

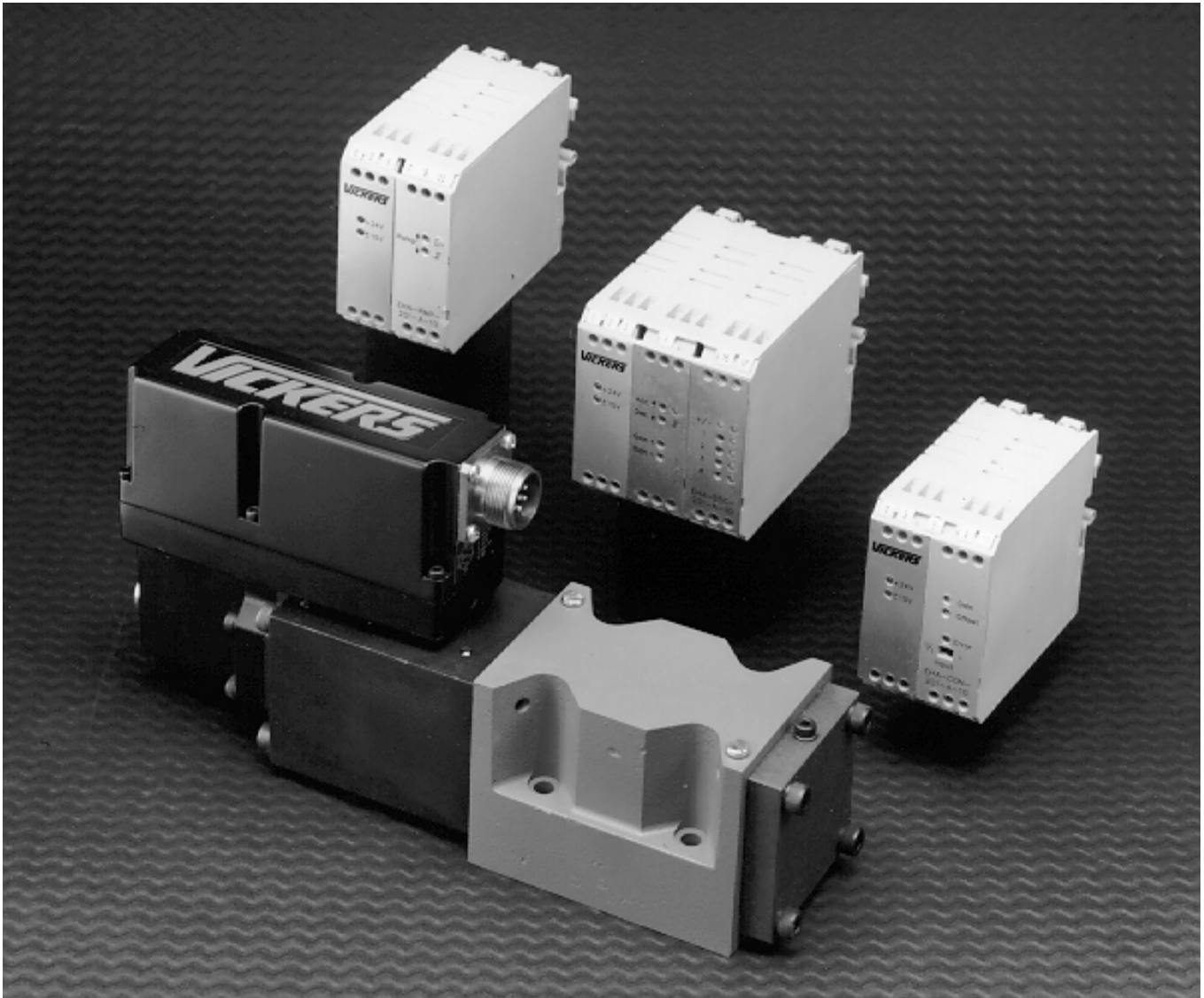
Vickers®


Proportional Valves



Proportional Directional Valves with Feedback

KBSDG4V-5, 1* Series – Pressures to 315 bar (4500 psi)



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by  Electromagnetic Compatibility (EMC).



Introduction

General Description

KBSDG4V-5 line offers a range of proportional directional valves with integral control electronics. Factory-set adjustments of gain and offset ensure consistent reproducibility valve-to-valve.

These four-way solenoid operated proportional valves have a high dynamic performance which enables them to be used in closed-loop applications, previously possible only with servo valves. Various spool options are available for rated flows up to 80 L/min (21 USgpm). Working pressures are to 315 bar (4500 psi). The spool position is monitored by an LVDT which feeds back information to the amplifier, enabling spool position to be accurately maintained.

This valve is currently available with an integral amplifier built directly onto the valve.

The only electrical inputs required are power supply (24V) and a voltage command signal of $\pm 10V$. The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via an industry standard 7-pin plug.

A spool position monitor pin allows the function of the valve to be electrically monitored. Ramp functions, if required, can be generated externally.

Features and Benefits

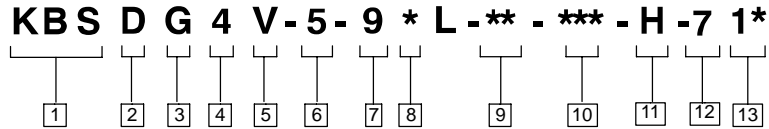
- Wide range of zero lap spool and flow rate options.
- Supported by a broad range of auxiliary function modules.
- Electronic feedback LVDT ensures accurate spool position control.
- Internal current feedback provides optimal control.
- Vibration and shock tested.
- Full CE electromagnetic compatibility.

- Factory-sealed adjustments ensure valve-to-valve reproducibility
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Standard $\pm 10 V$ DC command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- IP67 valve, environmental protection rating.
- Optional valve enable function.

Contents

Introduction	2
Features and benefits	2
Model codes	3
Typical section	4
Spool data	4
Functional symbol	4
Operating data	5
Pressures and flow rates	6
Performance curves	6
Installation dimensions	7
Subplates and mounting surfaces	8
Electrical information	10
Application data	12

Model Codes



1 Valve type

KBS – Servo performance proportional valve with integral amplifier and electronic feedback

2 Control type

D - Directional valve

3 Mounting

G – Subplate mounted

4 Operation

4 – Solenoid operated

5 Pressure rating

V – 315 bar (4500 psi)

6 Interface

5 – ISO 4401, size 05-04-0-94
ANSI/B93.7M-Size 05

7 Spool type, center condition

9 – Zero/underlap

8 Spool type, spring offset condition

2 – P,A,B,T blocked
6 – P blocked, A & B to tank

9 Rated flow at 70 bar (1000 psi) loop Δ p pressure drop

25 – 25 L/min (6.5 USgpm)
50 – 50 L/min (13.0 USgpm)
80 – 80 L/min (21.0 USgpm)

For actual maximum flow refer to Power capacity envelope curves, page 7.

10 Electrical connection

PC7 – 7 pin connector without plug
PE7 – 7 pin connector with plug
PH7 – As PE7 but with pin “C” used for enable signal
PR7 – As PC7 but with pin “C” used for enable signal

11 Electrical power

H – 24 VDC amplifier supply

12 Port T pressure limit code

7 – for all spools

13 Design number

1* series. Subject to change

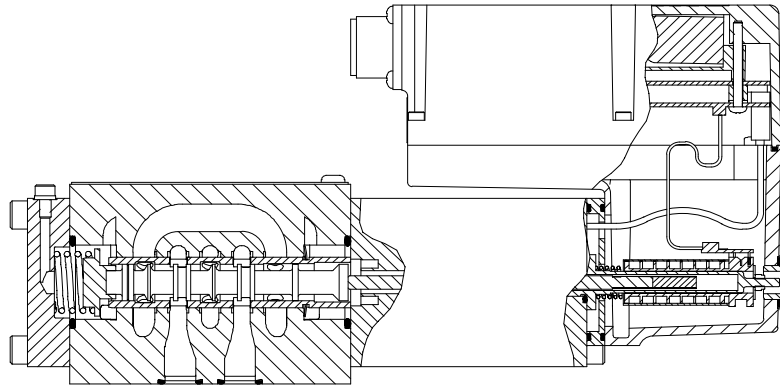


Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2,0-2,5 Nm (1.5-2.0 lbf ft), and the cable clamp (cable outside diameter range, 8,0–10,5 mm [0.31–0.41 inches] tightened as required to effect a proper seal.

Spool Data

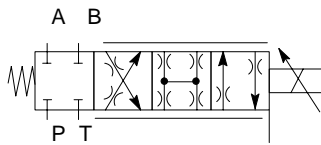
Typical Section View



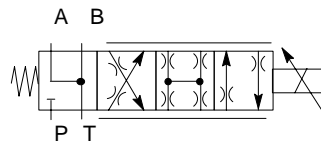
KBSDG4V-5

Spool Symbols

Available Spools for KBSDG4V-5



Spool type 92L



Spool type 96L

Spool Types and Flow Ratings

Symmetric Spools

Base line pressure drop (Δp) = 35 bar (500 psi) per metering flow path, e.g. B to T.
For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
------------	--------------	-------------

For KBSDG4V-5 valves:

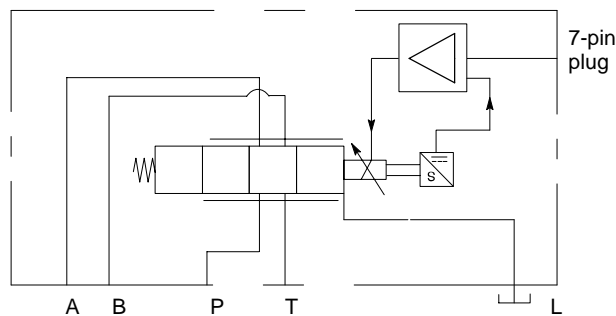
92L25	92L	25 L/min (6.5 USgpm)
92L50	92L	50 L/min (13 USgpm)
92L80	92L	80 L/min (21 USgpm)

96L25	96L	25 L/min (6.5 USgpm)
96L50	96L	50 L/min (13 USgpm)
96L80	96L	80 L/min (21 USgpm)

Functional Symbol

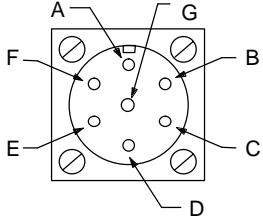
Model Type KBSDG4V-5

proportional directional valve (with integral electronics)



Operating data

Data is typical with fluid at 36 cST (168 SUS) and 50 °C (122 °F)

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max current 3,7A																		
Command signal Input impedance Common mode voltage to pin B	0 to +10V DC, or 0 to -10V DC, or -10 V to +10 V DC 47 kΩ 18V (max)																		
Valve enable signal for model code PH7 & PR7 Enable Disable Input impedance	>8.5V (36V max) <6.5V 10 kΩ																		
7-pin plug connector  View of pins of fixed half.	<table border="1"> <thead> <tr> <th>Pin</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Power supply positive (+)</td> </tr> <tr> <td>B</td> <td>Power 0V</td> </tr> <tr> <td>C</td> <td>Command/Monitor 0V (PE7 & PC7)</td> </tr> <tr> <td>C</td> <td>Valve enable (PH7 & PR7)</td> </tr> <tr> <td>D</td> <td>Command signal (+)-non-inverting input</td> </tr> <tr> <td>E</td> <td>Command signal (-)-inverting input</td> </tr> <tr> <td>F</td> <td>Monitor output</td> </tr> <tr> <td>G</td> <td>Protective ground</td> </tr> </tbody> </table>	Pin	Description	A	Power supply positive (+)	B	Power 0V	C	Command/Monitor 0V (PE7 & PC7)	C	Valve enable (PH7 & PR7)	D	Command signal (+)-non-inverting input	E	Command signal (-)-inverting input	F	Monitor output	G	Protective ground
Pin	Description																		
A	Power supply positive (+)																		
B	Power 0V																		
C	Command/Monitor 0V (PE7 & PC7)																		
C	Valve enable (PH7 & PR7)																		
D	Command signal (+)-non-inverting input																		
E	Command signal (-)-inverting input																		
F	Monitor output																		
G	Protective ground																		
Electromagnetic compatibility (EMC): Emission (10 V/m) Immunity (10 V/m)	EN 50081-2 EN 50082-2																		
Zero adjustment	± 18% mechanical adjustment accessible under plug in LVDT																		
Monitor point signal Output impedance	± 10 V DC for full spool stroke 10kΩ																		
Power stage PWM frequency	10 kHz nominal																		
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal	≤ 5%																		
Protection: Electrical Mechanical	Reverse polarity protected IEC 144, Class IP67																		
Ambient air temperature range for full performance Oil temperature range for full performance	0 °C to 70 °C (32 °F to 158 °F) 0 °C to 70 °C (32 °F to 158 °F)																		
Minimum temperature at which valves will work at reduced performance	-20 °C (-4 °F)																		
Storage temperature range	-25 °C to +85 °C (-13 °F to +185 °F)																		
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* ramp generator EHA-PID-201-A-2* PID controller EHA-PSU-201-A-10 power supply	See catalog GB 2410A See catalog GB 2470 See catalog GB 2410A See catalog GB 2427 See catalog GB 2410A																		
Relative duty factor	Continuous rating (ED = 100%)																		
Hysteresis	< 0.5%																		

Operating data (continued)

Step response: Step size (% of max spool stroke): 0 to 100% or 100 to 0% 10 to 90% or 90 to 10% 25 to 75% or 75 to 25% +90 to -90%	Time to reach 90% of required step: 24 ms 21 ms 20 ms 33 ms
Mass: KBSDG4V-5	5,9 kg (13 lb) approx..

Pressures and Flow Rates Maximum pressures, bar (psi)

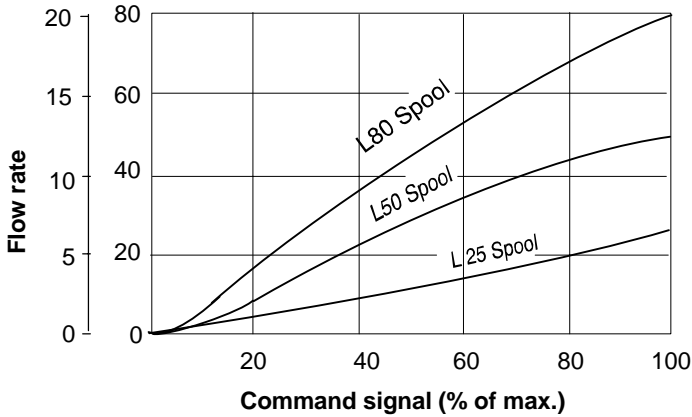
Port L condition	Ports P, A, B	T	L
Normally blocked by mounting surface	315 (4500)	160 (2300)	160 (2300)
Drained directly to tank	315 (4500)	210 (3000)	10 (145)

Performance Curves

Flow Gain

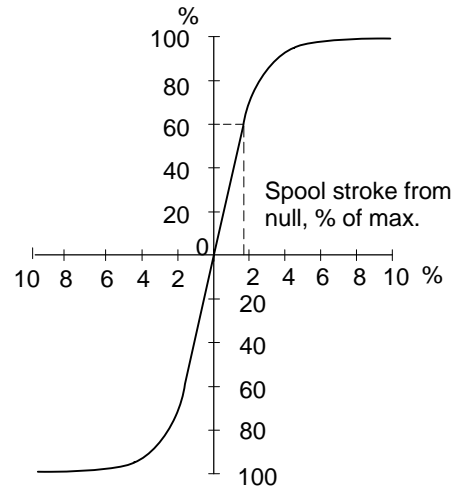
Flow from port P-A-B-T or P-B-A-T at 70 bar (1000 psi) total valve ~~at 70 bar~~ (500 psi) per metering edge

USgpm L/min

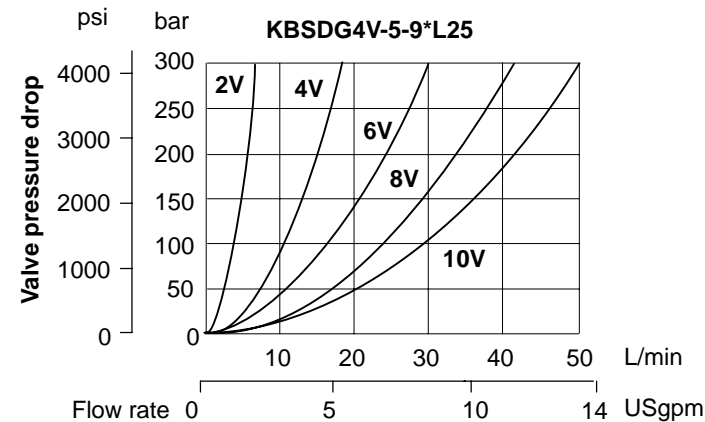


Pressure Gain

Δp between ports A and B or B and A, as % of port P pressure



Power Capacity Envelope



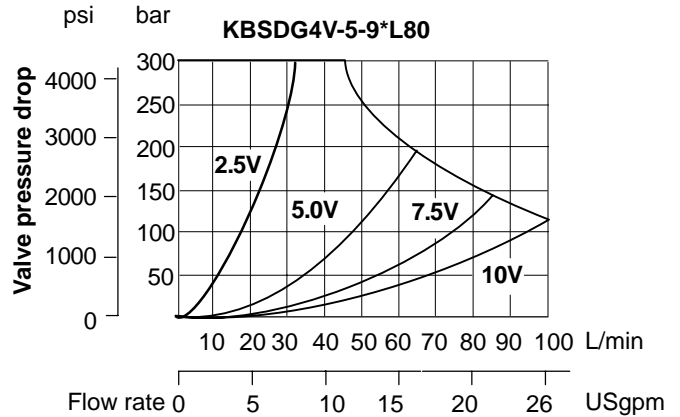
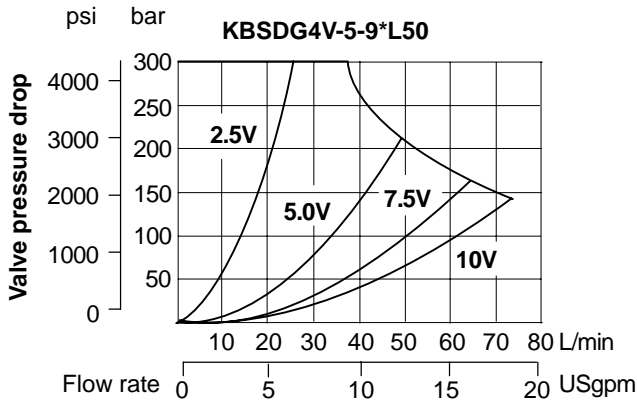
At other pressure drop (Δp) values, flow rates Q_x approximate to:

$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

where Q_D = Datum flow rate
 Δp_D = Pressure drop at datum flow rate
 Δp_x = Required Δp

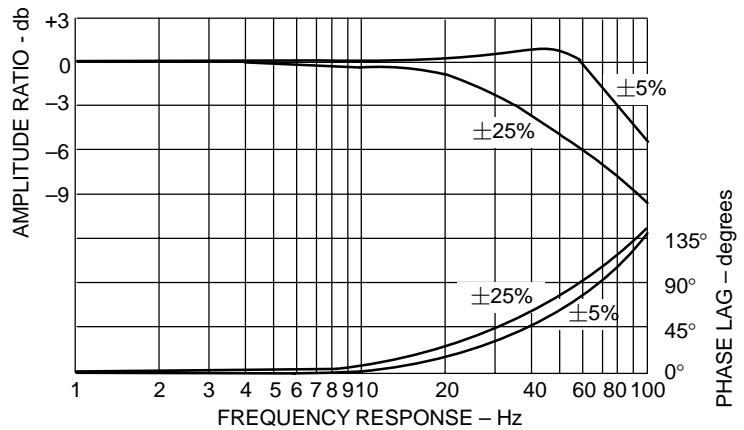
Limited by valve capacity. Refer to Power Capacity envelope.

Power Capacity Envelopes



Frequency Response

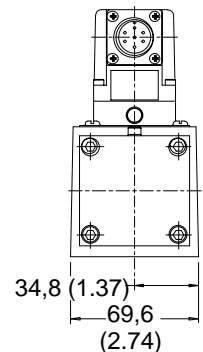
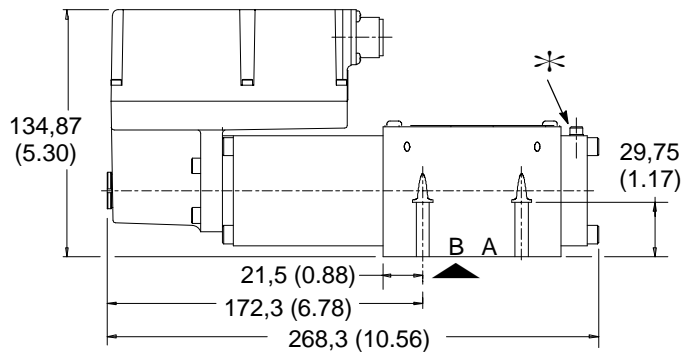
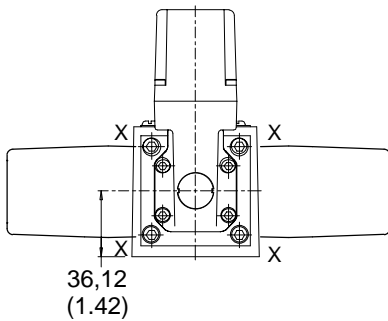
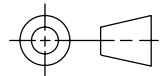
Typical amplitudes of $\pm 5\%$ and $\pm 25\%$ with zero offset. Δp (P to T)=70 bar



Installation Dimensions

mm (inch)

3rd angle projection



Amplifier and solenoid assembly may be rotated 90° as shown by removing 4 screws shown X. Re-torque to 13-15 Nm (10-11 lbf ft)

Note: Bleed screw locations Air bleed, Socket Head Cap Screw. Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

Mounting surface seals supplied. For mounting surface dimensions and subplate options see page 8.



Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2,0-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

Subplates and Mounting Surfaces

General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,0127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better.

Dimensional Tolerances

Dimensional tolerance on interface drawings is $\pm 0,2$ mm (± 0.008 ") except where otherwise stated. ISO 4401 specifies inch conversion to ± 0.01 " .

Conversion from Metric

ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

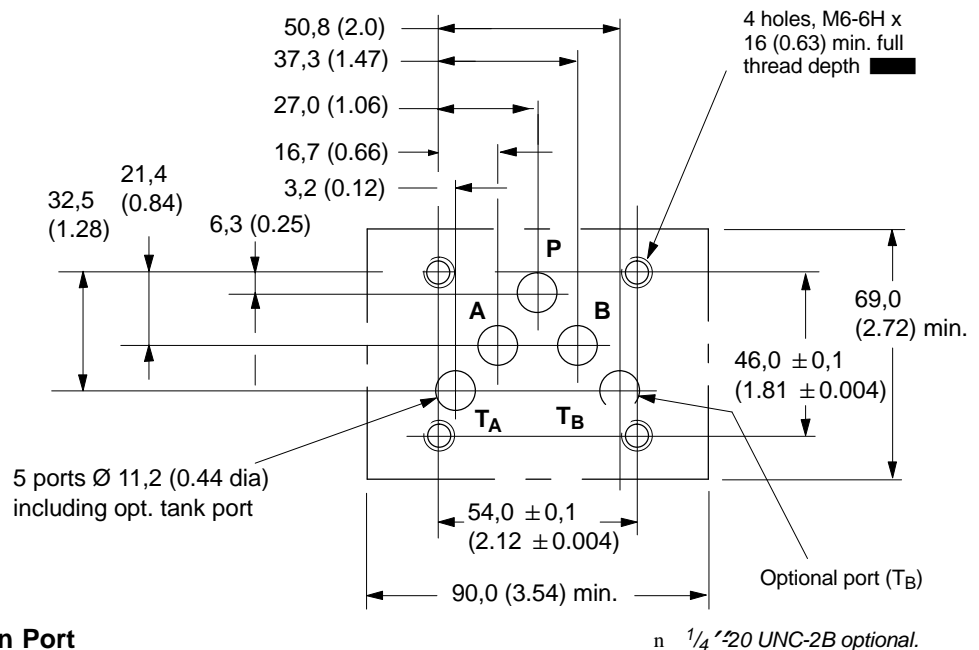
Mounting Bolt Tappings

ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

Mounting Surface Interface to ISO 4401

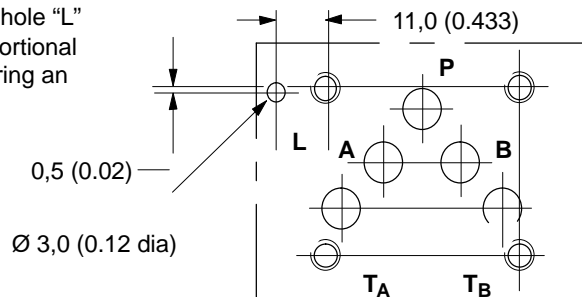
Size 05

This interface conforms to:
 ISO 4401-05-04-0-94
 ANSI/B93.7M (and NFPA) size 05
 CETOP R35H4.2-05
 DIN 24340 Form A10



Interface with Additional Drain Port

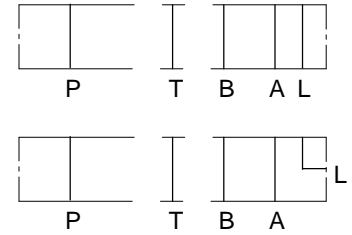
The interface conforms to Vickers standard, plus hole "L" Typically used for proportional and other valves requiring an additional drain port.



Sub-plate Installation Dimensions

Subplates with Rear Ports P, T, A, B, Maximum Pressure 210 bar (3000 psi)

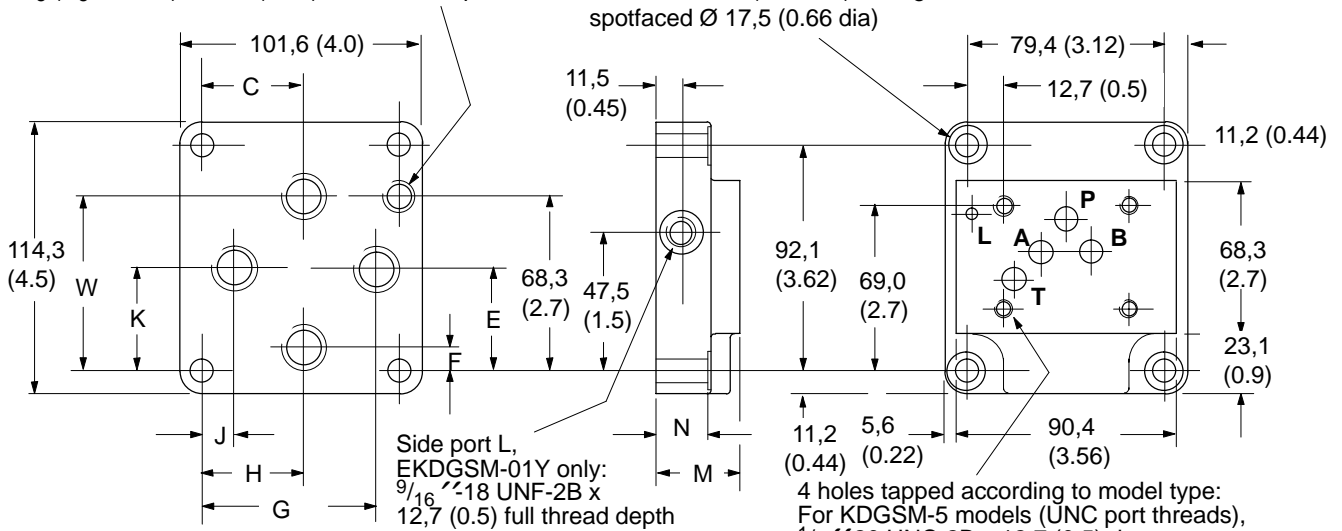
Model types: KDGSM-5-676805-2*
 (with rear port L)
 EKDGSM-01Y-1*-R
 (with side port L)



Rear port L, KDGSM-5-676805 only:

G¹/₈ (1¹/₈ BSPF) x 12,0 (0.47) full thread depth

4 holes Ø 10,8 (0.42 dia) through, spotfaced Ø 17,5 (0.66 dia)



Mass = 1,3 kg (2.9 lbs)

Model	Ports P, T, A, B Threads
210 bar (3000 psi) KDGSM-5-676805-2	3/4 UNF-2B x 14,0 (0.56) full thread depth
280 bar (4000 psi) EKDGSM-01Y-10-R	G 1/2 (1/2" BSPF) x 15,0 90.59 full thread depth

Dimensions

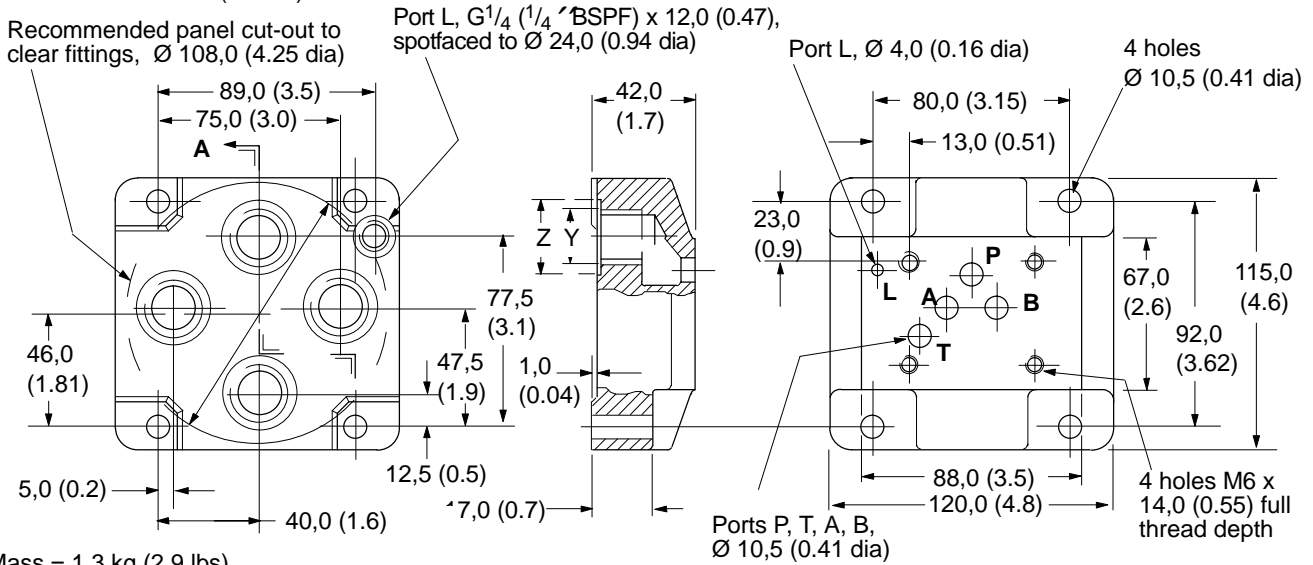
Model	C	E	F	G	H	J	K	M	N	W
210 bar (3000 psi) KDGSM-5-676805-2	45,2 (1.78)	42,1 (1.66)	19,0 (0.75)	68,3 (2.69)	45,2 (1.78)	23,8 (0.94)	42,1 (1.66)	31,8 (1.25)	23,8 (0.94)	57,1 (2.25)
280 bar (4000 psi) EKDGSM-01Y-10-R	39,7 (1.56)	40,5 (1.59)	9,9 (0.39)	70,6 (2.78)	39,7 (1.56)	10,7 (0.42)	40,5 (1.59)	36,5 (1.44)	28,6 (1.13)	72,6 (2.86)

Subplates with Rear Ports P, T, A, B, L

Maximum Pressure 315 bar (4500 psi)

Model types: KD GSM-5-615225-1*
KD GSM-5-615226-1*

All dimensions in mm (inches)



Ports P, T, A, B

Model	Y Thread	Z diameter
KD GSM-5-615225-10	G1/2 (1/2" BSPF) x 14,0 (0.55) full thread depth	30,0 (1.18)
KD GSM-5-615226-10	G3/4 (3/4" BSPF) X 16,0 (0.63) full thread depth	33,0 (1.30)

Electrical Information

**Block Diagram
Command Signals and Outputs**

7-pin plug		Flow direction
Pin D	Pin E	
Positive	0V	P to A
0V	Negative	
U _D - U _E = Positive		P to B
Negative	0V	
0V	Positive	
U _D - U _E = Negative		

Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 11 of this leaflet and Installation Wiring Practices for Vickers Electronic Products, leaflet 2468. Recommended cable sizes are shown below:

Screen (shield):

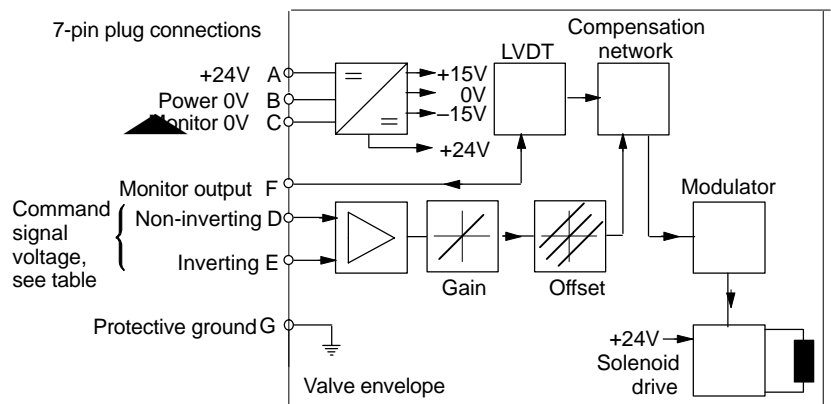
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.
Cable outside diameter 8,0–10,5 mm (0.31–0.41 inches)
See connection diagram on next page.

Signal cables:

0,50 mm² (20 AWG)

Power cables:

For 24V supply
0,75 mm² (18 AWG) up to 20m (65 ft)
1,00 mm² (16 AWG) up to 40m (130 ft)



Note: In valves with PH7 or PR7 type electrical connection, pin C is used for a valve enable signal.

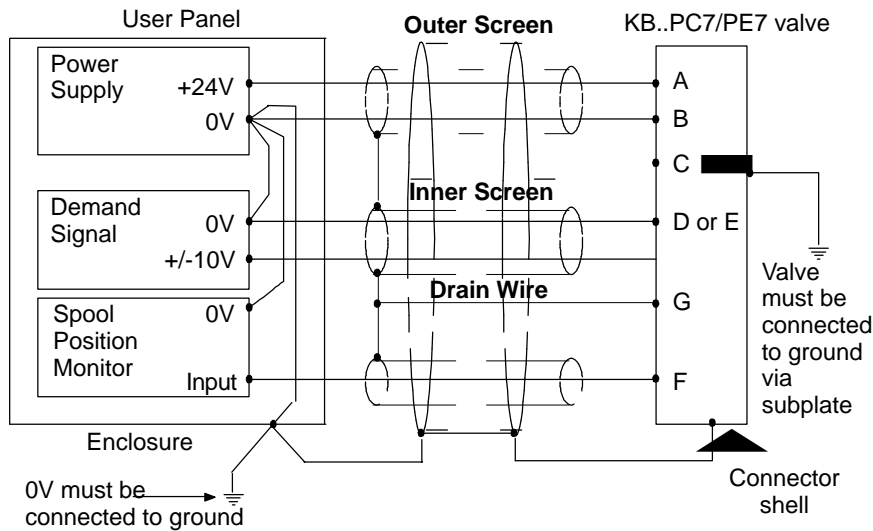


Warning

All power must be switched off before connecting or disconnecting any plugs.

Typical Connection Arrangements

Wiring Connections



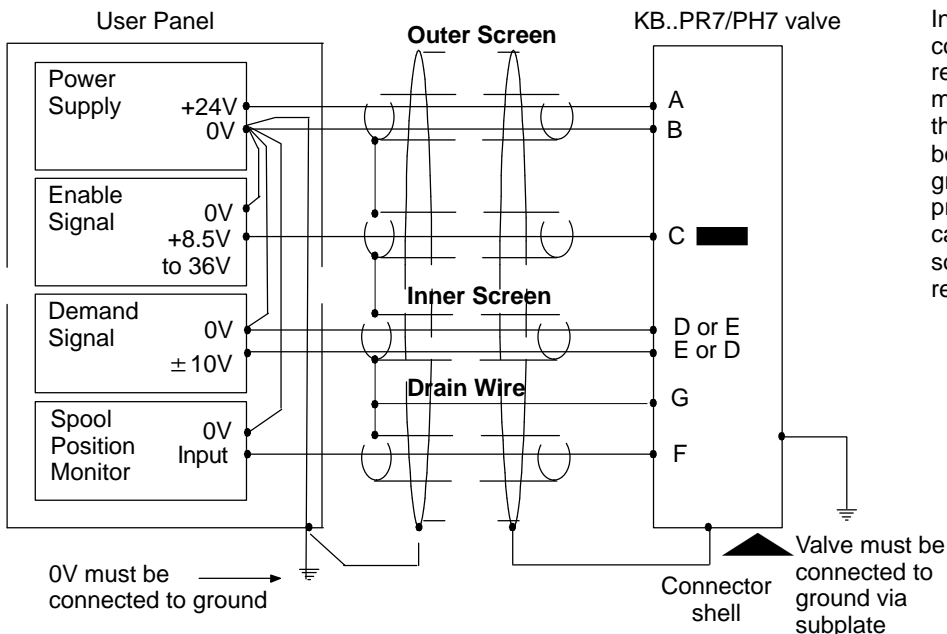
Spool position monitor voltage (pin F) will be referenced to the KB valve local ground. A "local ground" (pin C) is provided on PC7/PE7 versions for optional use by differential input customer supplied electronics.



WARNING

Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.

Wiring Connections for Valves with Enable Feature



Note:

In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences in command source and valve ground potentials will result in a screen (shield) ground loop.



Warning

Electromagnetic Compatibility (EMC)

It is necessary to ensure that the valve is wired up as above. For effective protection the user electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. The metal 7 pin connector part no. 934939 should be used for the integral amplifier.

In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

The enable line to pin C should be outside the screen which contains the demand signal cables.

Application Data

Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in Vickers publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Vickers concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 μ m and 15 μ m.

For products in this catalog the recommended levels are:

0 to 70 bar (1000 psi) 18/16/13
70 + bar (1000 + psi) 17/15/12

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Hydraulic Fluids

Materials and seals used in these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

Installation

The proportional valves in this catalog can be mounted in any attitude, but it may be necessary in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. Good installation practice dictates that the tank port and any drain port are piped so as to keep the valves full of fluid once the system start-up has been completed.

Mounting Bolt Kits

For KBSDG4V-5

BKDG01633M (metric)
BKDPNG40706 (inch)

If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.

Seal Kits

KBSDG4V-5 02-332751

Plugs

KBSDG4V
7-pin plug (metal) 934939
7-pin plug (plastic) 694534
(metal plug must be used for full EMC protection)

NOTE: An alternative metal connector which gives EMC protection but not IP67 rating is available from ITT-Cannon, part number CA06-COM-E-14S-A7-S. For IP rating consult the manufacturer.

Extension Cable

Extension Cable: Adapter for extending 7 core cable when changing from KA to KB valve and existing wiring is not long enough. Consists of a 7 pin plug, a 7 pin socket and a length of cable, fully assembled for ease of use
Extension Cable 944450

Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is therefore recommended that should any mechanical or electronic repair be necessary they should be returned to the nearest Vickers repair center. The products will be refurbished as necessary and retested to specification before return.

Field repair is restricted to the replacement of the seals.

Note: The feedback/solenoid assembly installed in this valve should not be disassembled.



Vickers Systems Division
Aeroquip-Vickers Ltd
P.O. Box 4
New Lane, Havant
Hampshire PO9 2NB
England

Aeroquip-Vickers do Brazil S.A.
CEP 07250-270
Av. Julia Gaioli, 450
Bonsucesso-Guarulhos
Sao Paulo 07
Brazil

Vickers Asia Pacific Ltd
Tennozu Parkside Building
2-5-8 Higashi Shinagawa
Shinagawa-ku
Tokyo 140
Japan

Vickers, Incorporated
5445 Corporate Drive
P.O. Box 302
Troy, Michigan
48007-0302
USA