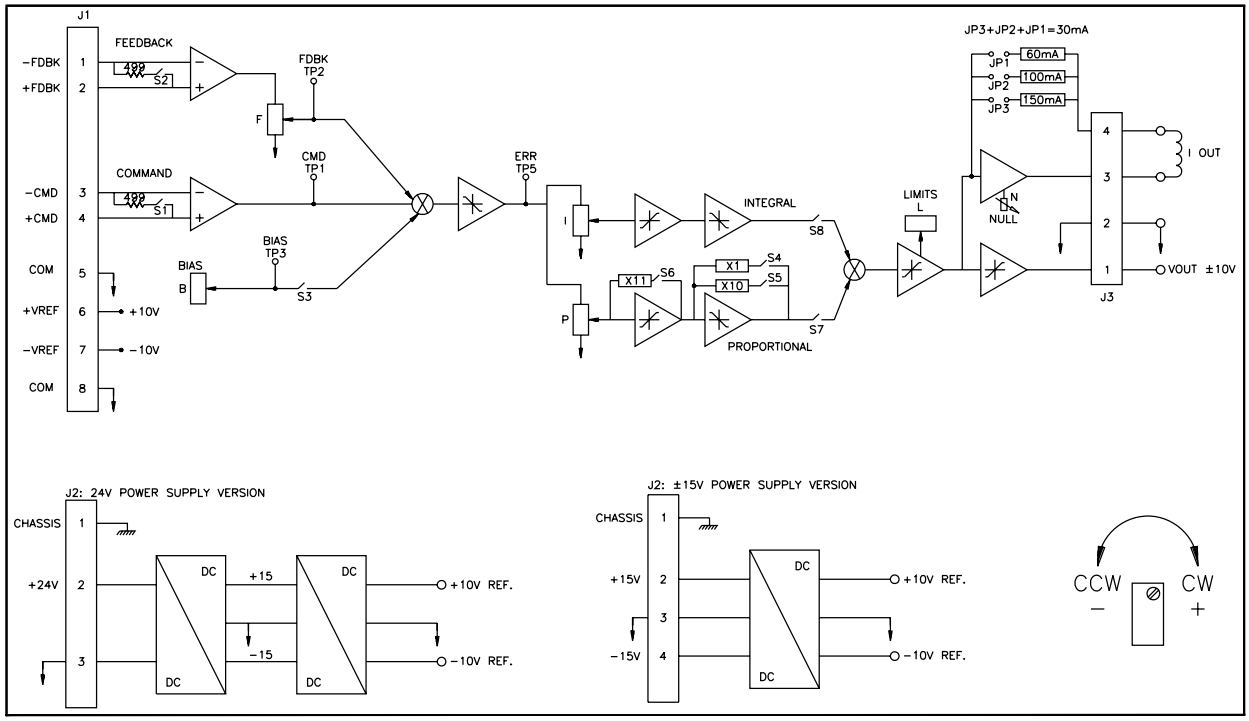
BD	101	—	□	□
Signal Conditional Card	Style		Power Supply	Design Series

Code	Description
15	±15 VDC @ 200 mA
24	24 VDC nominal

NOTE: Not required when ordering.

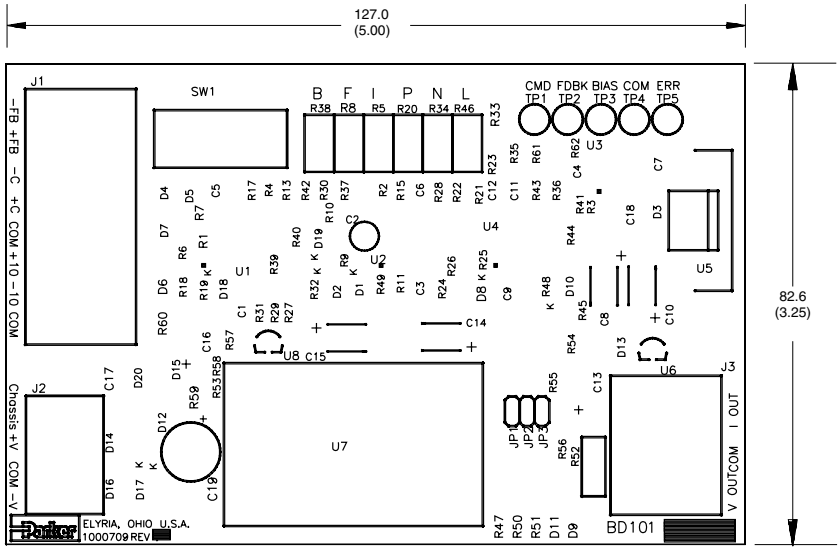
Note: Snap-Trac is included with delivery

Functional Block Diagram



Dimensions

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



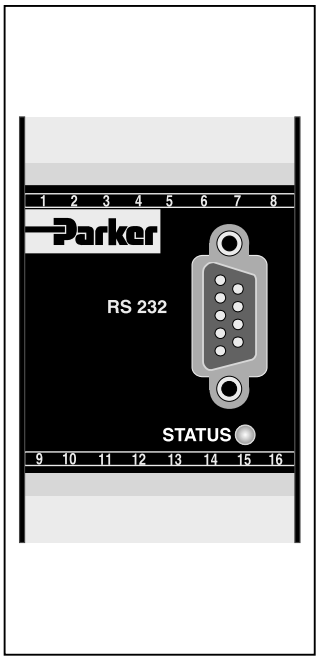
BD101.p65, dd

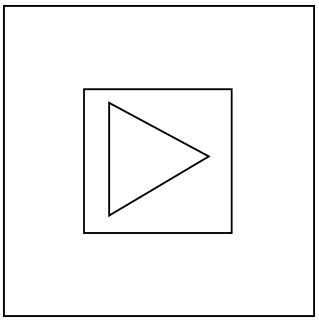
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series PZD00A-40* electronic modules provide options to enhance PWD, PCD driver modules and valves with onboard electronics. The modules are compact and easy to install with DIN rail mounting and plug-in terminals. The digital design allows for programmable parameters such as input signal conditioning, setpoints, ramps, mins, maxs, and command output options. The modules provide flexibility for different applications and repeatability from unit to unit. The module parameters are programmed with an RS-232 interface and user friendly software (ProPxD) with default values for the standard valves.

The PZD00A-40* module contains the functions required by typical proportional valve applications (series D*FP, D**FH valves, PWD, PCD modules).

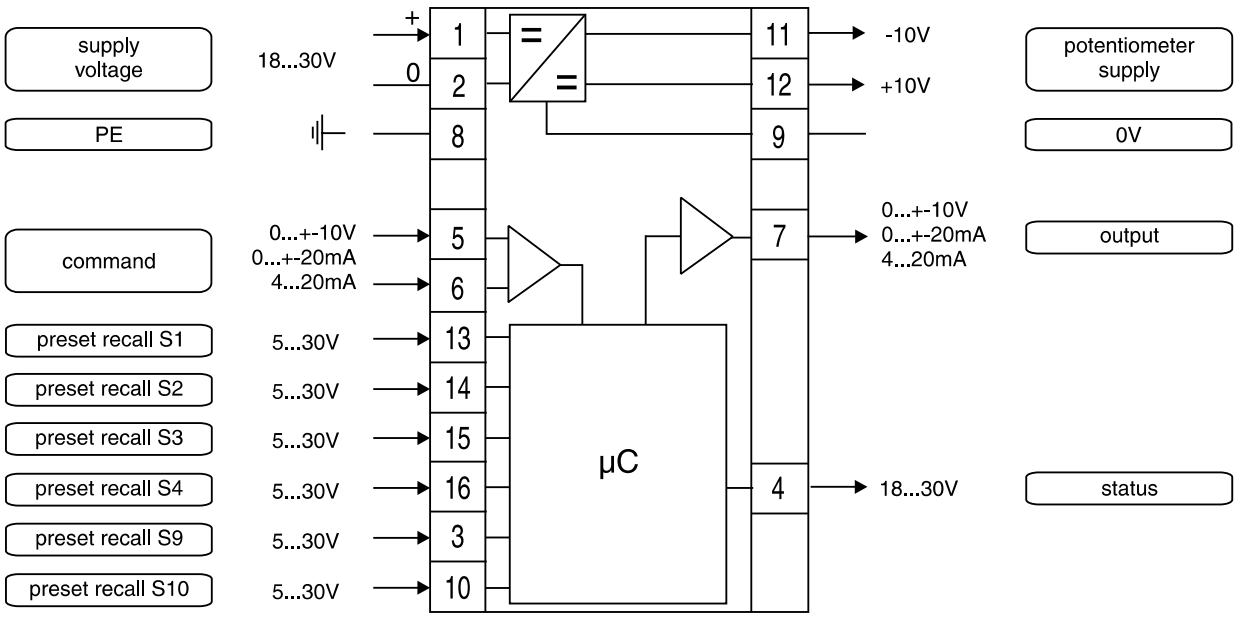




Features

- Setpoints, ramp options, mins, maxs.
- Command output options.
- Programmable parameters.
- Reference voltages.
- RS-232 Interface.
- User friendly programming software.
- Plug-in terminals.
- Compliant with European EMC Standards.

Block Diagram



Specifications

General			
Model	Module package for snap-on mounting on EN 50022 rail	**Mounting Position**	Any
		Ambient Temperature Range	-20°C to +60°C (-4°F to +140°F)
Package Material	Polycarbonate		
Inflammability Class	V2 to V0 acc. UL 94	**Protection Class**	IP 20 acc. DIN 40050
Electrical			
Duty Ratio	100%	**Status Signal**	Off – 0 to 0.5 VDC; On – Supply Voltage; rated max. 15 mA
Supply Voltage	18 VDC to 30 VDC, ripple < 5% eff., surge free	**Output Signal**	+10 to 0 to -10 VDC, rated max. 15 mA +20 to 0 to -20 mA, Ro < 500 ohm 4 to 12 to 20 mA, Ro < 500 ohm
Current Consumption Max.	100 mA		
Pre-fusing	500 mA medium lag		
Command Signal	+10 to 0 to -10 VDC, ripple < 0.01 % eff., surge free, Ri = 100K ohm +20 to 0 to -20 mA, ripple < 0.01 % eff., surge free, Ri = 200K ohm 4 to 12 to 20 mA, ripple < 0.01 % eff., surge free, Ri = 200 ohm < 3.6 mA = output signal 0 V / 0 mA / 12 mA acc. to output option > 3.8 mA = output signal on (acc. NAMUR NE43)	**Output Signal Resolution**	0.025%
		Reference output	+10 / -10, 2%, rated max. 15 mA
		Adjustment Ranges Minimum Maximum Cmd Channels Ramp Time Zero Offset	 0 to 50% 50 to 100% +100 to -100% 0 to 32.5 s +100 to -100%
		Interface	RS 232C, DSub 9p. male for null modem cable
Input Signal Resolution	0.025%	**EMC**	EN 50081-2, EN 50082-2
Differential Input Voltage Max.	30 VDC for terminals 5 and 6 against PE (terminal 8)	**Connection**	Screw terminals 0.2 to 2.5 mm², disconnectable
		Cable Specification	20 AWG overall braid shield
Channel Recall Signal	Off – 0 to 2.5 VDC; On – 5 to 30 VDC; Ri = 100K ohm	**Cable Length**	50m (164 ft.)
Options			
Technology Function	Code 1: Software adjustable transfer function with 10 compensation points for linearization of valve behavior.		

D

Ordering Information

PZD — Electronic Module Auxiliary Function
00 — Universal
A
—
40 — Module Type

Code	Description
40	6 Command signal presets Command input UP/DOWN ramps

Technology Function

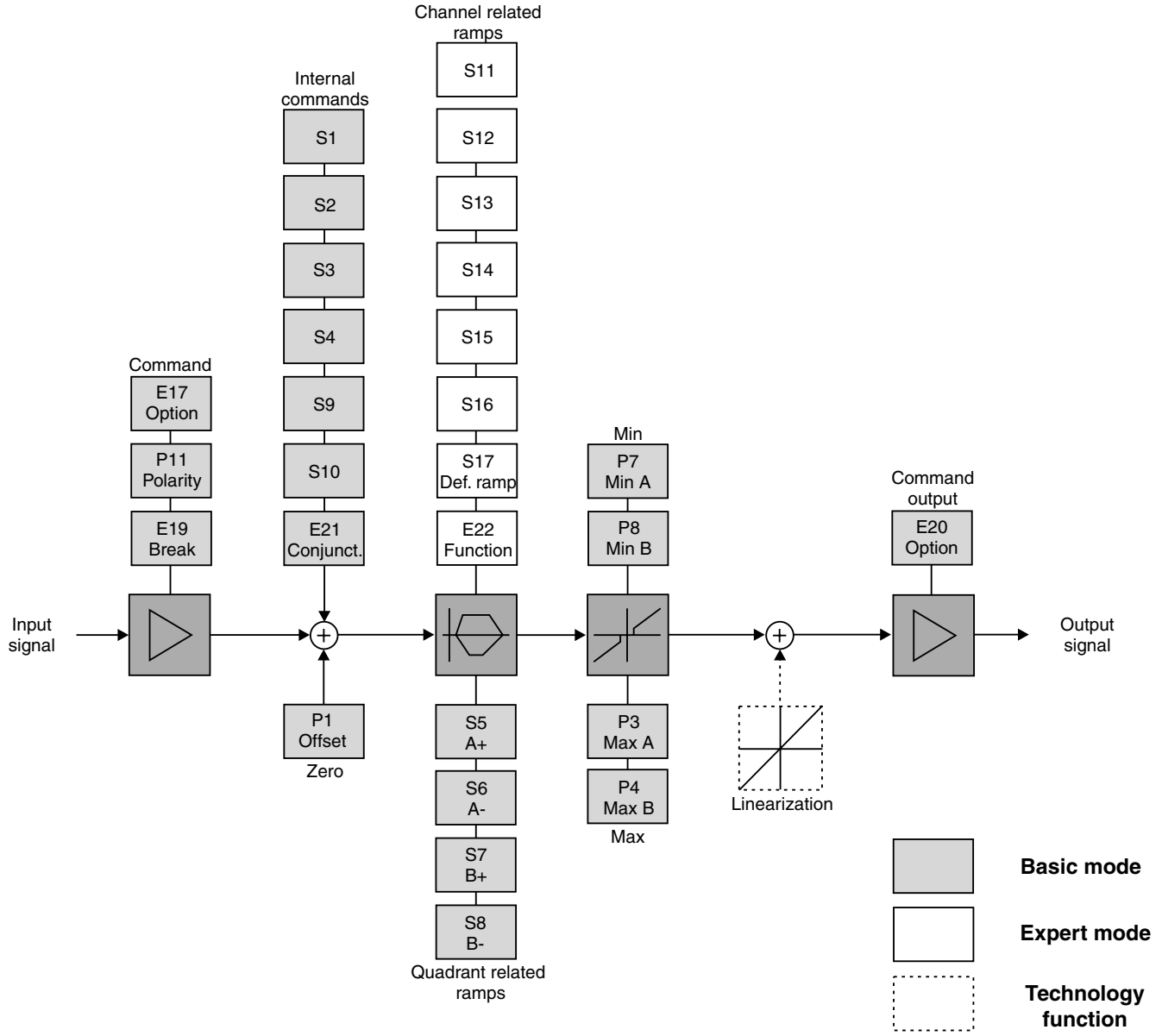
Code	Description
0	Standard
1	Linearization option

—
Design Series
NOTE: Not required when ordering.

Weight: 160g (0.35 lbs.)

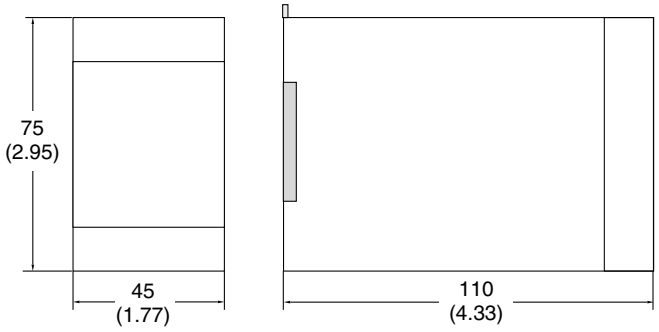
D

Signal Flow Diagram



Dimensions

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



ProPxD Interface Program

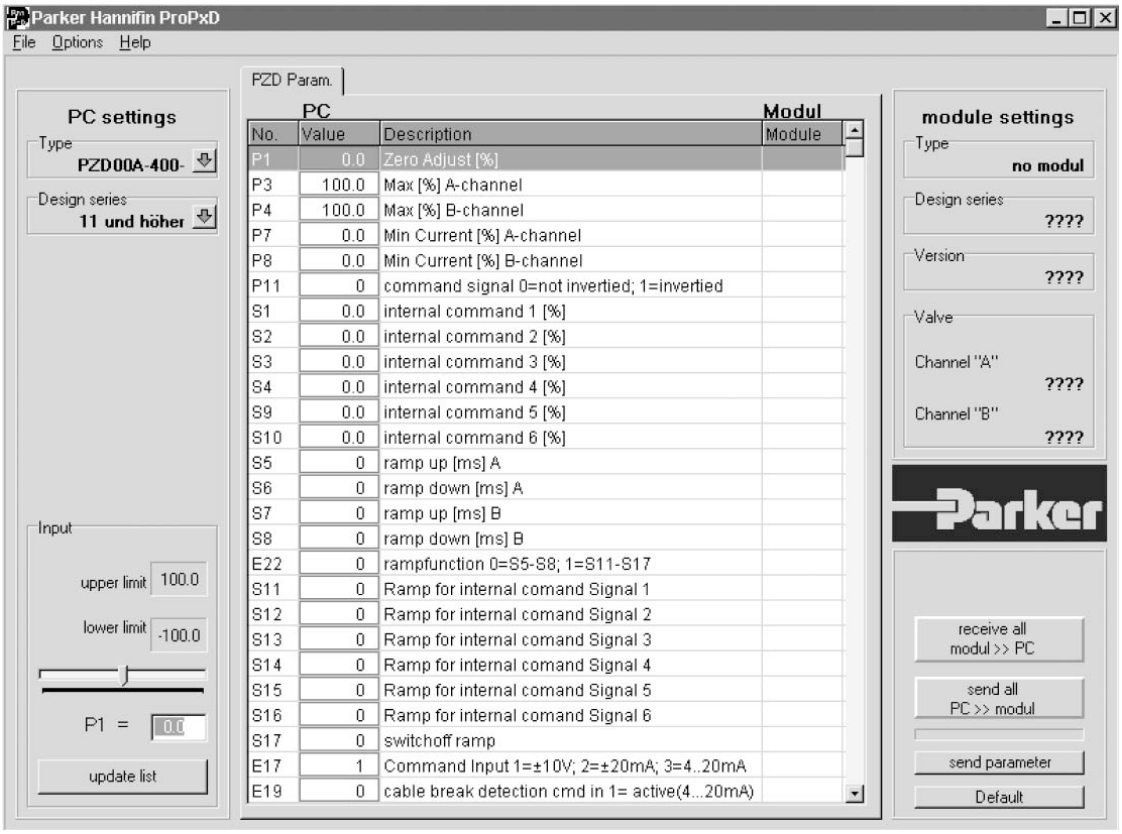
The new ProPxD software permits user-friendly parameter setting for the electronic module series PCD, PWD and PZD.

Via the clearly arranged entry screen the parameters can be identified and modified. Storage of complete parameter sets to floppy or hard disk is possible as well as printout or record as a text file for further documentation. Stored parameter sets may be loaded anytime and transmitted to the electronic module in the same manner as the default parameters which are available for all standard valve series. Inside the electronic a nonvolatile memory stores the data with the option for recalling or modification.

D

Features

- User-friendly editing of all parameters.
- Default values for standard valves.
- Identification and documentation of parameter sets.
- Executable with all actual Windows® operating systems from Windows® 95 upwards.
- Simple communication between PC and electronic via serial interface RS-323 and nullmodem cable.

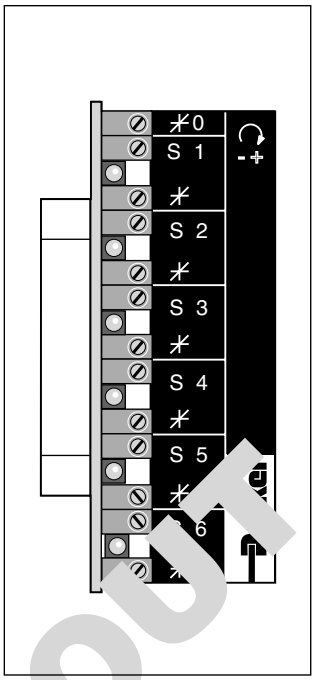


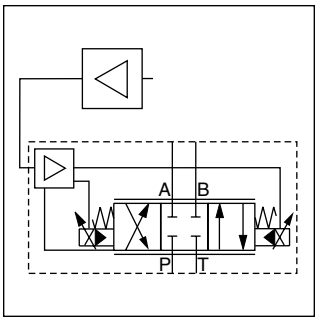
General Description

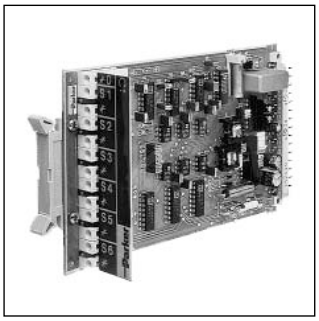
Series EZ150 electronic accessory module is a voltage command generator which can be used in conjunction with standard proportional valve control cards or directly with valves with integrated electronics. The module accepts up to 6 on/off input signals which select one of six voltage outputs set by potentiometer adjustments on the card. Six individually adjustable ramps are associated with each command.

Features

- Outputs to the main card can be "modulated" with up to six call-up set-values and six ramp potentiometers adjustable from 0 to 100%.
- Adjustable default ramp 0 to 100%.
- Reference outputs +10V/-10V.
- LEDs for indicating working conditions.





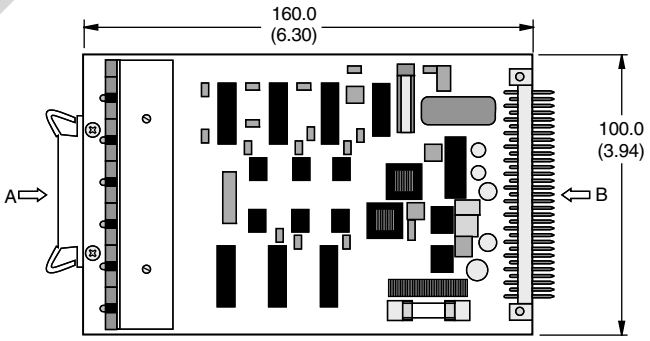


Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	4 VA
Command Signal	0 to +10 VDC and 0 to -10 VDC
Input Signal Voltage	5 to 30 VDC
Reference Outputs	±10 VDC @10 mA
Output	0 to +10 V and 0 to -10 V/10 mA
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramps	0-5 seconds adjustable
Shielded Cable Connect.	Supply connections: 0.5 sq. mm (20 AWG) Output and Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Dimensions

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



For new applications:
EZ150: Refer to PZD00A-400

Ordering Information

EZ — Electronic Module Auxiliary Card

For use with driver cards: E*102, E*104, E*105, E*154; or valves with integrated electronics with voltage input: D*FT, D*FH, RE*, D*FX.

00

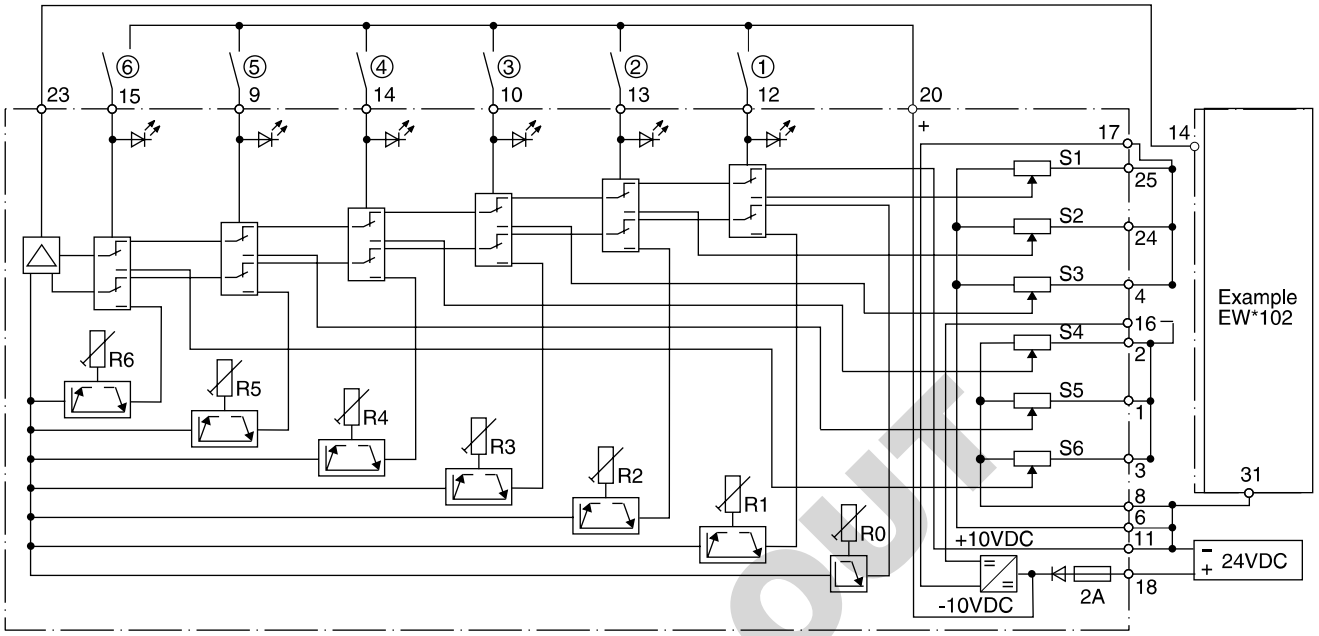
150 — Module Type

Code	Description
150	6 command channels, 6 ramps, 1 default ramp

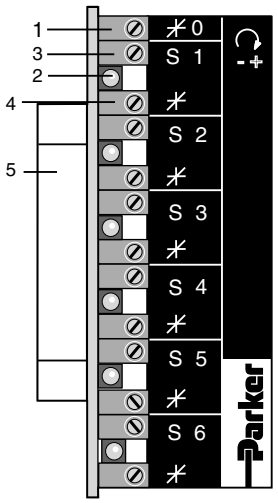
Design Series

NOTE: Not required when ordering.

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1 Default ramp, is active when all set-values have been switched-off.

2 6 Green LEDs as operating indicators for set value channels.

3 6 set value potentiometers S1–S6

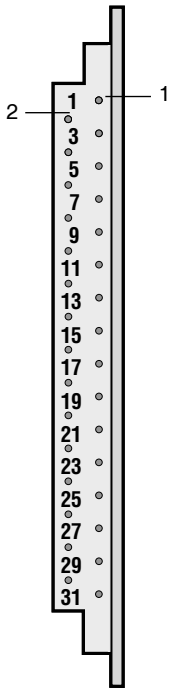
4 6 Set value ramp potentiometers, which are activated, when switching set values. The ramp is activated when its associated set value is newly switched in. The ramp time is added to any ramp time of the main card.

5 Yellow grip strip (auxiliary card).

Note:

- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



1 Input preselect channel 5
2 Input preselected channel 4
3 Input preselect channel 6
4 Input preselected channel 3
6 Reference potential channel 1..3
8 Reference potential channel 4..6
9 Input set value lock-on Chan 5
10 Input set value lock-on chan 3
11 Reference potential 0V supply/output set value
12 Input set value lock-on chan 1
13 Input set value lock-on Chan 2
14 Input set value lock-on chan 4
15 Input set value lock-up Chan 6
16 Output +10V reference
17 Output -10V reference
18 Input 24 VDC supply
20 Output 24 VDC set value lock-on
23 Output set-value
24 Input preselected channel 2
25 Input preselected channel 1

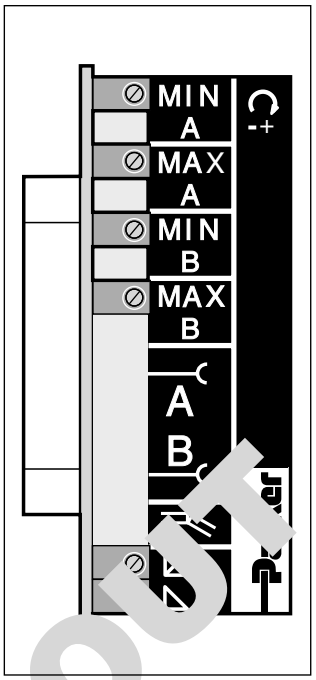
D

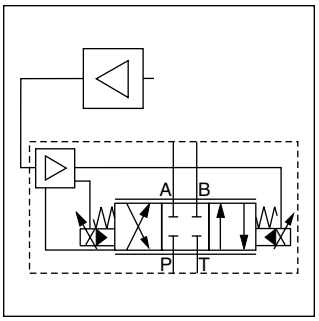
EZ150.p65, dd

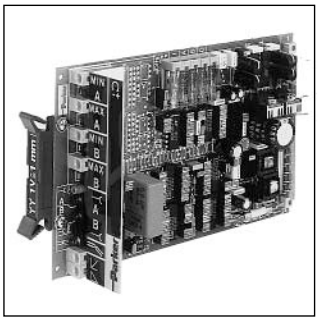
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series EZ154 electronic accessory module is a command signal conditioner which can be used in conjunction with standard proportional valve control cards or directly with valves with integrated electronics. The module accepts a ±10 volt command signal, and provides two potentiometer adjustments each for 'MIN' (deadband compensation), 'MAX' (gain), and ramps.







Features

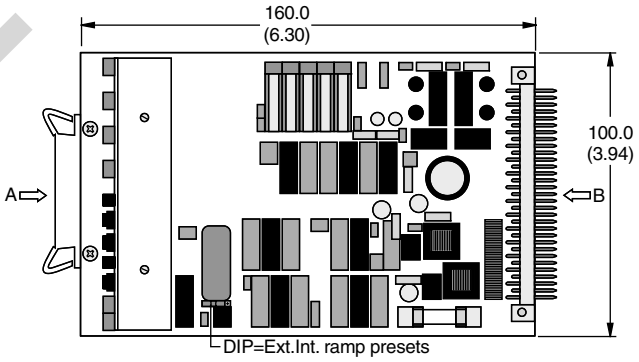
- Spool overlap range of the connected proportional valve can be manipulated with MIN potentiometer, adjustable by feeding a constant set value of appr. 0.2V.
- MAX-limiting of spool stroke with full set value range. Adjustable after MIN has been set and feeding a constant set value of 10V.
- DIP-switch from internal ramp generation to external ramp setting.

D

Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	4 VA
Command Signal	0 to +10 VDC and 0 to -10 VDC
Ramp Disable Voltage	5 to 30 VDC
Reference Outputs	±10 VDC @10 mA
Output Voltage	0 to ±10 V
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramp Time	0-5 seconds adjustable
Shielded Cable Connection	Supply connections: 0.5 sq. mm (20 AWG) Output and Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Dimensions



For new applications:
EZ154: Refer to PZD00A-400

Ordering Information

EZ	00	154	
Electronic Module Auxiliary Card		Module Type	Design Series

NOTE: Not required when ordering.

For:
DFT*
DFH*
RE*
DFX* – BJ

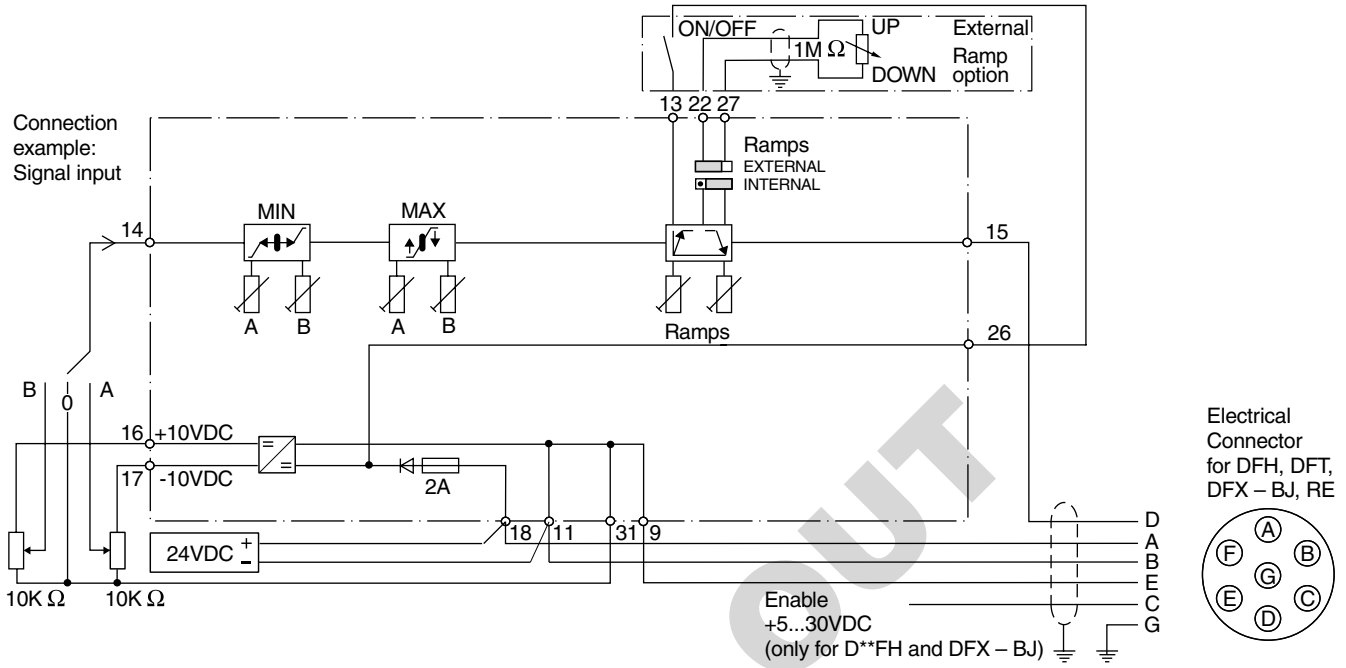
*with voltage input

Code	Description
154	Adjustable, MIN/MAX-limiters, UP/DOWN ramps

EZ154.p65, dd

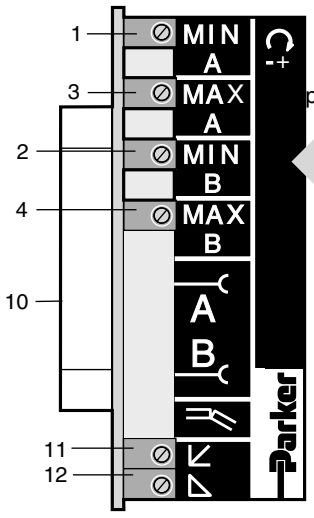
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Block Diagram



D

Operating and Diagnostic Elements (Elevation A)



1–2 MIN-limiting potentiometers for A- and B-sides

3–4 MAX-limiting potentiometers for A- and B-sides

10 Yellow grip strip (auxiliary Card)

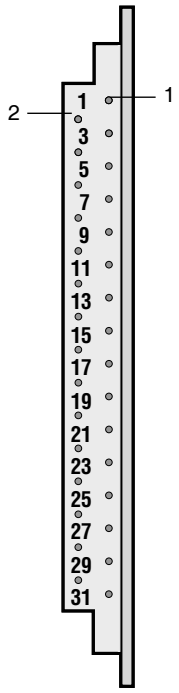
11 UP ramp potentiometer

12 Down ramp potentiometer

Note:

- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



9 Reference potential 0V output

11 Reference potential 0V supply

13 Input ramps switch off

14 Input control signal 0 to ±10 VDC

15 Output 0 to ±10V

16 Output +10V reference

17 Output -10V reference

18 Input 24 VDC supply

22 Input external ramp option

26 Output voltage to supply external switches

27 Input external ramp option

31 Reference potential 0V set value

EZ154.p65, dd

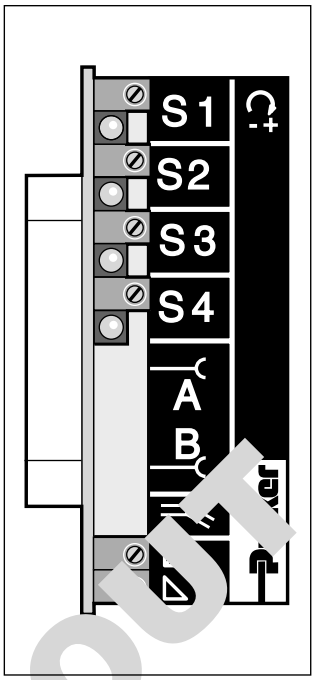
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

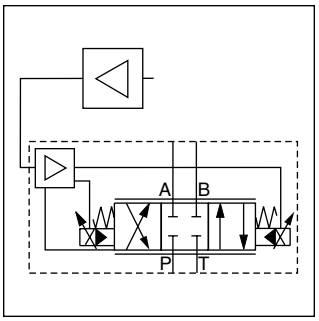
General Description

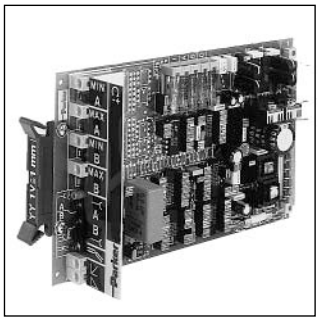
Series EZ155 electronic accessory module is a voltage command generator which can be used in conjunction with standard proportional valve control cards or directly with valves with integrated electronics. The module accepts up to 4 on/off input signals which select one of four voltage outputs set by potentiometer adjustments on the card. Two ramp adjustments provide control of actuator acceleration and deceleration.

Features

- Modulated output voltage by four selectable input values, adjustable from 0 to 100% and UP/DOWN ramp potentiometers.
- DIP-switch from internal ramp generation to external ramp setting.



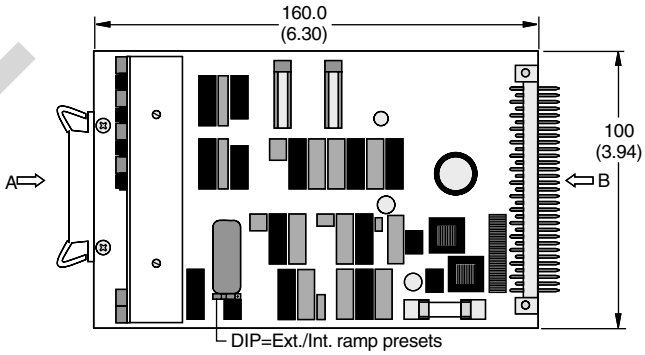




Specifications

Connection	31 Pole Male Connector, DIN 41617
Power Supply	Regulated: 18-26V Unregulated: 22-38V
Power Required	4 VA
Command Signal	0 to ±10 VDC
Ramp Disable Voltage	5 to 30 VDC
Reference Outputs	±10 VDC @10 mA
Output Voltage	0 to ±10 VDC
Ambient Temp. Range	0°C to +70°C (+32°F to +158°F), Standard Range
Ramp Time	0-5 seconds adjustable
Shielded Cable Connection	Supply connections: 0.5 sq. mm (20 AWG) Output and Command Signals: 0.5 sq. mm (20 AWG)
Fuse	2A medium lag, DIN 41571/5x20 mm

Dimensions



For new applications:
EZ155: Refer to PZD00A-400

Ordering Information

EZ — Electronic Module Auxiliary Card

For:
DFT*
DFH*
RE*
DFX* – BJ

*with voltage input

00

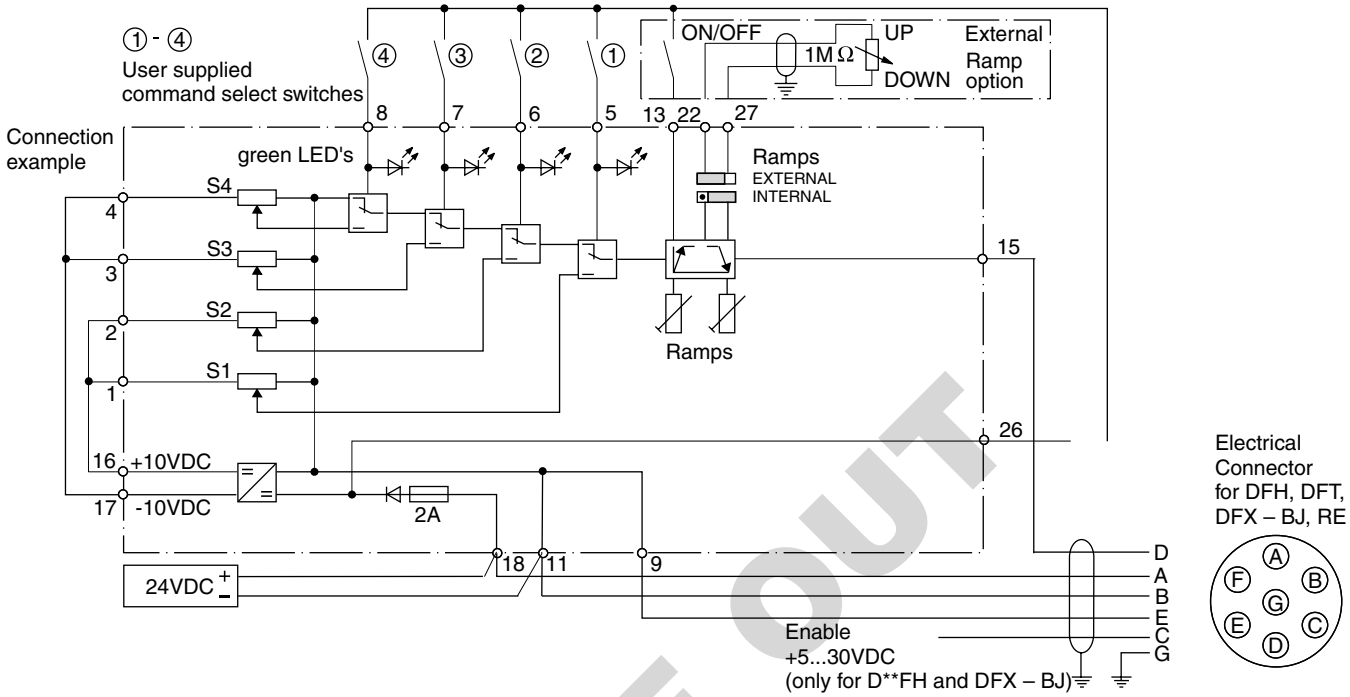
155 — Module Type

Code	Description
155	4 command channels, UP/DOWN ramps

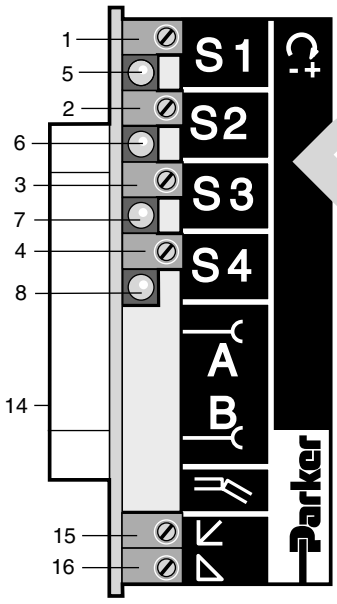
Design Series

NOTE: Not required when ordering.

Block Diagram



Operating and Diagnostic Elements (Elevation A)



1–4 Set value potentiometer S1–S4

5–8 Green LED's for channel activity of the set value

14 Yellow grip strip (auxiliary Card)

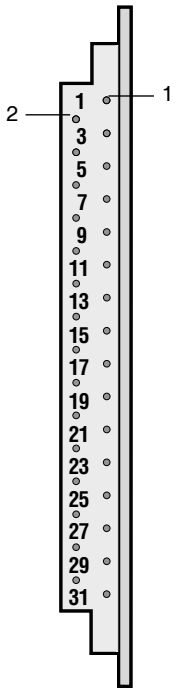
15 UP ramp potentiometer

16 Down ramp potentiometer

Note:

- Always turn off the power to this board before removing it from the card holder.

Connector (Elevation B)



1 Input preselect direction, channel 1
2 Input preselect direction, channel 2
3 Input preselect direction, channel 3
4 Input preselect direction, channel 4
6 Input set value lock on, channel 2
5 Input set value lock on, channel 1
7 Input set value lock on, channel 3
8 Input set value lock on, channel 4
9 Reference potential 0V transducer
11 Reference potential 0V supply
13 Input ramp disable
15 Output 0...+/-10V
16 Output +10V reference
17 Output -10V reference
18 Input 24 VDC supply
22 Input external ramp option
26 Output source to supply external switches
27 Input external ramp option

EZ155.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series EZ595 single loop servo amplifier is designed to enhance the performance of Parker Hannifin servo and proportional control devices in closed loop servo systems. The card has been designed to make servo loop tuning as straight forward as possible while retaining the essential dynamic compensation features of our more sophisticated servo amplifiers. The output of the EZ595 is a bipolar voltage signal scaled from 0 to ± 10 VDC. The card employs valve deadband control, as well as several logic and safety features to help optimize servo system design. It can be used as an input command to any of the following Parker EH control devices.

D

Servo and Proportional Directional Control Valves:

- D*FH (with open loop on–board driver electronics)
- D1FX (with open loop on–board driver electronics)
- D*FS (with PWDXXA-400 Driver)
- BD Series servovalve with BD101 Driver

Proportional Flow Control Devices:

- TDA (with PCD00A-400 Driver)

Specifications

Power Supply Requirements	24 VDC @ 100 mA
Command Signal Range	± 10 VDC, 0 to 20 mA, 4 to 20 mA selectable
Feedback Signal Range	± 10 VDC, 0 to 20 mA, 4 to 20 mA selectable
Frequency Response	In excess of 1000 Hz
Output Signal Range	0 to ± 10 VDC
Reference Voltage	± 10 VDC @ 10 mA
Input Impedance Command and Feedback	Voltage Input, 100K ohm Current Input, 499 ohm
Operating Temperature Range (Ambient)	0 to 70°C (32° to 158°F)
Mounting	DIN Style, 32 Pin, F
Protection Class	Open, not rated

Features

- DIN rack mounted in 32 Pin form 'F' format.
- Optional voltage or current command and feedback signal compatibility.
- Differential input feedback amplifier circuit.
- ± 10 VDC reference voltages @ 10 mA supplied for external pots.
- Out of range detection for command and feedback signals.
- LED front panel status indicators and diagnostics.
- PID gain control loop (user selectable).
- Separately adjustable gains for positive and negative output levels (for tuning with differential area cylinders).
- "Deadband eliminator" circuit to minimize electrical deadband in system due to spool overlap (Directional Valves) or coil threshold (Pressure Control & Throttle Valves).
- Buffered error signal read–out available for remote monitoring.
- Integrator shut–down feature selectable for low signal levels.

Ordering Information

EZ00 — **595** — **A**

- EZ00: Closed Loop Conditioning Cards
- 595: Function
- A: Design Code

Code	Description
595	Single Loop Servo Amplifier

Accessories

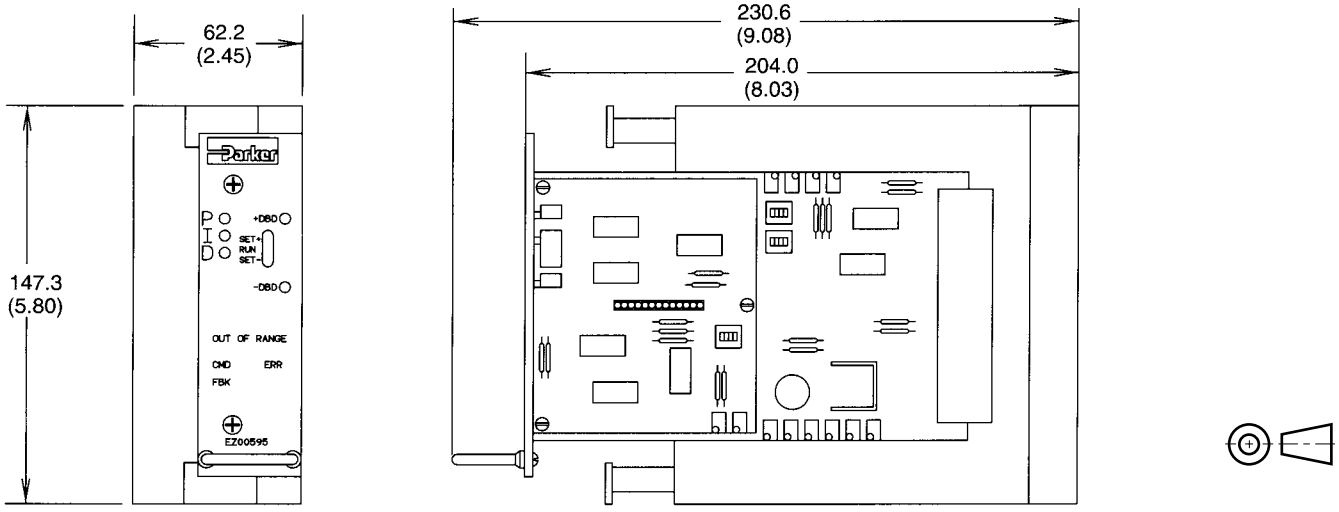
Code	Description
KH32F	32 Pin Card Holder
PS24	Power Supply, 24 VDC

D

Dimensions

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

Note: Board Dimensions w/o Cardholder
210 x 127 x 38mm (8.25" x 5" x 1.5")

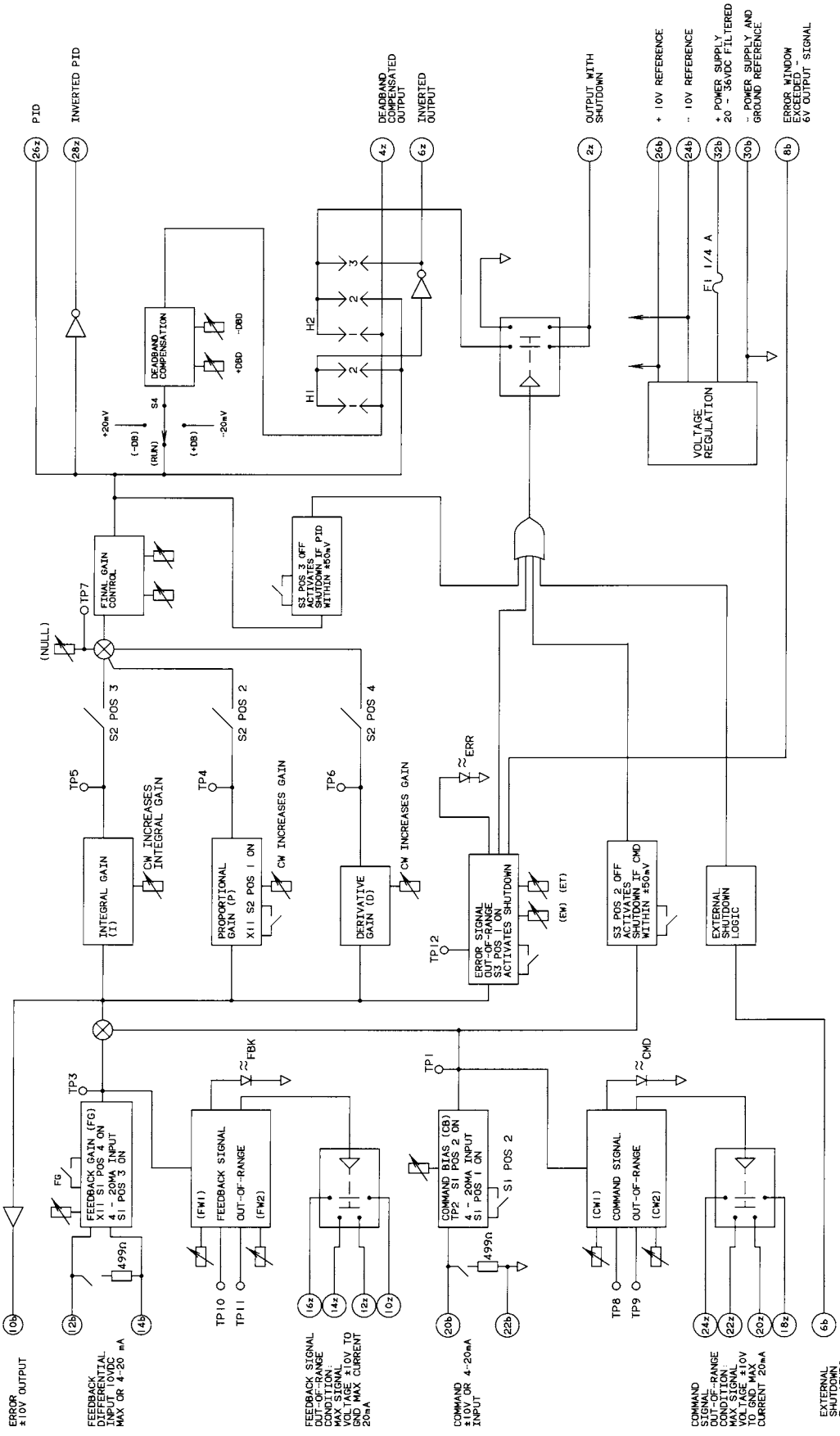


Special Note

It should be noted that, while the Parker single loop servo amplifier is designed to work with a wide range of control devices, these devices vary greatly in response characteristics and may be the limiting factors in total system performance. Careful analysis of your system requirements should be made prior to selecting any components for a closed loop system.

The successful design and startup of either a closed loop positioning or velocity control system requires considerable forethought and a good understanding of the dynamics of the system and the load one is attempting to control. Closed loop feedback control is a broad topic and is the responsibility of the user to understand the limitations, hazards, and implications of these systems, as well as detailed tuning procedures required by some control schemes.

D



SPECIAL NOTE: CW ADJUSTMENT OF POTS INCREASES GAIN, COMPENSATION, AND ERROR LIMITS.

EZ595.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series PS15 power supplies convert AC input power to a filtered and regulated ±15 volt and +5 volt DC output voltage. PS series power suppplies are UL recognized and meet CSA standards.

These power supplies provide the power necessary to operate the following Electrohydraulic products:

- BD95, BD101-15
- Magnetostrictive transducers

Operation

Connect the supplied 5 ohm, 10 watt resistor across the +5 VDC output and common terminals (V1 and G1) if the 5 volt supply is not in use or the +5VDC load current is less than 750 ma.

D

Specifications

Input Power Requirements			
Voltage	85–132 VAC, 47–440 Hz, single phase		
Current	2.2 amps		
Inrush Current	25 amps		
Output Power Specifications			
Voltage	+15VDC	-15VDC	+5VDC
Maximum Current	1.2A	0.5A	5.0A
Voltage Regulation	±1%		
Maximum Power	50 watts		
Start-up Time	100 ms		
Efficiency	70%		
Operating Temp./ Humidity	0°C to +50°C (+32°F to +120°F), 30% - 90% RH		
Storage Temp./ Humidity	-20°C to +75°C (-4°F to +170°F)		
Physical Characteristics			
Size	36.0 x 176.0 x 93.0 (1.42" x 6.93" x 3.66")		
Mounting	Slotted mounting holes, or use tapped holes. Both 8–32 UNC or M4 size holes are provided. Mounting screws should not exceed 6mm.		

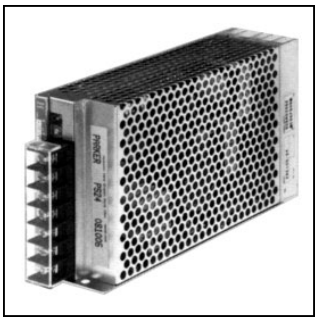
Ordering Information

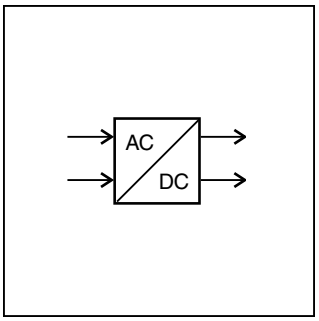
PS — Power Supply

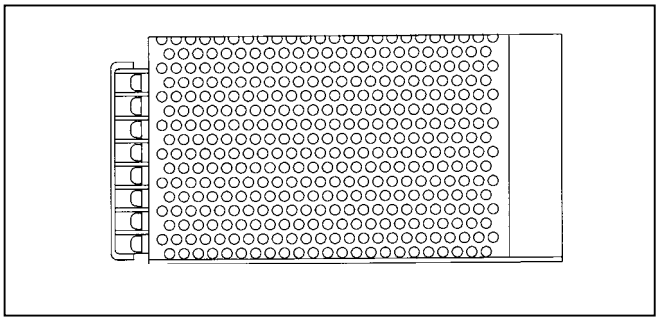
15 — Voltage Output

Code	Description
15	±15 VDC Power Supply

Weight: 1.2 kg (5.1 lbs)

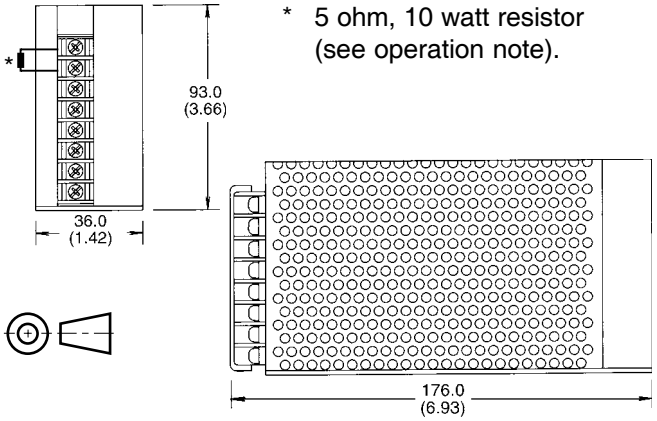






Dimensions

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



* 5 ohm, 10 watt resistor (see operation note).

Connector - Pinout

V1	○	+5 VDC Output
G1	○	+5 VDC Common
V2	○	+15 VDC Output
G2	○	±15 VDC Common
V3	○	-15 VDC Output
FG	○	AC Ground
L	○	AC Hot
N	○	AC Neutral

Contents

Series	Description	Page
PMC10	Single Axis Motion Controller – Programmable	E2 - E4
PMC20	Two Axes Motion Controller – Programmable	E2 - E4

E

Consult Factory

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

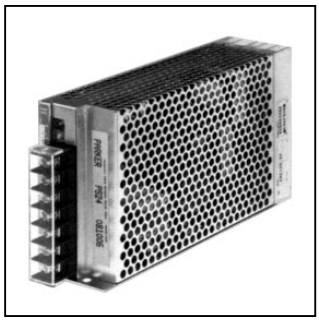
Series PS24 power supplies convert AC input power to a filtered and regulated 24 volt DC output voltage. PS series power supplies are UL recognized and meet CSA standards.

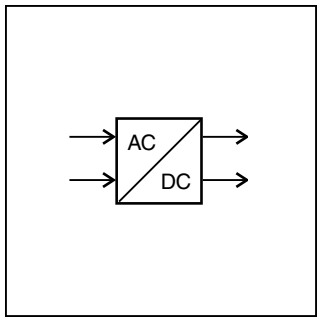
These power supplies provide the power necessary to operate the following Electrohydraulic products:

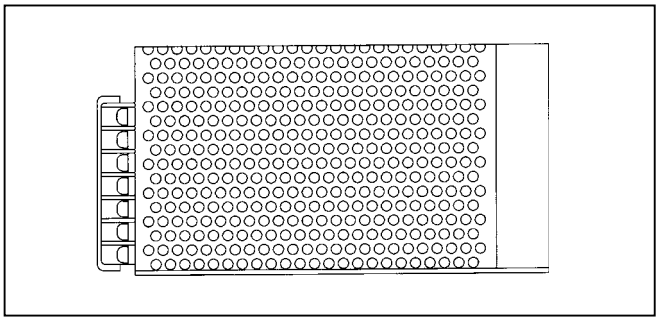
- D*FT, D*FX, D*FL, D*FH and RE* valves
- EW, ED, ET and EZ driver cards

Operation

The PS24 power supplies have “sense” inputs to compensate for voltage drops due to long cable runs. A separate set of wires connected to the “S” terminals read the voltage at the load and direct the power supply to adjust the output voltage. Factory installed jumpers between the sense and power terminals should be removed when using this feature.





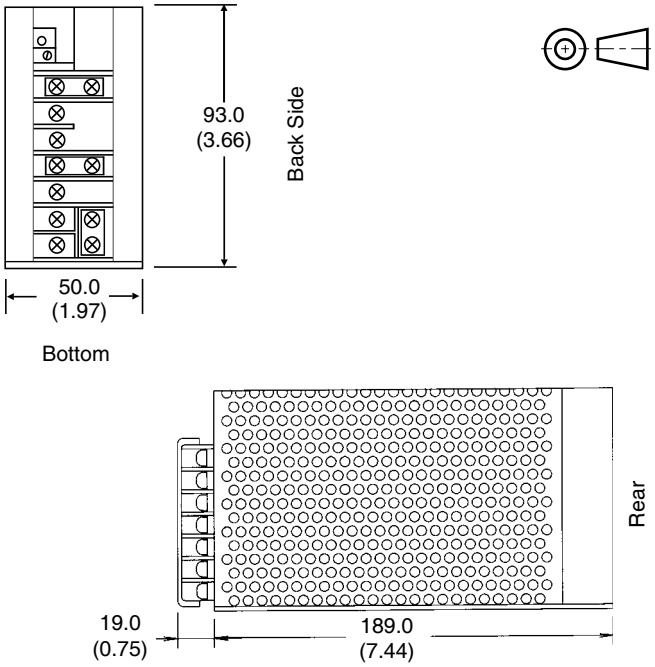


Specifications

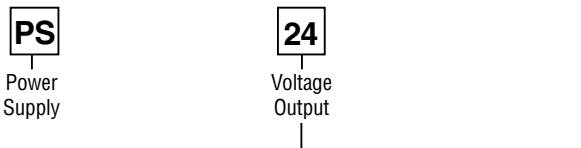
Input Power Requirements	
Voltage	85–132 VAC, 47–440 Hz, single phase
Current	2.2 amps (110V), 1.2 amps (220V)
Inrush Current	25 amps (110V), 30 amps (220V)
Output Power Specifications	
Voltage	24 VDC, (adjustable range, 21.6 to 26.4 VDC) set to 24 VDC at the factory.
Maximum Current	4.5 amps maximum
Voltage Regulation	±.4%
Maximum Power	108 watts
Start-up Time	200 ms
Efficiency	84%
Operating Temp./ Humidity	-9°C to +49°C (+15°F to +120°F), 30% - 90% RH
Storage Temp./ Humidity	-20°C to +85°C (-4°F to +185°F) 20% - 90% RH
Physical Characteristics	
Size	50.0 x 208.0 x 93.0 (1.97” x 8.19” x 3.66”)
Mounting	M4 tapped mounting holes; 2 located on back side, and 3 on bottom.

Dimensions

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



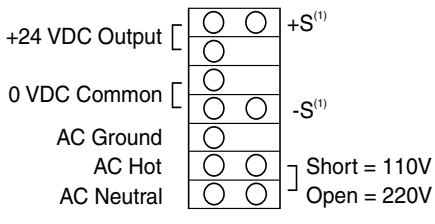
Ordering Information



Code	Description
24	24 VDC, 4.5 amp, Power Supply

Weight: 1.2 kg (5.1 lbs)

Connector - Pinout



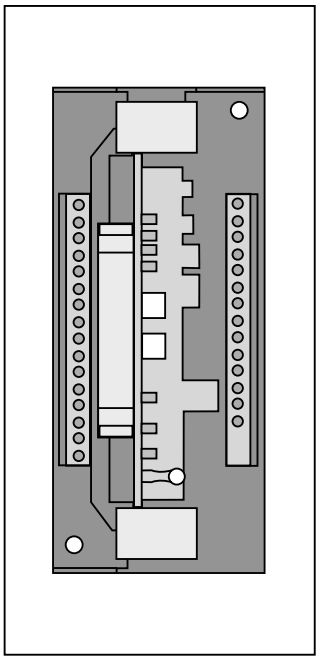
(1) Refer to Operation

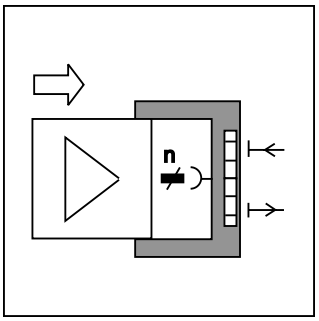
PS24.p65, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Card holders allow easy assembly and wiring of individual electronic driver card models EW, ED, EZ, and ET.





Technical Data

Base-unit	Fastened with screws or DIN rails 35mm
Printed circuit board	Carries the female connector and connection component for the terminal strip
Terminals	Screw terminals per DIN 41617 with wire prot. nominal cross-section AWG11, 5mm pitch
Female connector (per order code)	31 pole to DIN 41617, double row contacts. 15-, 48-, 96 pole to DIN 41612, 2 or 3 rows of contacts

D

Ordering Code

K Card Holder

For Driver card models:
EW 101, 102, 104
ED 101, 102, 104
ET 101, 102, 104, 105
EZ 150, 154, 155, 305

Ordering Code

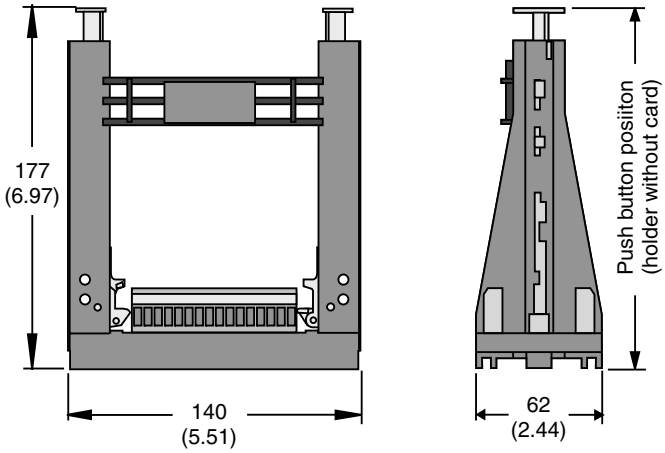
KH32F

For Driver card models:
ET 154
EZ 595

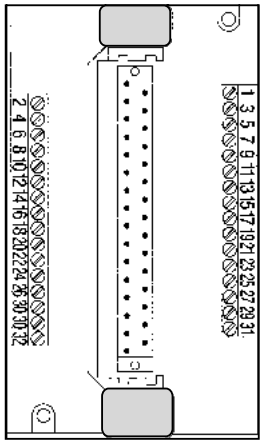
Weight: 0.5 kg (1.0 lbs)

Dimensions

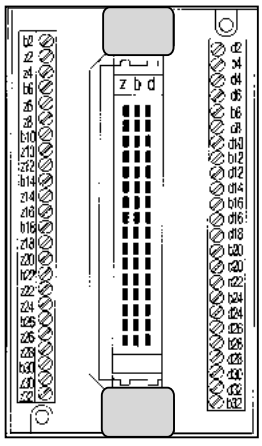
Inch equivalents for millimeter dimensions are shown in (**)



Terminal Locations



Model K



Model KH32F

K.p65, dd, an

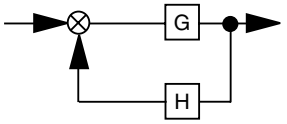
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

The PMC series digital closed loop motion controllers are available in one and two axes configurations, and can be ordered with either encoder or magnetostrictive feedback sensor interfaces. The PMC series controllers are stand-alone motion controllers requiring no additional components to implement up to two closed loop motion control axes per controller. Dual axes controllers can be programmed to operate either axis independently, coordinate both axes, or gear one axis to another.

A user friendly interface including a keypad and display are used to enter program steps, setup control parameters, monitor performance, and provide access to all available control functions.

The PMC motion controllers' output drivers can be configured to directly drive servo valves with current, or proportional valve interface electronics with voltage.



#1 WAIT TIL INPUT 1
#2 ACCEL 10.0 IN/SS
#3 VELOCITY 5.0 IN/S
#4 POSITION 22.0 IN
#5 WAIT IN POS
#6 END

Features

- Stand alone digital motion controller.
- One or two control axis versions available.
- Optional interfaces for encoder or magnetostrictive feedback transducers.
- User friendly programming interface.
- Natural language programming commands such as 'WAIT', 'REPEAT', 'RAMP'.
- Up to 8 programs per axis can be stored internally.
- Independent, interlocked or geared axes options.
- Programmable digital I/O: 10 inputs, 12 outputs.
- Valve output drivers can be set for current or voltage.

Specifications

Processor	16-bit 80188 CPU
Encoder Feedback Interface	+5 or +12 VDC bipolar or unipolar; quadrature with marker; max. input rate =.5 mHz; software scaling for 1x, 2x or 4x.
Magnetostrictive Feedback Interface	Pulse width modulated with external interrogation (Temposonics or equivalent) (1)
Control Algorithm	Proportional, integral, derivative (PID), dbl. derivative (acceleration), and feed forward loop compenations — 2ms loop update time
Servo Output	Jumper selectable: ±10VDC differential, 0 to +10VDC, and ±5VDC single ended or differential, and ±50 mA. Other current outputs available by request.
Input/Output	14 input and 5 output dedicated functions; 10 inputs and 12 outputs user programmable; optical isolation – 7500 V
Operator Panel	20-key pad with 3 software-defined functon keys
Display	4 lines by 16 character backlit LCD
Serial Interface	RS232, RS485 for 8 units in a multi-drop network, each with its own ID
Power Requirements	117 VAC ±10% (220 VAC available) 60 Hz, 1 amp continuous, 5 amp – inrush
Operating Environment	0°C to +50°C (+32°F to +122°F); 10% to 90% humidity, non-condensing
Weight	3.4 kg (7.5 lbs.)

(1) Temposonics is a trademark of MTS Corporation

Ordering Information

PMC
Motion Controller

Configuration

Code	Description
10T	Single Axis, Temposonics Feedback
20T	Dual Axis, Temposonics Feedback
10E	Single Axis, Encoder Feedback
20E	Dual Axis, Encoder Feedback
RK	Remote Kit

Design Series

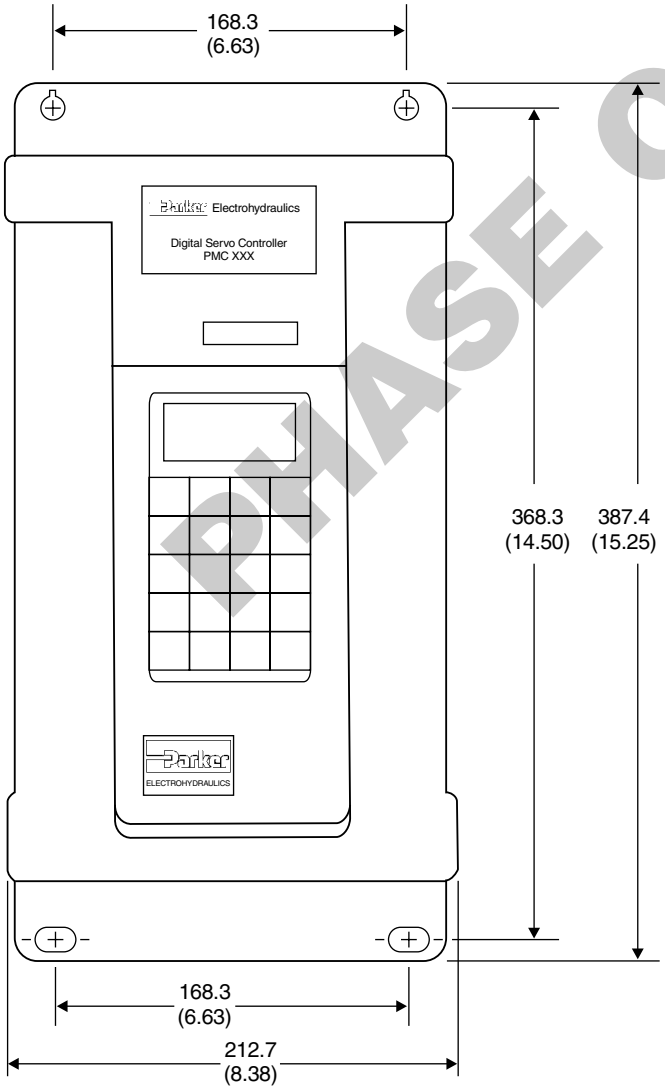
NOTE:
Not required when ordering.

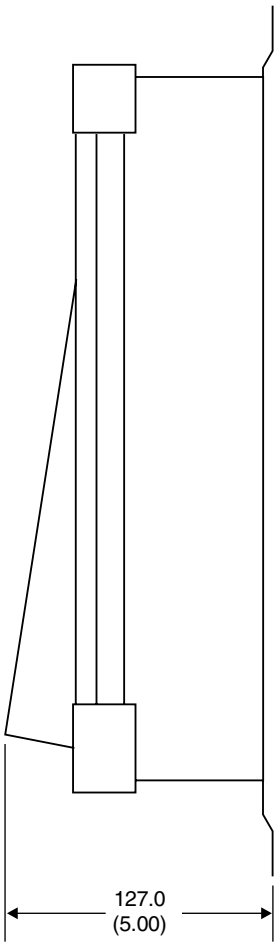
Weight:

PMC10T	3.4 kg (7.5 lbs.)
PMC20T	3.4 kg (7.5 lbs.)
PMC10E	3.4 kg (7.5 lbs.)
PMC20E	3.4 kg (7.5 lbs.)
RK	3.4 kg (7.5 lbs.)

Dimensions

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





PMC10T/20T

E

Operation

A PMC series controller can be used in the following ways:

- Independently, as a stand-alone control system. In this mode, the controller can be programmed from the on-board keypad. The stored programs can then be run from the keypad or by an external switch or relay control. In addition, direct operator control is possible. An axis may be jogged or stepped from the keypad.
- With digital I/O connections to an external PLC (programmable logic contoller). In this mode, stored programs are selected and started by the PLC. The PLC also has the ability to interact with the running program via the digital inputs and outputs.
- Integrated through the serial interface into a multiple controller system. In this mode, up to eight PMC controllers can be connected to a host device (such as a personal computer or PLC) for two-way communications.

Interfacing

Transducer Interface – Temposonics (1)

Each Temposonics tranducer interface is designed to work with a 15 V Temposonics tranducer. Each interface provides connections for plus and minus interrogate signals, plus and minus gate signals, +15 VDC, +5 VDC, and a ground for the shielded connections, all on one terminal strip.

Transducer Interface – Encoder

Each encoder tranducer interface is designed to work with an incremental encoder requiring either +5 VDC or +12 VDC. The encoder may have either TTL or differential outputs. Each interface provides connections for A+, A-, B+, B-, Marker+, Marker-, +5 VDC (or +12 VDC) and a ground for the encoder, all on one terminal strip.

Servo Interface

Each servo interface can be independently configured to drive current or voltage outputs. Jumper selectable configurations are ±10VDC differential, 0 to +10VDC and ±5VDC sgl. ended or differential, and ±50 mA. Other current outputs available by request.

Communications

Serial Communications

The standard RS232 serial interface allows programs and setup data to be sent to a printer or transferred to or from a personal computer or other external device. Alternatively, the RS232 interface allows two-way communications with an external host, such as a personal computer.

The RS485 serial communications mode (jumper selectable) allows a multi-drop configuration using a host plus up to eight PMC controllers, controlling up to 16 axes.

(1) Temposonics is a trademark of MTS Corporation

Digital I/O

The PMC provides 20 inputs and 16 outputs, which can be operated on internal or external power.
The 20 inputs incude the following:

Run X	Starts the currently selected program for Axis X.
X Select 1, 2 and 4	Selects a program for Axis X.
Run Y	Starts the currently selected program for Axis Y.
Y Select 1, 2 and 4	Selects a program for Axis Y.
Interlock	If off, stops the running program(s) and disables both axes.
Access	If off, allows opetrator to establish presets, run and monitor programs, but prevents operator access to programming and setup functions.

The remaining 10 inputs are user programmable. They can be used to tie external events to a running program. For example, if a “move next distance” switch for Axis X is connected to Input 1, then the program instruction WAIT TIL INPUT 1 can be used to make the running program stop at this point and wait for an operator response.

The PMC provides 16 outputs, including the following:

X Ready	Indicates that the X axis is not running a program and is clear of errors.
Y Ready	Indicates that the Y axis is not running a program and is clear of errors.
Status	Indicates that there are no errors on any axis. Twelve outputs are user programmable. They can be used to tie external events to a running program. For example, if Output 10 is connected to an LED, then the axis is at or beyond the specified position.

Contents

Description	Page
Installation Guides	F4
Accessories	F2 - F4
EHC Cable Assemblies	F2
Connectors	F3
Bolt Kits/Subplates	F4

F

General Description

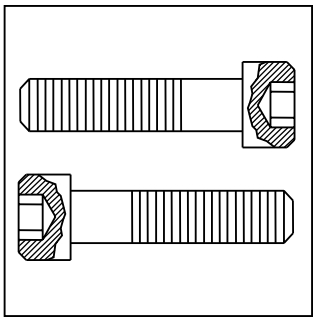
Supporting accessory products for proportional valves listed in this section include cable assemblies, connectors, bolt kits, and subplates. Valve drivers and power supplies can be found in the electronics section.

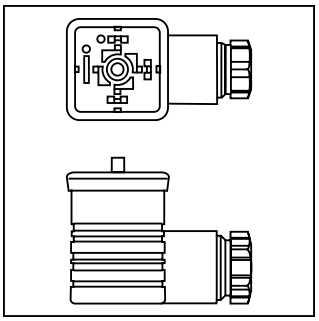
EHC cable assemblies are listed for specific valves, by function, and are supplied with an installed connector as specified at one end, pig-tails leads at the other.

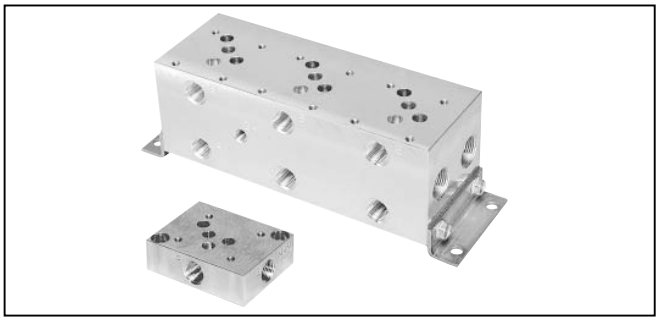
Note that all valves are not shipped with a mating connector. Mating connectors are listed by valve application.

Bolt kits and subplates are listed by valve application. Refer to catalog 2543/USA: Subplates and Manifolds for more options.

Installation guides are listed in this section for supplemental application information.







Electronic Accessories

Refer to the Electronics section for valve driver electronics, power supplies and accessories.

EHC Cable Assemblies

Valve Application	Connector Option (1) (2)	Connector Pins	Function (3)	Model
D*FH D*1FH D*FP D*FX (‘B’ ele. option) D*6FH	CE compliant, ‘MS’ style (Preferred)	7	Primary cable assembly	EHC158GE
D*FT D*1FT RE**T RE06*T	Plastic	7	Primary cable assembly	EHC158G
D*FX (‘C’ and ‘D’ ele. option)	‘MS’ Style	6	Primary cable assembly	EHC158
D*FL	Environmental ‘MS’ style Environmental ‘MS’ style CE compliant ‘MS’ style CE compliant ‘MS’ style	4 6 4 6	Power cable Logic I/O Power cable Logic I/O	EHC154LR EHC156R EHC154LRE EHC156RE
BD, DY	‘MS’ style	4	Primary cable assembly	EHC154S

Notes: (1) CE compliant connectors are environmental resistant. Plastic and standard ‘MS’ style are not.
(2) CE compliant cable assemblies must be used to meet CE, RFI and EMC susceptibility and emissions regulations.
(3) Cable length: 4.5 meters (15 feet) standard. Additional length options available, see price list.

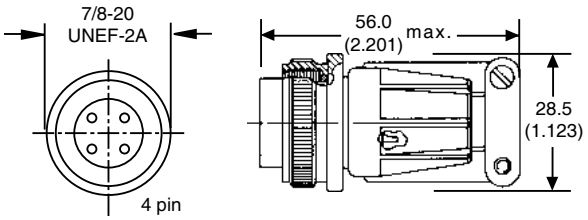
EHC Cable Assemblies Wire Color Assignments

Pin	Cable Model – Wire Color					
	154LR 154LRE	156R 156RE	158	158G	158GE	154S
A	Red	Black	Orange	Red	Red	Black
B	Green	Red	Blue	Black	Black	Red
C	Black	White	Black	Yellow	Red/Bla	Green
D	White	Green	Grn/Yel	Blue	Blue	White
E	–	Orange	Red	Orange	Orange	–
F	–	Blue	White	White	White	–
G	–	–	–	Green	Green	–

accessories.p65, dd

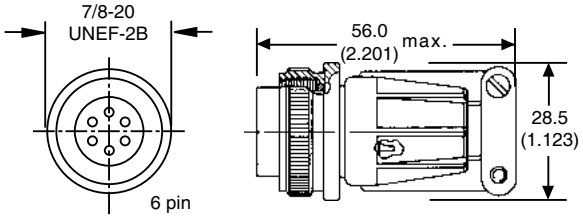
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Power Connector — D*FL



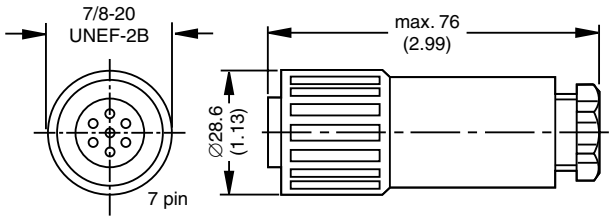
Description	Order Number
4 pin	1210292

I/O Connector — D*FL



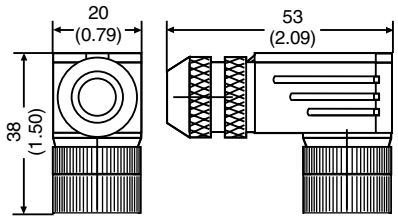
Description	Order Number
6 pin D*FL	MS3106E-14S-6S
Rubber Boot	801227
6 pin D*FX (ele. design A, C & D)	697561

Primary Connector — D*FT, D*FX (Ele. Design 'B'), D*FH, D*FM, RE06*T and RE**T



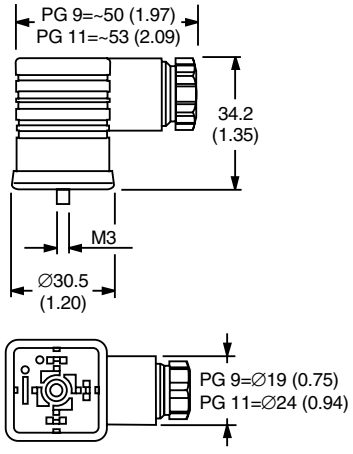
Description	Order Number
DIN 43563 6+PE	5004072

LVDT Connector — D*1FS



Description	Order Number
M12 / 5 pin	5004109

Solenoid Connector



Description	Variation	Order Number
DIN 43650	Black	692914
DIN 43650	Grey	692915

F

Interface	Valve	Bolt Kit	Qty	Size	Subplate(1)	Port Size	Port Location
NG6	D1F*	BK209	4	10-24 x 1.25"	SPD23NS35	3/8" NPTF	Bottom
CETOP 3		BK375	4	M5 x 30mm	SPD23NAS35	3/8" NPTF	Side
	RE06	BK210	4	10-24 x 1.875"	SPD26SS35	#12 SAE	Bottom
					SPD26SAS35	#12 SAE	Side
NG10	D3F*	BK98	4	1/4-20 x 1.625"	SPD31V6NS35	3/4" NPTF	Bottom
CETOP 5		BK385	4	M6 x 40mm	SPD31V6NAS35	3/4" NPTF	Side
					SPD31V6SS35	#12 SAE	Bottom
					SPD31V6SAS35	#12 SAE	Side
	D31F*	BK02	4	1/4-20 x 1.5"	SPD31V6NS35	3/4" NPTF	Bottom
		BK385	4	M6 x 40mm	SPD31V6NAS35	3/4" NPTF	Side
					SPD31V6SS35	#12 SAE	Bottom
					SPD31V6SAS35	#12 SAE	Side
	D36F*	BK03	6	1/4-20 x 1.5"	1402190	#16 SAE	Side
		BK439	6	M6 x 40mm			
NG16	D41F*	BK160	4	3/8-16 x 2.5"	SPD46SA	#12 SAE	Side
CETOP 7			2	1/4-20 x 2.25"			
		BK320	4	M10 x 60mm			
			2	M6 x 55mm			
	D46F*	BK153	6	3/8-16 x 2.0"	1402191	#20 SAE	Side
		BK440	6	M10 x 50mm			
NG25	D81F*	BK228	6	1/2-13 x 3"	SPD66NS35	3/4" NPTF	Bottom
CETOP 8	D91F*	BK360	6	M12 x 75	SPD66NAS35	3/4" NPTF	Side
					SPD68NS35	1" NPTF	Bottom
					SPD68NAS35	1" NPTF	Side
					SPD610NS35	1 1/4" NPTF	Bottom
					SPD610NAS35	1 1/4" NPTF	Side
					SPD610SS35	#20 SAE	Bottom
					SPD610SAS35	#20 SAE	Side
	D96F*	BK227	6	1/2-13 x 2.5"	1402192	#24 SAE	Side
		BK462	6	M12 x 60mm			
NG32	D111F*	BK150	6	3/4-10 x 3.5"	SPD1010N35	1 1/4" NPTF	Bottom
CETOP 10		BK386	6	M20 x 90	SPD1012N35	1 1/2" NPTF	Bottom

(1) Ductile iron; maximum operating pressure: 350 Bar (5075 PSI). Refer to valve specificatons for actual recommended maximums.

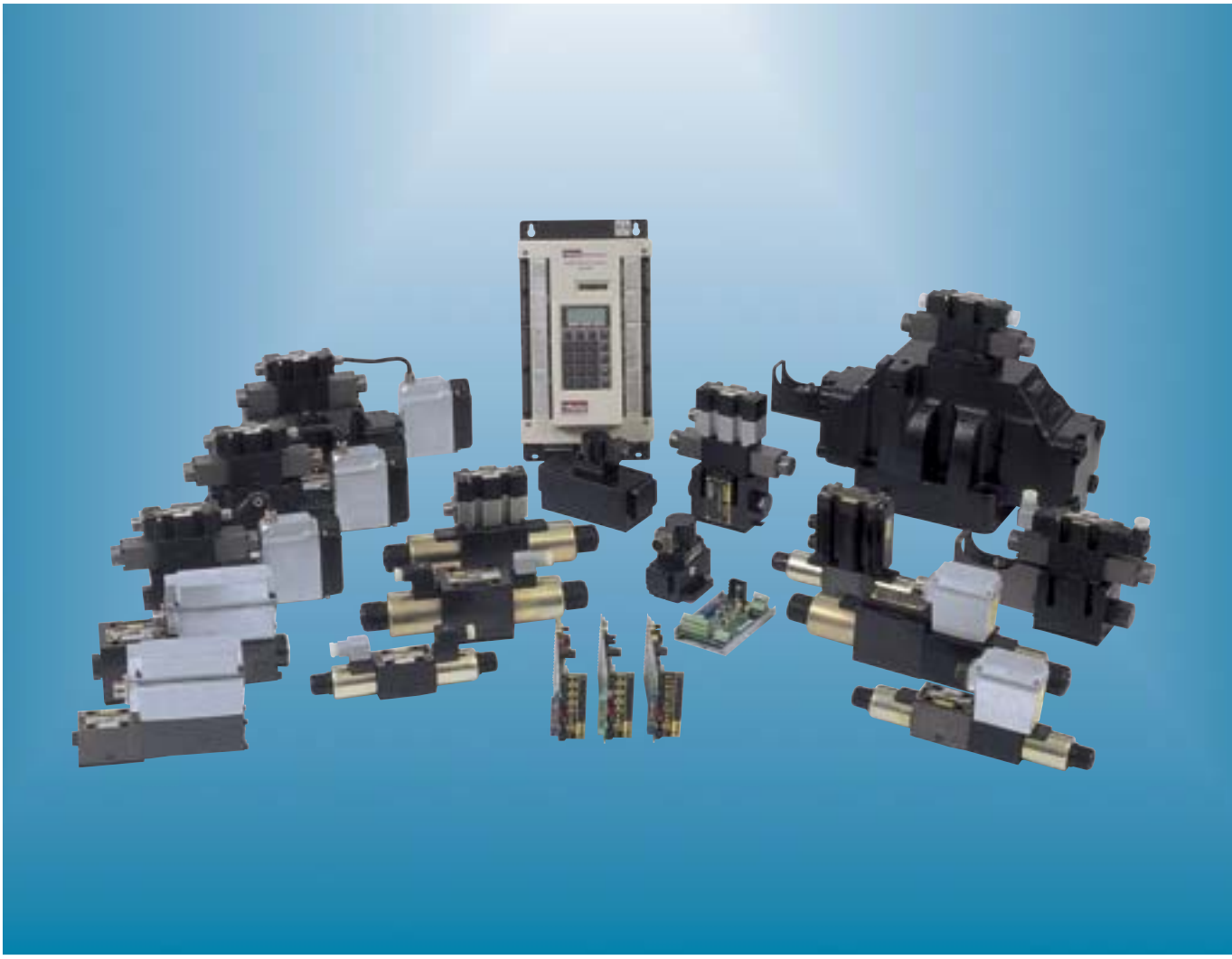
Note: All subplates listed use SAE mounting bolt hardware. Refer to catalog HY14-2543/US for metric options.

Installation Guides

Valve	Installation Guide	Valve	Installation Guide	Valve	Installation Guide
BD15/30	Cat 1450 ISM	D111FS	Bul. 2562-M4/USA	D1FL	Bul. 2589-M2/USA
BD90/95	Bul. IG 1463-000/USA	D1FW	Bul. HY14-2563-M1/US	D3FL	Bul. 2589-M3/USA
BD101	Bul. HY14-1484-M1/US	D3FW	Bul. 2572-M1/USA	D*FM and D*FH	Bul. HY14-2599-M1/US
EW**104D	Bul. 2558-000/USA	D**FT	Bul. 2580-M1/USA	PCD00A	Bul. HY11-3236-M1/UK
EZ00595	Bul. IG 2561-000/USA	D1FX	Bul. 2583-M1/USA	PWDXXA	Bul. HY11-5715-602/UK
D31FS	Bul. 2562-M1/USA	D3FX	Bul. 2587-M1/USA	PZD00A	Bul. HY11-5715-603/UK
D41FS	Bul. 2562-M2/USA	D41FL and D91FL	Bul. 2589-M1/USA		
D81FS	Bul. 2562-M3/USA				

Electrohydraulic Motion Control Products

Catalog HY14-2550/US



⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

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The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the "Offer of Sale".

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Introduction G2

Training Materials

Textbooks/Course Components

Industrial Hydraulic Technology G3
Hydraulic Maintenance Technology G3
Fluid Power Basics G4
Filtration Technology G4
Hydraulic Pumps & Controls G5

Reference Books

Design Engineers Handbook G5
Handbook of Electrohydraulic Formulae G6
An Engineering Analysis of the Pulse Width Modulation G6
Lexicon III G7

Video Training

Industrial Hydraulic Technology G7

Trainer Stands

Portable Hydraulic Trainer G8

Lab Manuals

Bulletin 0249 ..... G8
EHD Supplement G8

Training Programs

Industrial Hydraulic Technology (IHT), Part 1 & Part 2 ..... G9
Hydraulic Pumps & Controls (HPC) G9
Introduction to Electrohydraulics (EHD) G10
Hydraulic Component Sizing (HCS) G10
Electrohydraulic Feedback Systems (EFS) G10
Hydraulic Maintenance Technology (HMT) G11
Cartridge Valve Systems (CVS) G11
Mobile Hydraulic Technology (MHT) G11

Offer of Sale G12

G

Welcome to Parker's Involvement Training Program

The Training Department at Parker Hannifin was established in the early 1970's and is recognized today as the industry leader in the development and presentation of training materials and programs.

The Department's charter states that the primary focus of activity shall include all phases of technical training for hydraulic and pneumatic industries. The charter also states that this would be non-commercial and involve state-of-the-art methodology.

The Parker approach is one of involvement training. In its full scope, involvement training is one of active participation. This participation results in excellent student retention as well as providing a comfortable way of learning.

Parker Catalog 0200 details the Training Department's current offerings. This catalog is presented in two parts: Training Materials and Training Programs.

Training Materials

The training materials section contains the following mixed media components:

- Textbooks/Course Components
- Reference Books
- Computer Software
- Video Tapes
- Trainer Stands
- CD-ROMs

Parker offers seven textbook and course combinations designed for both industrial and educational applications. Topics range from Basic Fluid Power to the specifics of Hydraulic and Pneumatic Technology.

All materials needed for a complete classroom curriculum are available. Textbooks can be purchased separately or in combination with any number of additional course components including workbooks, instructor guide, multiple choice exams, answer book, course certificates and, where appropriate, digital transparencies and relevant reference books.

Parker currently has six reference books available. Led by the *Design Engineer's Handbook, Vol. 1 - Hydraulics*, all of the books are valuable tools for any Design Reference Library, whether for individual use or as an accompaniment to the courses.

Additionally, course subject matter can be further enhanced with related computer software, video tapes and trainer stands.

Parker's computer-aided software represents a strong commitment to advanced training technology. The *Industrial Hydraulic Training CD*, featuring animation and video, is the leading hydraulic computer based training program in the industrial market place.

The video tape library contains 14 complete modules for self-paced one-on-one or group learning activities. Both hydraulic and pneumatic training programs are available.

Parker's portable hydraulic, pneumatic trainer stands provide students with valuable hands-on experience. All training stands feature industrial grade components and provide "Real World" applications of principles and circuitry.

Training Programs

In addition to training materials, Parker offers an ongoing schedule of classroom educational programs. The current list of classes includes ten 3-5 day programs. Each class is led by a Parker certified instructor(s). Students are provided all necessary materials to attain course certification.

Classes are held in strategic locations across North America and Europe. Download current training schedule for a complete list of scheduled class locations.

Course fees cover all class room expenses. Meals, transportation and lodging are not included. However, Parker will be glad to assist you with lodging arrangements.

For the latest information on training materials or programs, please contact:

Parker Hannifin Corporation
Training Department
6035 Parkland Blvd.
Cleveland, OH 44124-4141
Tel: (216) 896-2495
Fax: (216) 514-6738
E-mail: mctrain@parker.com

or visit our website at:
www.parker.com/training

The following section gives a brief overview of the training materials and classes with a hydraulic or electrohydraulic emphasis.

INDUSTRIAL HYDRAULIC TECHNOLOGY

Industrial Hydraulic Technology

2nd Edition, Bulletin 0232-B1
ISBN 1-55769-025-1

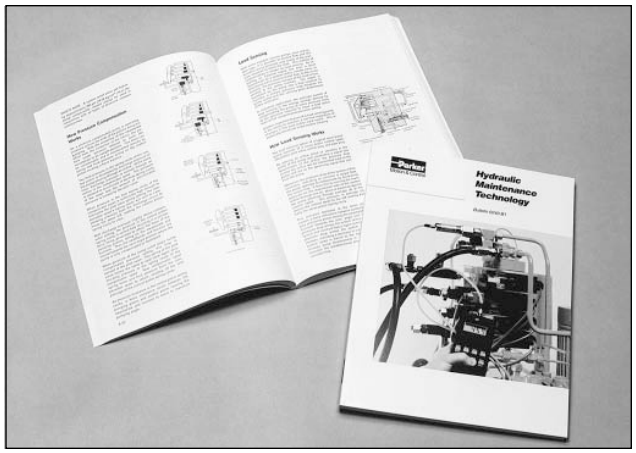
The *Industrial Hydraulic Technology* textbook is designed to introduce a student to hydraulics as it relates to industrial machinery. The 330-page text is organized into fifteen chapters which include:

The Physical World of a Machine
Hydraulic Transmission of Force and Energy
Petroleum Base Hydraulic Fluid
Fire Resistant Hydraulic Fluid
Operation at the Suction Side of a Pump
Hydraulic Actuators
Control of Hydraulic Energy
Check Valves, Accumulators and Cylinders
Flow Control Valves
Directional Control Valves
Pressure Control Valves
Pilot Operated Pressure Control Valves
Hydraulic Pumps
Hydraulic Motors
Reservoirs, Coolers and Filters

• Circuit illustrations are in six-color to aid the student in visualizing what is happening in a circuit.

• Each chapter incorporates an exercise reviewing the lesson's main points.

HYDRAULIC MAINTENANCE TECHNOLOGY



Hydraulic Maintenance Technology

Bulletin 0240-B1
ISBN 1-55769-019-7

The *Hydraulic Maintenance Technology* textbook provides detailed maintenance and troubleshooting information for the user of industrial hydraulic equipment. The 148-page text contains ten chapters which include:

Hydraulic Maintenance Introduction
Hydraulic Graphic Symbology
Power Unit Maintenance
Pump Maintenance
Pressure Control Valve Maintenance
Directional Control Valve Maintenance
Flow Control Valve and Check Valve Maintenance
Cylinders, Motors and Accumulator Maintenance
Leakage Elimination in Hydraulic Systems
Fluids and Filter Maintenance

• Contains troubleshooting charts with lists of common problems, causes and possible remedies.

• This text is also a valuable reference for designers of industrial hydraulic equipment

G

For information on Course Components, refer to Catalog 0200.

FLUID POWER BASICS

Fluid Power Basics

Bulletin 0239-B1
ISBN 1-55769-029-4

The *Fluid Power Basics* textbook is designed to introduce students to hydraulics and pneumatics as it relates to industrial machinery. The 174-page text is organized into fifteen chapters which include:

The Physical World of a Machine
Force Transmission Through a Fluid
Energy Transmission Using a Hydraulic System
Control of Hydraulic Energy
Energy Transmission Using a Pneumatic System
Control of Pneumatic Energy
Hydraulic Pumps and Compressors
Check Valves, Cylinders and Motors
Flow Control Valves
Directional Control Valves
Simple Pressure Control Valves
Pilot Operated Pressure Control Valves
Hydraulic Fluid Conditioning
Air Preparation
Fluid Conductors and Connectors

• Each chapter incorporates an exercise reviewing the lesson's main points.

FILTRATION TECHNOLOGY

Filtration Technology, 2nd Edition

Bulletin 0247-B1 **(Softcover)**
ISBN 1-55769-030-8

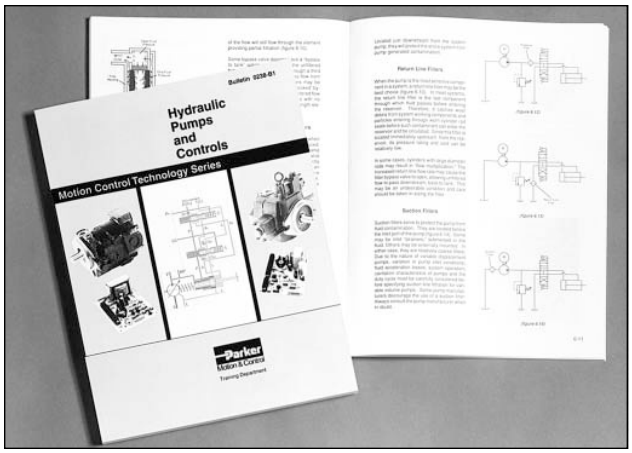
Bulletin 0250-B1 **(Hardcover, Not Shown)**
ISBN 1-55769-033-2

Filtration Technology is a must as a fundamental introduction to industrial filtration. The text covers topics such as fluids, contaminants, media selection and more. It is helpful to all personnel concerned with OSHA, safety and quality issues. This 250-page text is organized into twelve chapters which include:

Introduction to Industrial Filtration Technology
Fluids and Contaminants
Contamination Dynamics
Fluid and Filter Analysis
Hydraulic Fluid Filter Selection
Water Absorption in Hydraulic and Lubricating Oils
Filter and Media Selection for Single-pass Systems
Fuel Filtraion
Process Filtration Systems
Compressed Air and Gas Filtration
Coolant Filtration

For information on Course Components, refer to Catalog 0200.

HYDRAULIC PUMPS & CONTROLS



Hydraulic Pumps & Controls

Bulletin 0238-B1
ISBN 1-55769-031-6

Hydraulic Pumps and Controls is a comprehensive text covering relevant pump topics from basic pump construction and operation to multiple controls, horsepower control and electronic pump controls. The book also contains sections on filtration and troubleshooting. This 185-page, multi-colored text is organized into nine chapters which include:

Pressure Compensation
Load Sensing Theory of Operation
Input Power and Inlet Conditions
Electrohydraulic Pump Control
Troubleshooting
Remote Compensation
Horsepower (Torque) Limiting Control
Hydraulic Filtration
Energy Conservation

For information on Course Components, refer to Catalog 0200.

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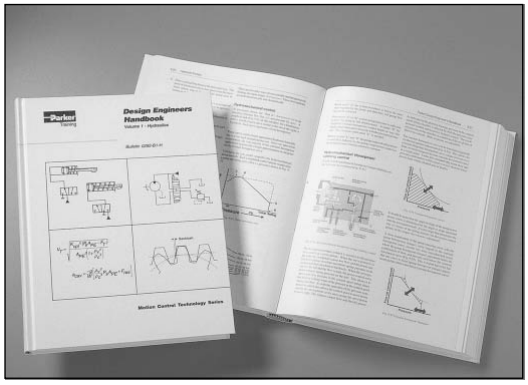
Reference Books

Design Engineers Handbook

Bulletin 0292-B1 Volume 1 - Hydraulics
ISBN 1-55769-018-9

To satisfy the demand for a simple and practical treatment of hydraulics and pneumatics, including components and system connectors, Parker Hannifin Corporation has published a one volume, 520-page text entitled *Design Engineers Handbook, Vol 1. - Hydraulics*. The information contained in this text is organized to assist the machine designer and manufacturer, as well as service and maintenance personnel. It should prove to be equally valuable to the college and vocational school student preparing to enter any of these fields.

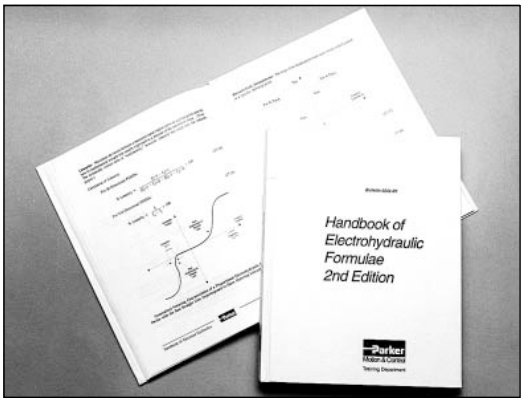


- Each section includes design data, reference material, charts and diagrams.

Handbook of Electrohydraulic Formulae, *2nd Edition*

Bulletin 0242-B1
ISBN 1-55769-034-0

This handbook, written for technicians, engineers and designers, contains 25 chapters of commonly used formulas for the design of electrohydraulic motion control systems. All of the necessary information is centralized, making the design of electrohydraulic motion control systems easier. There is no other text available that offers this accessibility or breadth and depth of information.



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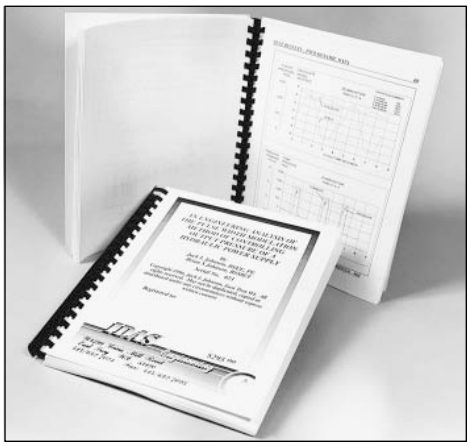
An Engineering Analysis of the Pulse Width Modulation

Bulletin 0244

This research report contains over 100 pages of detailed engineering information and data regarding the design and evaluation of the pulse width modulation (PWM) method of controlling hydraulic pump outlet pressure. PWM offers a very efficient way for making regulated pressure power units using fixed displacement pumps instead of the more expensive, conventional pressure compensated pumps.

The report contains scores of graphical responses, representing hundreds of hours of labs and data analysis time. Concise Conclusions sections help the reader to quickly summarize the results and apply them immediately. A complete section is dedicated to Design Methodology so that users can learn the details needed to properly design and construct the power units.

Also included is a background on motion control and constant pressure. In addition, authors discuss equipment and principles of operation as well as the method of investigation used.



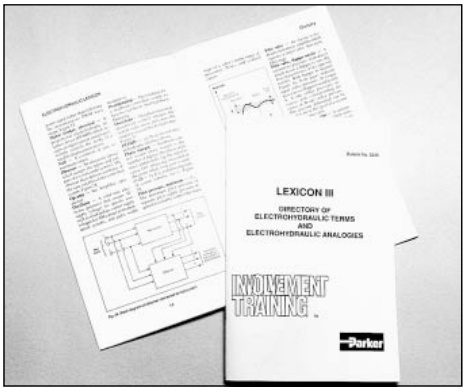
An Engineering Analysis of the Pulse Width Modulation is a must for anyone who uses, specifies, designs or builds hydraulic power units!

Lexicon III

Bulletin 0245

The Lexicon III is a detailed bulletin of electrohydraulic terms and analogies. The book is laid out into two easy-to-use sections – a glossary of terms and a section on understanding electrohydraulic analogies. Many of the areas are represented by graphs and diagrams to further identify in detail the terms and analogies of electrohydraulics.

The author conveniently includes a chart of the SI prefixes, the Handy Conversions Factors Table and a listing of the Greek Letters. This bulletin is a must-have for engineers, students and anyone interested in electrohydraulics.



Video Tapes

Industrial Hydraulic Technology

Bulletin 0299-T1

The *Industrial Hydraulic Technology* course material is available utilizing an audiovisual tape training method. With all the training information stored on cassette tapes, the training sessions can be repeated as often as necessary, allowing each student to acquire the technical knowledge at his or her own pace.

The various tapes focus on enabling the user to interpret and read schematics, obtain a working knowledge of components that make up hydraulic systems and advance to trouble shooting techniques. (Refer to page 4 to see specific chapters covered).

- Video tapes are available in Beta, VHS or PAL.
- Individual chapters are also available.

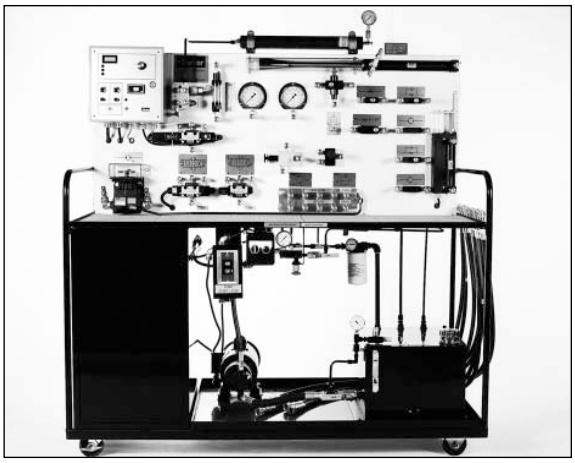
Includes:
14 Video Tapes
1 Textbook
1 Instructor's Guide

Portable Hydraulic Trainer

Based on Parker's long term experience in designing, manufacturing and servicing fluidpower components worldwide, the Portable Hydraulic Trainer is designed to be a tool for learning hydraulic technology principles and circuitry. It has been engineered for ruggedness, portability and ease of operation. The unit is completely self-contained and operates on standard 115 Volt AC single phase outlet electrical power.

The components on the trainer are all industrial grade components used in industry every day. This "real world" approach allows the student to learn what those components look like as well as how they operate.

All necessary connections are made with hoses and quick disconnects. No tools are required to arrange circuits. Simply plug in the components needed to arrange a circuit. In addition, all the hoses are stored in a rack to avoid misplacing "loose" components.



For detailed information, see Bulletin 0203 online at www.parker.com/training - click on Download Files

Also available with the following options:

• **Electrohydraulic option** provides an introduction to both open loop and closed loop electrohydraulic systems.

• **Pneumatic option** transforms the hydraulic trainer into a complete fluidpower training stand.

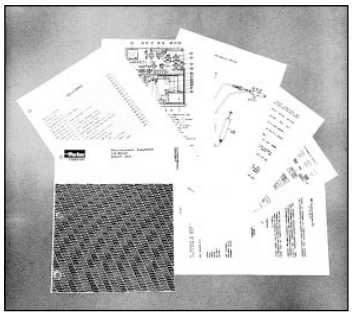
Bulletin 0249

In order to aid the student in understanding hydraulic components and systems operation, Parker has developed this comprehensive lab manual for the Model HTU-00 Portable Hydraulic Trainer Stand. This manual contains circuit problems and demonstrations designed for use with the Parker trainer. These exercises are intended to supplement text material covered in the classroom. References are made in this manual to Parker textbook, Industrial Hydraulic Technology (page L3).

Also available in Spanish!
Bulletin 0229-B9

EHD Supplement
Bulletin 0231

Contains exercises using the Electrohydraulic Option Kit (P/N 875279) on the Parker Portable Hydraulic Trainer Stand.



Industrial Hydraulic Technology 1 & 2

Parker Hannifin's **INDUSTRIAL HYDRAULIC TECHNOLOGY** 1 & 2 (I.H.T. 1 & 2) are completely integrated three-day programs during which you discuss and work with fundamental fluid power principles and formulas, and actually experience the functional characteristics of the complete spectrum of hydraulic components.

You will be studying and using pumps, flow valves, pressure valves, directional valves, hydraulic motors, filters, cylinders and accumulators. And, because its divisions actually manufacture and market all of these products, Parker Hannifin is uniquely qualified to give you an in-depth practical knowledge of how to best use them in your field. You will receive the broadest and deepest exposure possible during a three-day period.

At least a fourth of the time you will be working at the Parker Hannifin hydraulic systems simulators. These units were designed and built by Parker Hannifin expressly for this program. They supply you with all the necessary components – valves, pumps, motors, cylinders, filters, power units, hoses and gauges – to hook up to working hydraulic circuits and then check flows, pressures and velocity. Unlike most other training apparatus, the Parker Hannifin simulators operate at pressures up to 500 psi so that you can closely simulate real system conditions.

The balance of your time will be devoted to classroom sessions. But, these too, are designed for maximum interest and involvement. There is plenty of lively discussion, questions, answers and practical problem solving.

Hydraulic Pumps & Controls

In **HYDRAULIC PUMPS & CONTROLS** (H.P.C.), students learn a logical procedure for designing circuits, not just from the standpoint to make them work, but to make them work efficiently. This is accomplished by approaching the entire design with a view towards power transmission and ultimate circuit efficiency, concentrating on the power unit. Various variable volume pressure compensated pumps and numerous pump controls are examined in detail.

An important result of this new Parker design method is that the student can always obtain a very efficient circuit, making it possible for a group of designers to develop very similar circuits for each set of mechanical requirements. The only variance will be in the sequential logic and the appearance, which depends upon which components are selected. This results in less expense to operate and maintain circuits.

Course attendees will have ample opportunity to practice their newly acquired skills. Approximately 40% of the class time is spent in the training lab utilizing Parker hydraulic power units and trainer stands. This familiarization with typical styles of variable volume pressure compensated pumps and their controls ties together the lecture material and the design problems. Students will also benefit from the instructor's many years of industrial fluid power experience.

To get the most from this course, it is necessary to establish prerequisites for attendance. This assures that everyone participating has approximately equal knowledge of fluid power and can work at a compatible pace.

Introduction to Electrohydraulics

The **INTRODUCTION TO ELECTROHYDRAULICS** (E.H.D.) course is designed for the individual who requires an increased understanding of the rapidly emerging field of electrohydraulic proportional control valves and the electronics used to operate these valves. The individual must have completed the **INDUSTRIAL HYDRAULIC TECHNOLOGY** and **HYDRAULIC COMPONENT SIZING** courses or equivalent. Basic DC theory knowledge is helpful but not necessary as the topic is covered in the course.

In this five-day course we present fundamental electronic theory applicable to electrohydraulic proportional valve; help participants understand how electrohydraulic proportional valves operate; examine in detail a typical circuit board used with a typical electrohydraulic proportional valve.

Approximately 30% of the class time is spent in the lab where the individual is familiarized with lab instrumentation, and various circuits on the printed circuit board are examined in detail.

Hydraulic Component Sizing

HYDRAULIC COMPONENT SIZING (H.C.S.) is ideally suited for the new designer and the maintenance and service individual who needs that important step beyond fundamental circuit design; the step that provides a more comprehensive understanding of efficient power transmission.

This program, using standard formulas and catalog data creates a benchmark that allows the student to objectively analyze the quality of the circuit in terms of efficiency and energy conservation. You will learn how to overcome problem areas and also become aware of the proper conditions for selecting components such as pressure compensated valves and fixed versus compensated pumps.

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Parker Hannifin has written a special textbook for this course, which you will use during the program as the basis for your discussions and practical problem solving.

Since **HYDRAULIC COMPONENT SIZING** is an analytical course, we want to insure that all participants have a solid relatively equal background in basic fluid power technology. Completion of Parker Hannifin's **INDUSTRIAL HYDRAULIC TECHNOLOGY** course is an ideal foundation for understanding and further pursuing the maximum energy savings approach that is key to the **HYDRAULIC COMPONENT SIZING** subject matter.

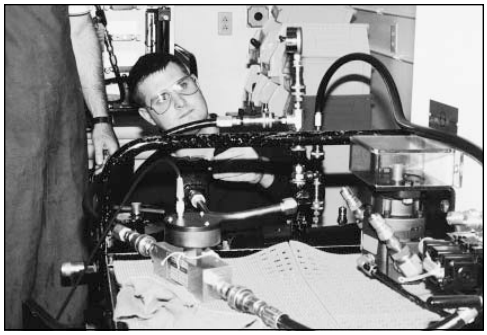
Electrohydraulic Feedback Systems

Parker's **ELECTROHYDRAULIC FEEDBACK SYSTEMS** (E.F.S.) course is designed for engineering oriented individuals requiring an in-depth understanding of electrohydraulic feedback control systems. Attendees should have completed the Parker **INTRODUCTION TO ELECTROHYDRAULICS** prior to attending this advanced course.

The following topics are covered in this course: servo valve sizing, basic positional servo valve systems, position transducers, speed transducers, frequency response curves, transfer functions and speed control loops.

Approximately 20% of the class time spent is in the lab working with various feedback control systems to gain a better understanding of their operating characteristics.

Hydraulic Maintenance Technology

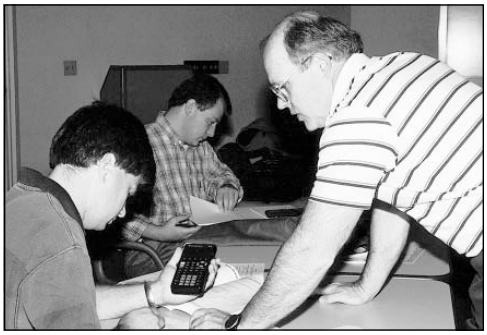


HYDRAULIC MAINTENANCE TECHNOLOGY (H.M.T.) is ideally suited for maintenance personnel, engineers, first line supervisors and anyone desiring an in-depth understanding and appreciation of hydraulic system component operation and troubleshooting techniques. Participants should have completed the **INDUSTRIAL HYDRAULIC TECHNOLOGY** course or equivalent.

The topics covered in this four-day program are graphic symbols of hydraulic components in which we utilize the International Standards Organization (ISO) System; troubleshooting common hydraulic components such as pumps, cylinders, valves, rotary actuators, hydraulic motors; hose and tube fittings maintenance and assembly; and maintenance of fluid power systems.

There is plenty of “hands on” in this particular course. Everyone will get a chance to take apart and reassemble various pumps and valves as well as other typical hydraulic components.

Cartridge Valve Systems



CARTRIDGE VALVE SYSTEMS (C.V.S.) is an integrated three-day course where the student will work with and discuss the principles, applications, formulae, and functional characteristics of “insert” or “DIN” style cartridge valves.

The student will learn the practical aspects of “insert” and “screw-in” style cartridge valves as they apply to industrial machinery. Principles of operation, functional characteristics, and typical applications for these valves are presented. The student also uses performance characteristics and fluid power formulae in realistic design problems. Valves studied include spool and poppet types, pilot operated valves, direct acting types, and multistage valves, as well as proportional styles.

CARTRIDGE VALVE SYSTEM is recommended for maintenance personnel, technicians and engineering personnel. It is also suitable for sales and non-technical personnel who want to increase their knowledge and understanding of cartridge valve systems.

Parker’s **CARTRIDGE VALVE SYSTEMS** course integrates classroom sessions with lab activities to give the student practical knowledge and skills that can be used in a workplace setting. In the labs, students get “hands-on” experience with typical valves and the circuits which utilize them.

Mobile Hydraulic Technology

MOBILE HYDRAULIC TECHNOLOGY (M.H.T.) is a 4-day course on hydraulic principles as they apply to mobile equipment (loggers, waste hauling trucks, cranes, etc.).

Such topics as basic mobile circuitry, hydrostatic transmissions and power beyond are discussed throughout the course. Components – directional control valves, pumps and steering systems – are also covered. Labs include a demo on a wheel motor driving a rubber tire.

MOBILE HYDRAULIC TECHNOLOGY is recommended for maintenance technicians and engineering. Sales and non-technical personnel wishing to increase their understanding of mobile hydraulics would find this class helpful.

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

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2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

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6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

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