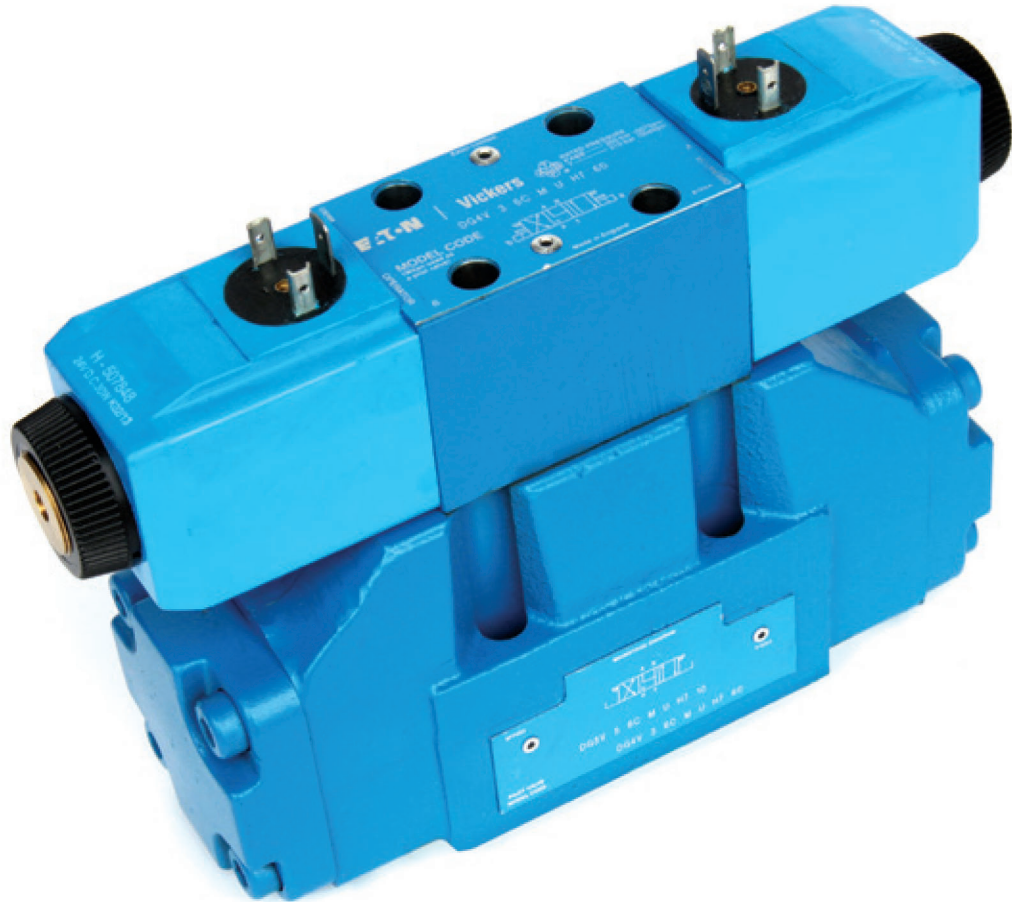


DG3V-5 10 & DG5V-5 10 Design

ISO4401 Size 05;
ANSI/B93.7M-D05



Powering Business Worldwide

Pilot Operated Directional Valve

DG3V-5-10 Design

Solenoid Controlled Pilot Operated Directional Valve

DG5V-5-10 Design

General description

DG*V-5 valves are used primarily for controlling the starting, stopping and direction of fluid flow.

Two series of valves, DG5V solenoid controlled, pilot operated and DG3V pilot operated models are available with a wide selection of spools. These include meter-in and meter-out spools and a regeneration type that can obviate extra valves essential in traditional circuit arrangements.

All spools have been designed to provide good low shock, fast response characteristics which can be enhanced by optional stroke and/or pilot choke adjustments.

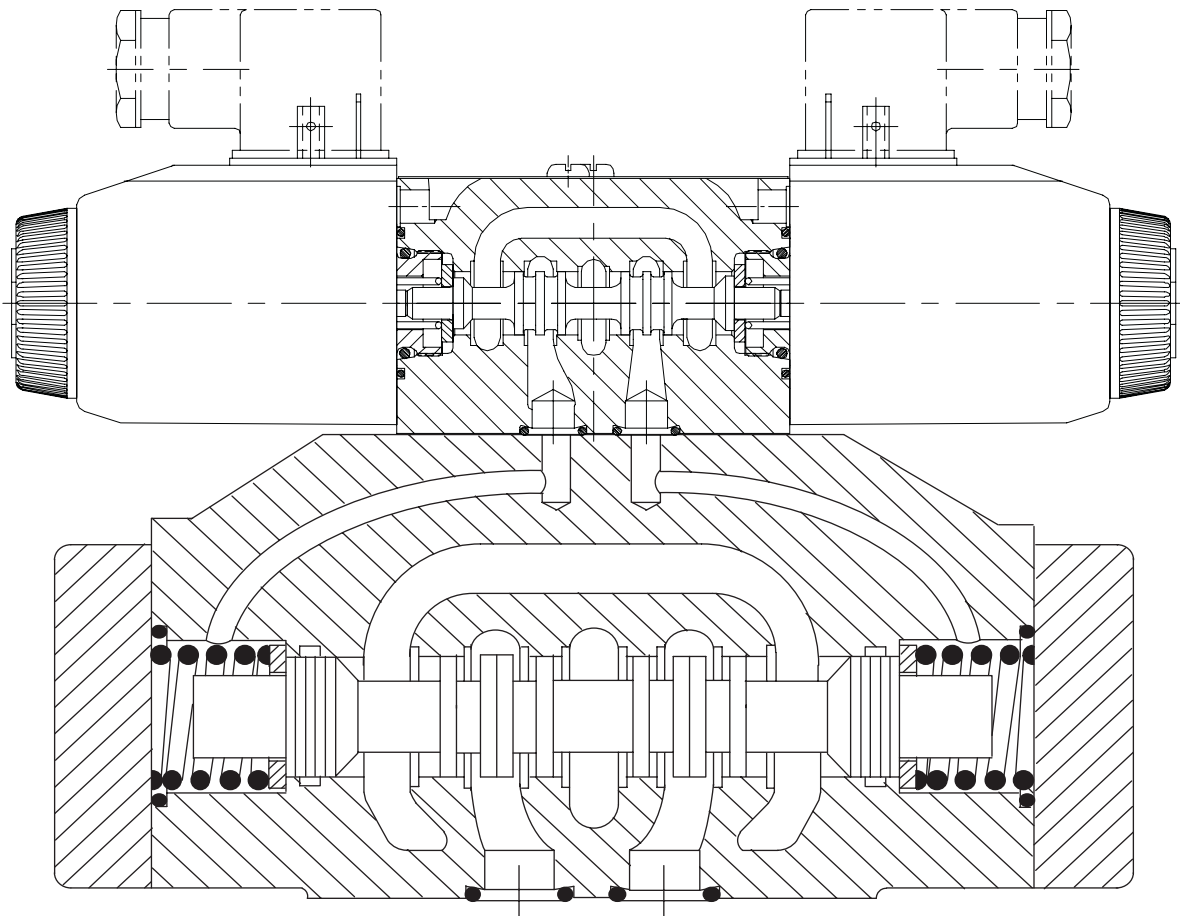
Models include spring offset, spring centered and detented versions.

Features and Benefits

- High pressure and flow capability for maximum cost-effectiveness.
- Low headloss to minimize power wastage.
- Low shock characteristics to maximize machine life.
- Facility to change solenoid coils without disturbing the hydraulic envelope.
- The many optional features, particularly for DG5V valves, permit matching to virtually every application within the valve's power capacity.
- Optional mainstage spool position monitoring switch (CE marked)

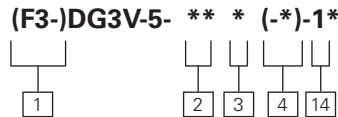
Typical Section

DG5V-5-2C

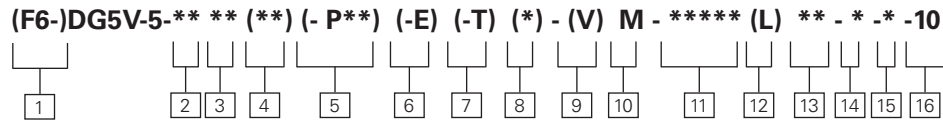


Model Codes

For pilot operated valves:



For solenoid controlled, pilot operated valves:



- 1 F6** – Viton
Blank – Buna Nitrile/ High CAN
-
- 2 Spool Type**
 See “Functional Symbols” section on pages 5-6.
-
- 3 Spool Spring Arrangement**
A – Spring offset, end-to-end
AL – Same as “A” but left hand build
B – Spring offset, end-to-center ▲
BL – Same as “B” but left hand build ▲
C – Spring centered ▲
N – No-spring detented ▲
 ▲ Not available for DG3V-5
-
- 4 Spool Control**
1 – Stroke adjustments, both ends ▲■
2 – Pilot choke (dual) adjustments
27 – Dual pilot choke and stroke adjustment “A” port end only ▼
28 – Dual pilot choke and stroke adjustment “B” port end only
3 – Pilot choke and stroke adjustments ▲■
7 – Stroke adjustment “A” port end only ▼
8 – Stroke adjustment “B” port end only ▼
 ▲ Not applicable to DG5V-5-*B(L) models.
 ▼ Not applicable to models shown in the “Spring offset, end-to-center, opposite hand” section on page 6
 ■ Not applicable for spool “8” models

- 5 Main Stage Spool Monitoring Switch**
Blank – None
PCA – Center sensing switch on “A” port end
PCB – Center sensing switch on “B” port end
PDA – Double offset sensing switch on “A” port end
PDB – Double offset sensing switch on “B” port end
PCD – Center sensing switch on “A” port end and double offset sensing switch on “B” port end ■
PPA – Offset sensing proximity switch “A” port end
PPB – Offset sensing proximity switch “B” port end
PPD – Offset sensing proximity switch both ends ■
- * The spool position monitoring switch shown on this technical document is CE marked and certified and complies to European Standard EN 61000-6-4: 2001 (Emissions) for Class A and European Standard EN 61000-6-2: 2001 (Immunity).
 ■ Not applicable for spool 8 model
-
- 6 Pilot Pressure Supply**
E – Valve configured for external pilot supply to port “X”
 Omit for internal pilot supply (port “X” must be blanked off, e.g. at the valve mounting face, when using internal pilot supply)

- 7 Pilot Drain Arrangement◆**
T – Valve configured for internal pilot valve drain (port “Y” must be blanked off, e.g. at the valve mounting face, when using internal drain) Omit for external drain from port “Y”.
 ◆ See 15 for pressure limits.
-
- 8 Pilot Valve Manual Override Option**
Blank – Plain override(s) on solenoid end(s) only. ▲
W – Twist & lock override in solenoid ends DC only
H – Water-resistant override(s) on solenoid end(s) ▲
Z – No override at either end
 ▲ No override in non solenoid end of single solenoid valve.
-
- 9 Solenoid Identity Method**
V – Solenoid “A” at port “A” end of pilot valve body and/or solenoid “B” at port “B” end of pilot valve body, independent of main-stage port locations and spool type. Omit (except as noted below) for US ANSI B93.7 standard requiring solenoid “A” energization to connect main ports P and A and/or solenoid “B” energization to connect P and B, independent of solenoid location.

- 10 Flag Symbol**
M – Electrical options and features
-
- 11 Solenoid Type/ Connection(s)**
U – ISO4400, DIN43650 connector
U1 – ISO4400 fitted with PG11 plug
U6 – ISO4400 with fitted DIN plug with lights
KU – Top exit flying lead (150mm)
KUP4 – Junior timer (Amp) connector
KUP5 – Integral Deutsch connector
FW – Flying lead with 1/2” NPT thread wiring housing
FTW – Fly. lead wired terminal block & 1/2” NPT thread wiring housing
FPA3W – Fly. lead, 3 Pin connector & 1/2” NPT thread wiring housing
FPA5W – Fly. lead, 5 pin connector & 1/2” NPT thread wiring housing

- 12 Indicator Lights**
Blank – None
L – Solenoid indicator lights•
 •Flying lead coil type only

Note: The “V” code is always used for valves with type “8” spool as the solenoid identity is the same for both methods of identification.

Model Codes (Contd.)

13 Surge Suppressor/damper

- D1** – Diode positive bias
- D2** – Negative bias
- D7** – Transorb type

See Page12 for circuit details

14 Coil Rating

- B** – 110V AC 50Hz/120V AC 60 Hz
- BL** – 110V 50 Hz/120V 60 Hz
- D** – 220V AC 50 Hz/240V AC 60 Hz
- DS** – 28V DC 30 watt
- G** – 12V DC
- GL** – 12V DC
- H** – 24V DC
- HL** – 24V DC
- HM** – 24V DC 8 watt

15 Port T or Y Maximum Pressure†

- 6** – 160 bar (2300 psi), for AC solenoids only
- 7** – 210 bar (3000 psi), for DC solenoids only

† This pressure rating (determined by the pilot valve drain port) is applicable to:

1. Port T when using internal drain (“T” at position 6)
2. Port Y when using external drain (no symbol at position 6)

16 Design Number

H

Application Notes

Pilot Pressure

- a. Pilot pressure must always exceed tank line pressure by at least the requisite minimum pilot pressure. This also applies when combining open center spools (0, 1, 8, 9 and 11) with internal pilot pressure, but they should be used only with externally drained valves.
- b. Internally drained valves may be used only when surges in the tank line cannot possibly overcome the minimum pilot pressure differential referred to above. When the possibility of pressure surges in the tank line exist, externally drained valves are recommended.
- c. When DG5V-7-*N valves are de-energized the pilot and main spools remain

in the last selected position, provided that pilot pressure is maintained. If pilot pressure fails, or falls below the minimum, the main spool will spring center.

Caution: Because of this in-built feature the flow conditions of the center position must be selected with care, for the effect on both the direction of flow and the pilot pressure.

Stroke Adjustment Options

These control the maximum opening of the main spool/body passages by adjusting the limits of spool stroke. By this means, the response time and the pressure drop across the valve for any particular flow rate can be controlled. Stroke adjusters can be fitted at either or both

ends of the main-stage valve for adjusting the stroke in one or both directions. One use of stroke adjusters is for controlling the metering characteristics of “X*” or “Y*”- type spools. (See model code #4.)

Pilot Choke Adjustment Options

These provide a meter-out flow control system to the fluid in the pilot chambers of main-stage valves. It allows the velocity of the mainstage spool to be controlled, thereby reducing transient shock condition. For optimum results, a constant reduced pilot pressure is recommended.

Control Data, General

- a. Dependent on the application and the system filtration, any sliding spool valve,

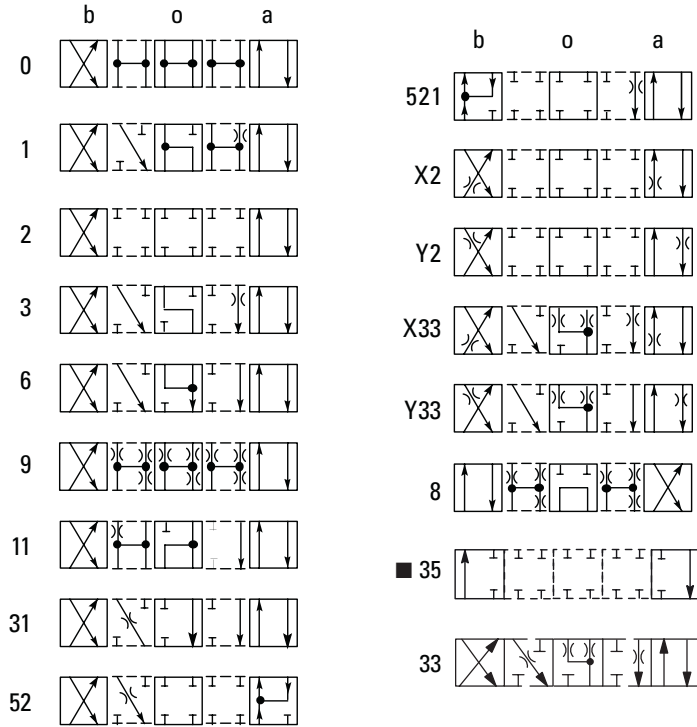
if held shifted under pressure for long periods of time, may stick and not move readily due to fluid residue formation. It may therefore need to be cycled periodically to prevent this from happening.

- b. Surges of fluid in a common drain line serving two or more valves can be of sufficient magnitude to cause inadvertent shifting of the spools. It is recommended that circuit protection be used, such as separate drain lines.
- c. Control by stroke adjusters, pilot chokes and minimum-pilot-pressure generator options is described on this page.

Functional Symbols

Spool Types

Shown in 3-position form, plus 2 transients.



Notes:

1. In certain 2-position valves, the "o" position becomes an additional transient, i.e. in DG5V-5-**-A(L) and DG5V-5-**-N valves.

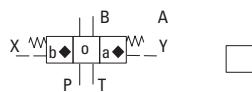
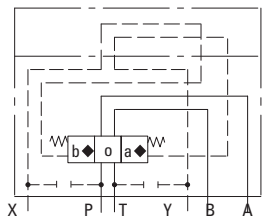
■ Only 35A available.

DG3V-5 Pilot Operated Models

Comprehensive and simplified symbols.

Spring Centered, DG3V-5-**-C

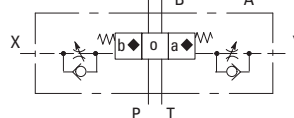
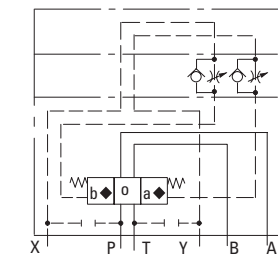
Spool types: All



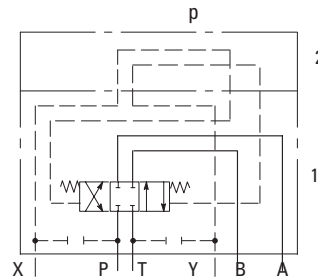
◆ "a" and "b" interchanged for spool type 8

DG3V-5-**-C Models with Pilot Choke Module

Obtained by specifying "2" at Model Code position 4

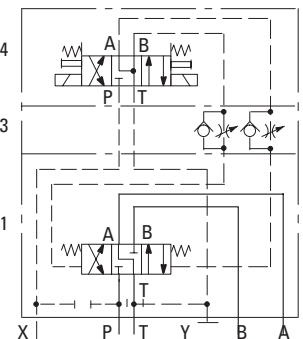


DG3V-5-2C



Note that for clarity pilot lines (dotted lines in illustrations) are omitted from the main-stage nameplate.

DG5V-5-3C-2-E-T



Symbols on Nameplates

Typical illustrations for:

Control elements (i.e. solenoid pilot valve, choke module, cover plate) used with size 5 main stage valves are standard Eaton units complete with their individual

nameplates including model code and symbols. The main stage carries the model code of the 2-stage valve and the functional symbol of the main stage spool.

Referring to the examples, nameplates are located as follows:

1. On main stage (DG3V-5/DG5V-5)

2. On cover plate (DG3V-5)
3. On pilot choke module (DG5V-5)
4. On pilot stage valve (DG5V-5)

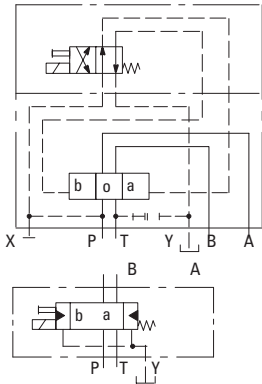
Functional Symbols

DG5V-5, Solenoid Controlled, Pilot Operated Models ▲

Comprehensive and simplified symbols shown configured for external pilot supply and internal drain

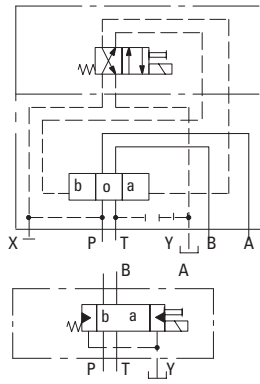
Spring Offset, End-to-End, DG5V-5**A

Spool types: 0, 2, 6, 35, 52



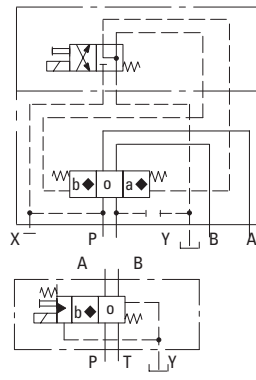
Spring Offset, End-to-End, Opposite Hand, DG5V-5**AL

Spool types: 0, 2, 6, 52



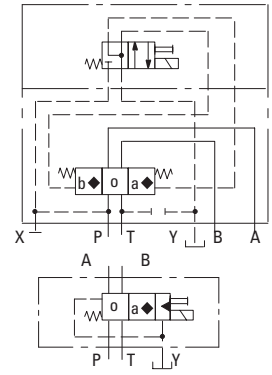
Spring Offset, End-to-Center

Models DG5V-5**B 0, 2, 52
DG5V-5**BL 8



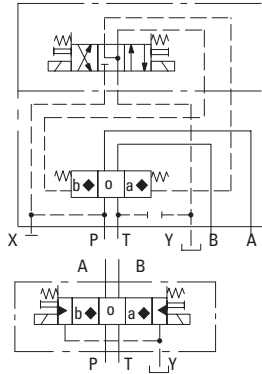
Spring Offset, End-to-Center, Opposite Hand

Models DG5V-5**B 8
DG5V-5**BL 0, 2, 52



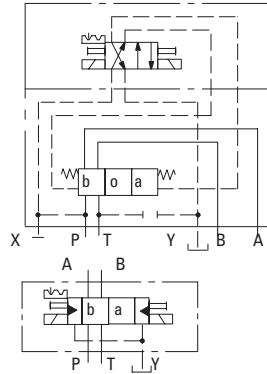
Spring Centered, DG5V-5**C

Spool types: All



Detented, DG5V-5**N■

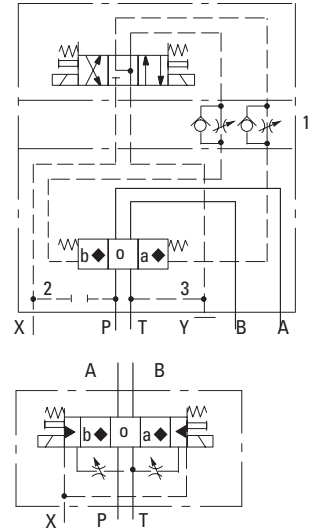
Spool types: 0, 2, 6, 52



DG5V-5 Options

The following are shown in a DG5V-5**C example:

1. Pilot choke module
2. External pilot connection
3. Internal drain



■ Subject to availability of pilot pressure.

▲ All main-stage assemblies are spring-centered. The conditions described depend on the availability of pilot pressure in excess of 4.5 bar (65 psi) to move the spools against these springs. This is particularly important when using external pilot pressure supply

Solenoid Identification (refers to installation drawing, page 10 - 12)

For model code variants:

Position 3, spool spring arrangement

Position 8, solenoid identity method

Model	Spool Types	Solenoid Identify Main Port A End	Solenoid Identify Main Port B End
DG5V-5*A/B(-2)(-E)(-T)(-**)M	All except "8"	-	B
DG5V-5*A/B(-2)(-E)(-T)(-**)VM	All except "8" "	-	A
	"8" only	B	-
DG5V-5*AL/BL(-2)(-E)(-T)(-**)M	All except "8"	A	-
DG5V-5*AL/BL(-2)(-E)(-T)(-**)VM	All except "8" "	B	-
	"8" only	-	A
DG5V-5*C/N(-2)(-E)(-T)(-**)M	All except "8"	A	B
DG5V-5*C/N(-2)(-E)(-T)(-**)VM	All spools	B	A

Note : For information on pilot valves please refer segment B of the catalog.

Operating Data

MAXIMUM PRESSURES:

DG3V-5 valves; ports:

P, A, B, X and Y	315 bar (4500 psi)
T	315 bar (4500 psi)

DG5V-5-**(L){-*}(-E){-*} valves, (externally drained); ports:

P, A, B, T and X	315 bar (4500 psi) ▲
Y with AC solenoid	160 bar (2300 psi)
Y with DC solenoid	210 bar (3000 psi)

DG5V-5-**(L){-*}(-E)-T{-*} valves, (internally drained); ports:

P, A, B and X	350 bar (5000 psi) ▲
T with AC solenoid	160 bar (2300 psi)
T with DC solenoid	210 bar (3000 psi)

Maximum flow (for both DG3V-5 and DG5-V5) 160 L/min (42Usqpm)

Pilot pressures refer segment B for pilot valve data

▲ The DG5V, 50 design two-stage valves have been designed to satisfy the needs of most applications.

Consult your Eaton representative about an alternative model if:

- a) Valves are required to remain pressurized for long periods without frequent switching, and /or
- b) Back pressure on the drain port of externally drained models (or the tank port of internally drained models) is required to rise above 210 bar (3000 psi).

ELECTRICAL INFORMATION

Voltage ratings, DG5V valves See 14 in "Model Code" on page 4

Voltage limits, DG5V valves:

Maximum voltage	See "Temperature limits", on page 8
Minimum voltage	90% of rated voltage

Power consumption, DG5V valves with AC solenoids:

	Initial VA rms	Holding VA rms
Dual-frequency coils at 50 Hz, types "B" and "D"	280	61
Dual-frequency coils at 60 Hz, types "B" and "D"	300	58

Power consumption, DG5V valves with DC solenoids 30W at rated voltage and 20 C (68 F)

Relative duty factor, DG5V valves Continuous; ED = 100%

Type of protection, DG5V valves:

ISO 4400 coils with plug fitted correctly	IEC 144 class IP65
Junction box	IEC 144 class IP65 (NEMA 4)
Coil winding	Class H
Lead wires (coil types "F****")	Class H
Coil encapsulation	Class F

Operating Data

TEMPERATURE LIMITS:

Fluid temperature limits	See appendix
Ambient temperature limits:	See appendix
Minimum ambient, all valves	-20°C (-4°F)

Maximum ambients, DG5V valves with coils listed in 12 in "Model Code" two pages back, and under conditions stated below:

Dual-frequency coils:

at 50 Hz and 107% of rated voltage	65°C (150°F)
at 50 Hz and 110% of rated voltage	65°C (150°F)
at 60 Hz and 107% of rated voltage	65°C (150°F)
at 60 Hz and 110% of rated voltage	65°C (150°F)

Single-frequency (50 Hz) coils at 50 Hz and 110% of rated voltage	65°C (150°F)
---	--------------

DC coils at 110% of rated voltage	70°C (158°F)
-----------------------------------	--------------

INSTALLATION DIMENSIONS:

Valves	See page 11, 12, 13
--------	---------------------

Mass (weight), basic models: kg (lb) approx.

DG3V-5-*A(L)	10,0 (22.0) ◆
DG3V-5-*B(L)/*C	7,3 (16.1) ◆
DG5V-5-*A/B (AC voltages)	8,4 (18.5) ◆
DG5V-5-*A/B (DC voltages)	8,5 (18.7) ◆
DG5V-5-*C/N (AC voltages)	8,7 (19.2) ◆
DG5V-5-*C/N (DC voltages)	9,1 (20.0) ◆

◆ Add 1,1 kg (2.4 lb) when pilot chock adjustment is fitted.

Note : For information on pilot valves please refer segment B of the catalog.

H

Performance Data

Pilot Pressures

Differential pressure, i.e. pilot pressure at port P (or port X) minus pilot drain pressure at port T (or port Y).

Maximum
315 bar (4567 psi)

Minimum (for max. flow):
For spool types 0, 1, 8♦, 11
4,5 bar (65 psi)

For spool type 6
8 bar (116 psi)

For spool types 2, 3, 31, 33,
52
10 bar (145 psi)

All main stages are spring centered. Selection of spool offset positions "a" or "b" requires pilot pressure equal to or in excess of the above minimums to move the spool against the spring force. This is particularly important when using external pilot pressure supply.

♦ When using a type 8 spool with the valve configured for internal pilot supply, flow through the valve should be at least 80 L/min (21 USgpm) to generate 4,5 bar (65 psi) pressure drop when the spool is in the center position (flow P to T).

DG5V-5-**N

The spool of the pilot valve of this model is detent-held in its last selected position, and the spool will remain ▲ in this position after the solenoid has been de-energized.

The main stage is spring-centered and requires at least minimum pilot pressure to hold the spool in its offset ("detent-held") position. When pilot pressure falls below the recommended minimum, the main-stage spool will move to position "o" under the action of the centering springs.

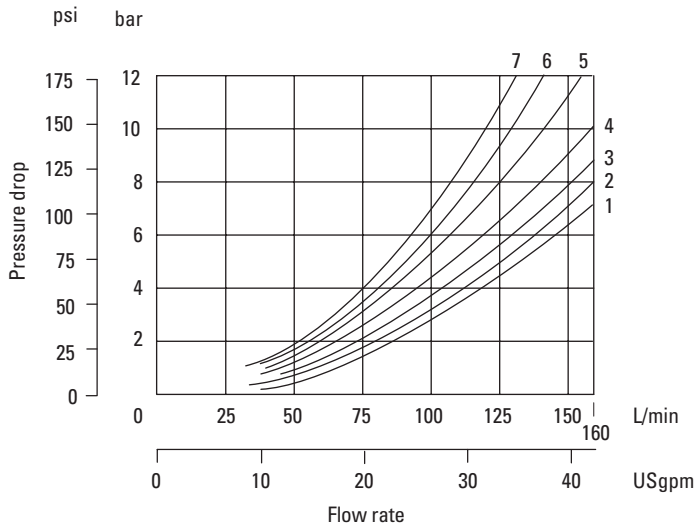
The system designer should ensure that under these conditions the flow condition at center position "o" is appropriate for the application.

▲ See comment in "Mounting Attitude".

Pilot Choke Module

This allows the velocity of the main-stage spool to be controlled, thereby reducing transient shock conditions. For best results a constant, low pilot pressure is recommended.

Based on petroleum oil at 36 cSt (168 SUS) and at 50 C (122 F).



SPOOLTYPE	FOR POSITIONS "A" OR "B"				FOR POSITION "O":		
	P → A	B → T	P → B	A → T	A → T	B → T	P → T
0	4	4	1	4	1	3	5
1	1	4	1	4	3	-	6
2	1	2	1	5	-	-	-
3	2	3	1	4	5	-	-
6	1	2	1	3	-	-	-
8	4	2	2	6	-	-	7
11	4	1	3	4	-	7	5
31	3	3	3	4	-	4	-
33	2	2	3	4	-	-	-
35A	See page 14						
52	2	3	3	5	-	-	-

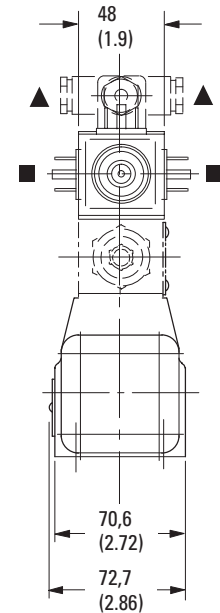
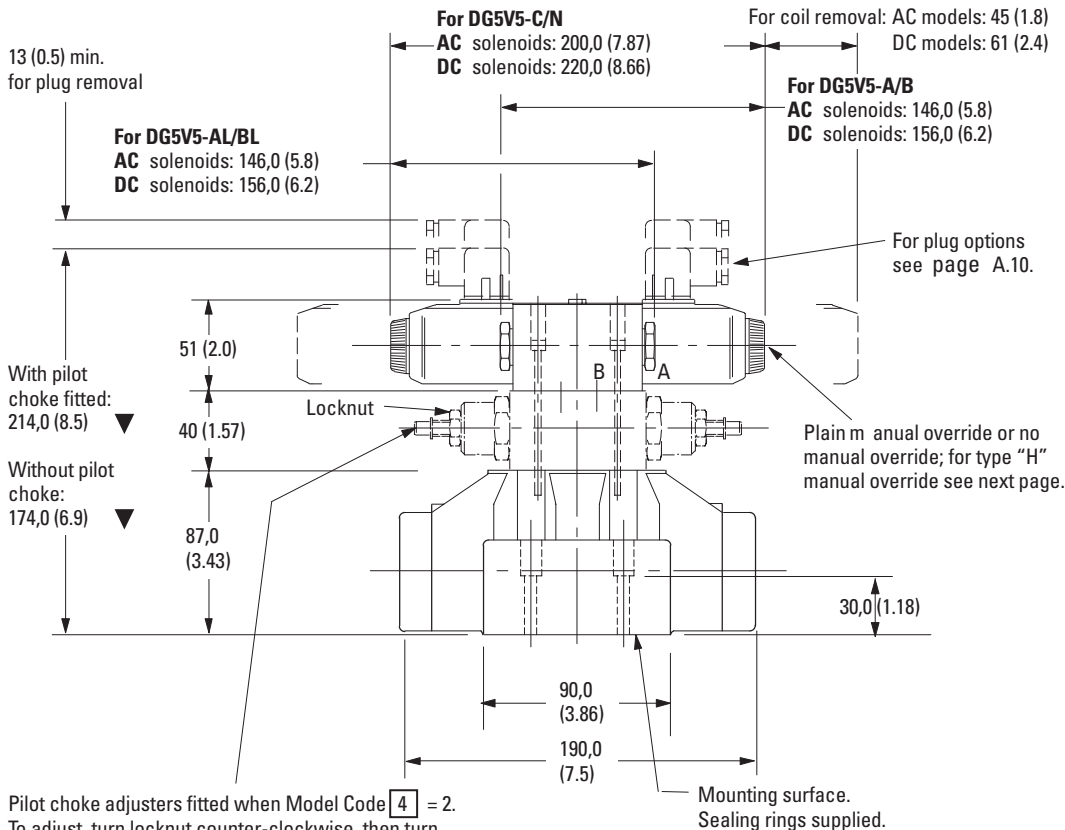
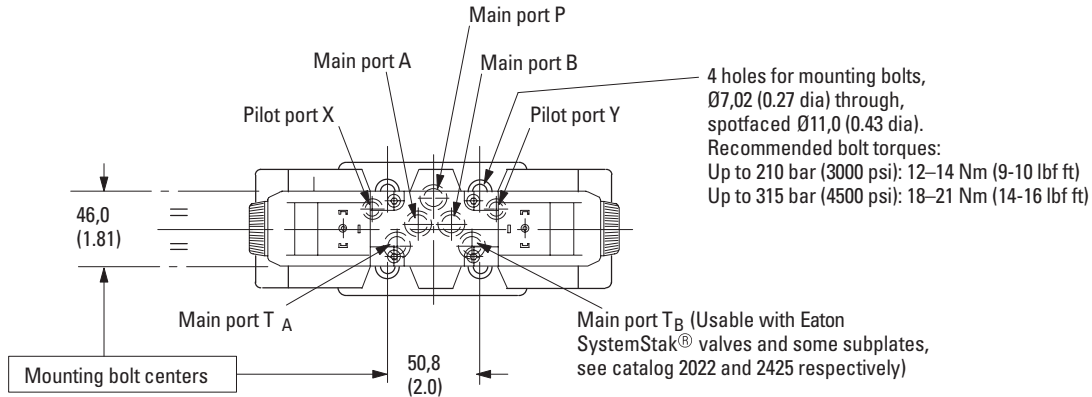
Installation Dimensions

Millimeters (inches)

Solenoid Controlled Models with ISO 4400 (DIN 43650) Electrical Connections and Optional Pilot Choke

DG5V-5-**-*(L)(-2)(-E)(-T)(-*)(-V)M-U example

For solenoid identification see previous page.



Pilot choke adjusters fitted when Model Code **4** = 2.
To adjust, turn locknut counter-clockwise, then turn screw clockwise to slow down rate of spool travel, or counter-clockwise to increase the rate.
Re-tighten locknut to 25-30 Nm (18-22 lbf ft).

- ▼ May vary according to plug source.
- Alternative plug positions by loosening knurled nut counter-clockwise, turning coil and re-tightening nut.
- ▲ Cable entry can be positioned at 90° either way from position shown, by re-assembling the contact holder into the appropriate position inside the plug connector housing.

Installation Dimensions

Solenoid Controlled Models with Junction Box having Optional Terminal Strip and Indicator Lights

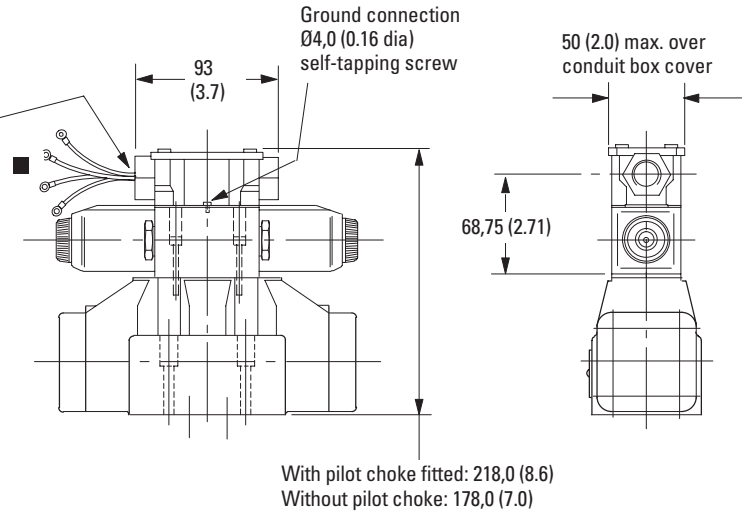
DG5V-5-*** (L)(-2)(-E)(-T)(-*)(-V)M-F**** (L) example

For solenoid identification see page A.7.
Available also with other options shown on previous and following pages.

M20-6H x 1,5 thread for F(T)J options, or 1/2" NPT for F(T)W options, at both ends. Closure plug fitted at one end.
For other options see [10](#) & [11](#) in "Model Code" on page A.5 and under "NFPA Connector---" and "Terminal Strip and Lights", on pages A.10 and A.11.

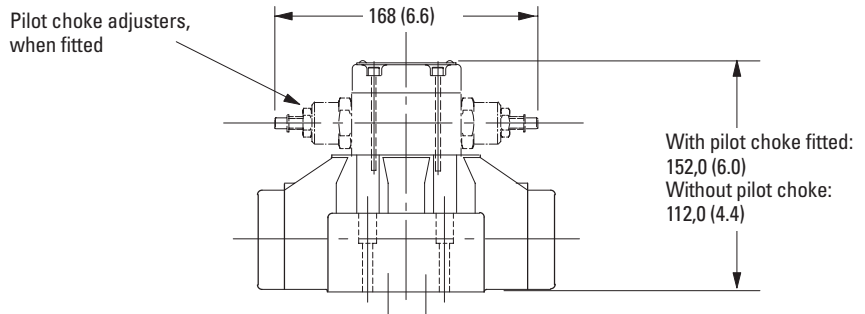
■ Ref. "Model Code" : Codes "FJ" and "FW" [10](#)
Codes "FTJ" and "FTW":

2 lead wires for each solenoid, approx. 150 (6.0) long. M3 (#6) terminals provided for customer connection. Valve supplied with lead wires connected into terminal strip suitable for M3 (#6) terminals provided for customer connection.



Pilot Operated Models with Optional Pilot Choke

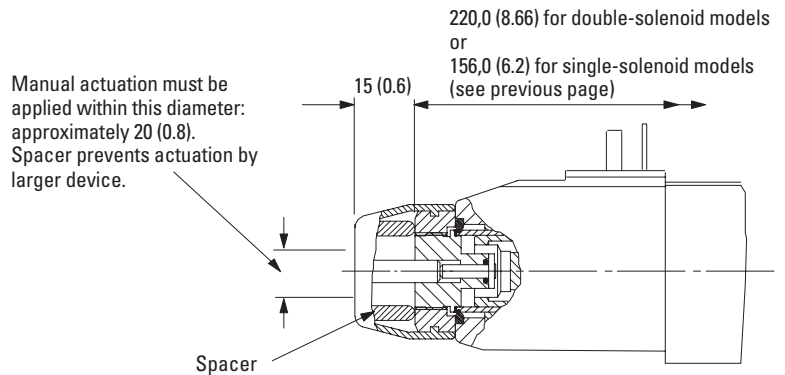
DG3V-5-** C(-2) example



Water-Resistant Manual Override

DG5V-5---M-*****(L)-H valves

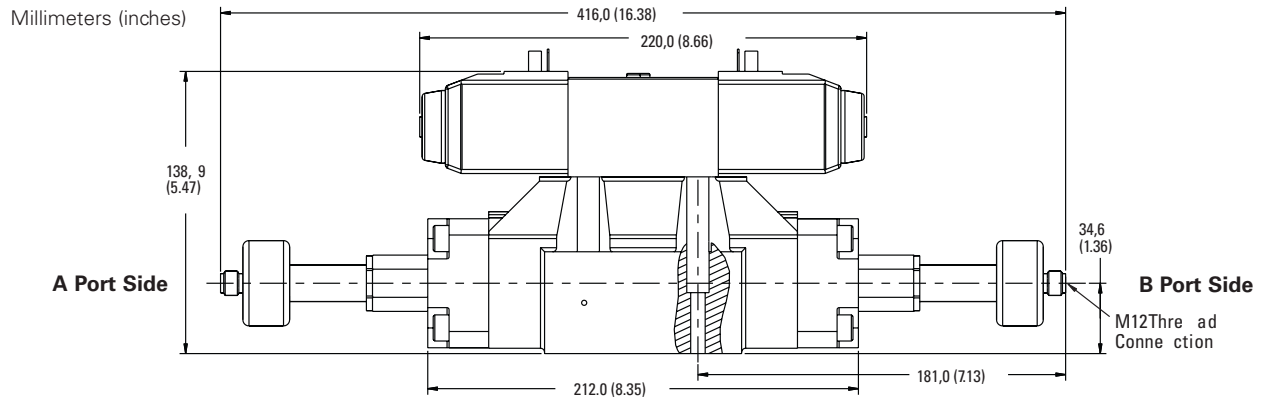
Application:
General use where finger operation is required (standard manual overrides can only be operated by using a small tool).



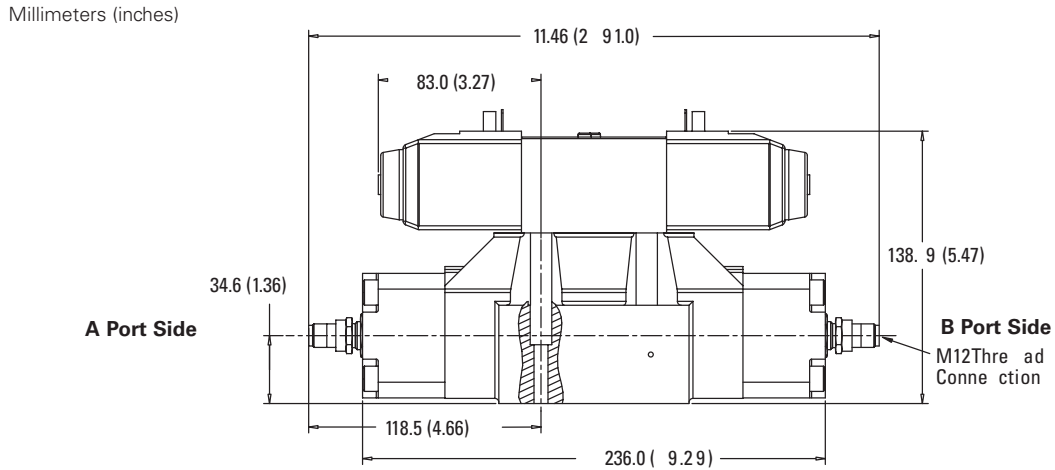
Note: "H" feature is not field convertible from other models; specify with order.

Installation Dimensions

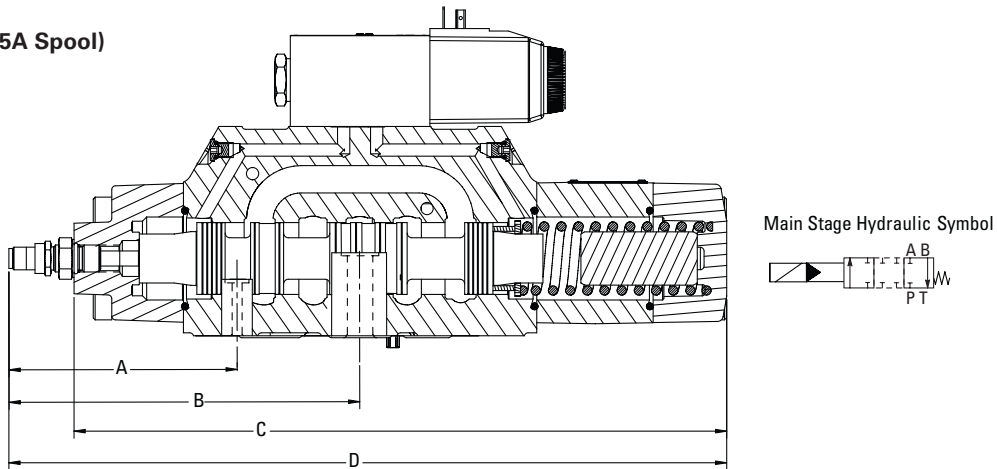
DG5V-5 with Main Stage Spool Monitoring Switch "PCA", "PCB", "PDA", "PDB" or "PCD" Models (LVDT style)



DG5V-5 with Main Stage Spool Monitoring Switch "PPA", "PPB", "PPD" Models (Proximity Switch)



Valve for Safety Circuit Application (35A Spool)



DG5V with PPA Switch Option Shown

MODEL	A	B	C	D	LEAKAGE P-A	FLOW CURVE
	mm (in)	mm (in)	mm (in)	mm (in)	cc/min (in ³ /min)	
DG5V5-35A	118.5 (4.67)	118.5 (4.67)	234.7 (9.24)	262.1 (10.32)	Available upon request	Available upon request

Electrical Information

Mainstage Spool Monitoring Switch

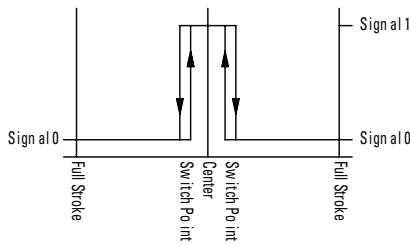
[LVDT Style] Specification

SPECIFICATIONS

Supply Voltage (Vs)	24VDC ± 20%
(Full Wave Bridge with Capacitor) Reverse Polarity Protection	MAX. 300 V INSTALLED
Ripple Voltage	10%
Current Consumption	40 mA APPROX
Outputs	NC CONTACT POSITIVE
Sensing Distance (offset position)	9.36 to 9.65 mm
Sensing Distance (from center position)	± 0.35 to 0.65 mm
Hysteresis	±0.06mm
Output Voltage	(NO SHORT CIRCUIT PROTECTION)
Signal 1	Vs – 2.5 V
Signal 0	< 1.8 V
Output Current	< 400 mA AT INPUT + 20%
Environmental Protection	IP65 (WITH MOUNTED PLUG)
Operating Temp Range	-20° C to +85° C
Maximum Operating Pressure	315 bar (4500 psi)
CE Declaration of Conformity No.	00 02 002 9 93

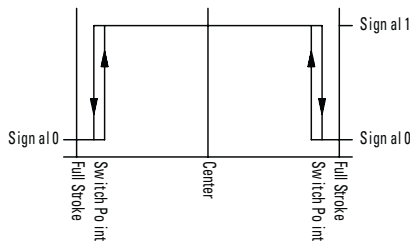
ATTENTION: EMC ONLY ENSURED WHEN USING SCREENED CABLES AND SCREENED PLUG CASING!

TYPICAL "PCA/PCB" OUTPUT
(FOR SENSING CENTER POSITION)



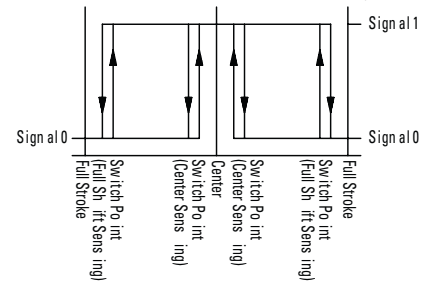
Signal 0 = Voltage at pin 2/4 < 1.8V
Signal 1 = Voltage at pin 2/4 > (Vs – 2.5V)

TYPICAL "PDA/PDB" OUTPUT
(FOR FULL SHIFT SENSING)



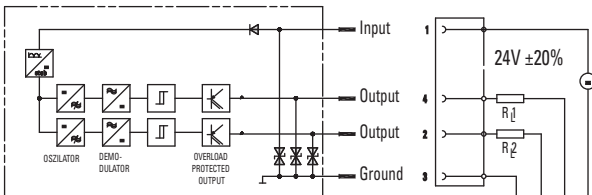
Signal 0 = Voltage at pin 2/4 < 1.8V
Signal 1 = Voltage at pin 2/4 > (Vs – 2.5V)

TYPICAL "PCD" OUTPUT
(FOR CENTER SENSING 'A' PORT END,
FULL SHIFT SENSING 'B' PORT END)



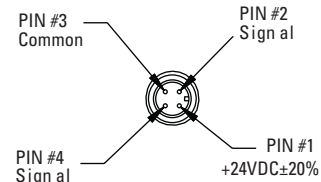
Signal 0 = Voltage at pin 2/4 < 1.8V
Signal 1 = Voltage at pin 2/4 > (Vs – 2.5V)

Electrical Schematic and Mating Connector Detail



R₁, R₂ = e.g. Coil Resistance of the switch relay >= 60 OHMS

Connector Detail



Electrical Information

Mainstage Spool Monitoring Switch

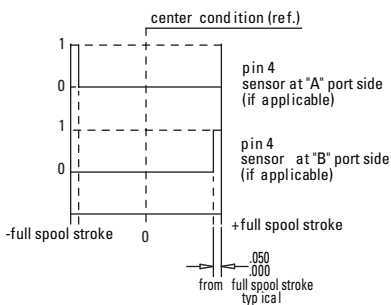
[Priority Switch] Specification

SPECIFICATIONS

Supply Voltage (Vs)	10 to 30 Vdc
Supply Current (Is)	8 mA at 24 Vdc (plus load current)
Supply Over-voltage Rating:	35 Vdc continuous
Supply Reverse Polarity Rating	-35 Vdc (with no shorts)
Short Circuit Tolerance:	Continuous short between any two pins
High Potential Test, Pin to Case:	300 Vdc
Electromagnetic Compatibility:	ISO 7637 Parts O and I worst case and Immunity to Radiated Electromagnetic Fields, 10 KHZ to 1 GHZ per SAE J1113/25 Sep 95
Pins to Case Resistance	50 Megohms
Load Dump Tolerance:	80 Vdc Peak, 400 ms Decay, with 1.5 Ohm Source Impedance
Switching Frequency:	0 to 3K Hz
Output:	Open collector PNP sourcing, normally open
Sensing Distance:	1.27 mm ± 0.25mm (.050" ± .010")
Hysteresis:	0.35 mm (.010") Max.
Rise/Fall Time:	6.5/1.5 microsec R1=820 Ohm, C1=20 pF @ 8Vdc
Output Leakage Current	10µa Max.
Output Voltage High:	+Vs - 2.2 Vdc minimum
Output Load Current:	200 mA Max.
Operating Pressure:	350 bar (5000 psi)
Operating Temperature:	-40° to -110°C
Humidity:	0 to 100%

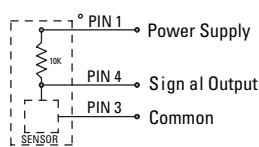
Electrical information shown is for offset sensing, Proximity Switch "PPA", "PPB" or "PPD" Models

Functional Diagram - Spring Offset

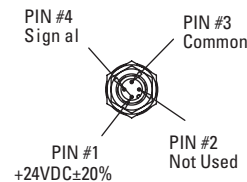


0=voltage at pin 4 0.5V min.
1=voltage at pin 4 (Input-2.2V) min.

Output Circuit Wiring Instruction



Connector Detail



Eaton
Hydraulics Group USA
14615 Lone Oak Road
Eden Prairie, MN 55344
USA
Tel: 952-937-9800
Fax: 952-294-7722
www.eaton.com/hydraulics

Eaton
Hydraulics Group Europe
Route de la Longeraie 7
1110 Morges
Switzerland
Tel: +41 (0) 21 811 4600
Fax: +41 (0) 21 811 4601

Eaton
Hydraulics Group Asia Pacific
Eaton Building
4th Floor, No.7 Lane280 Linhong Rd.
Changning District
Shanghai 200335
China
Tel: (+86 21) 5200 0099
Fax: (+86 21) 2230 7240

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