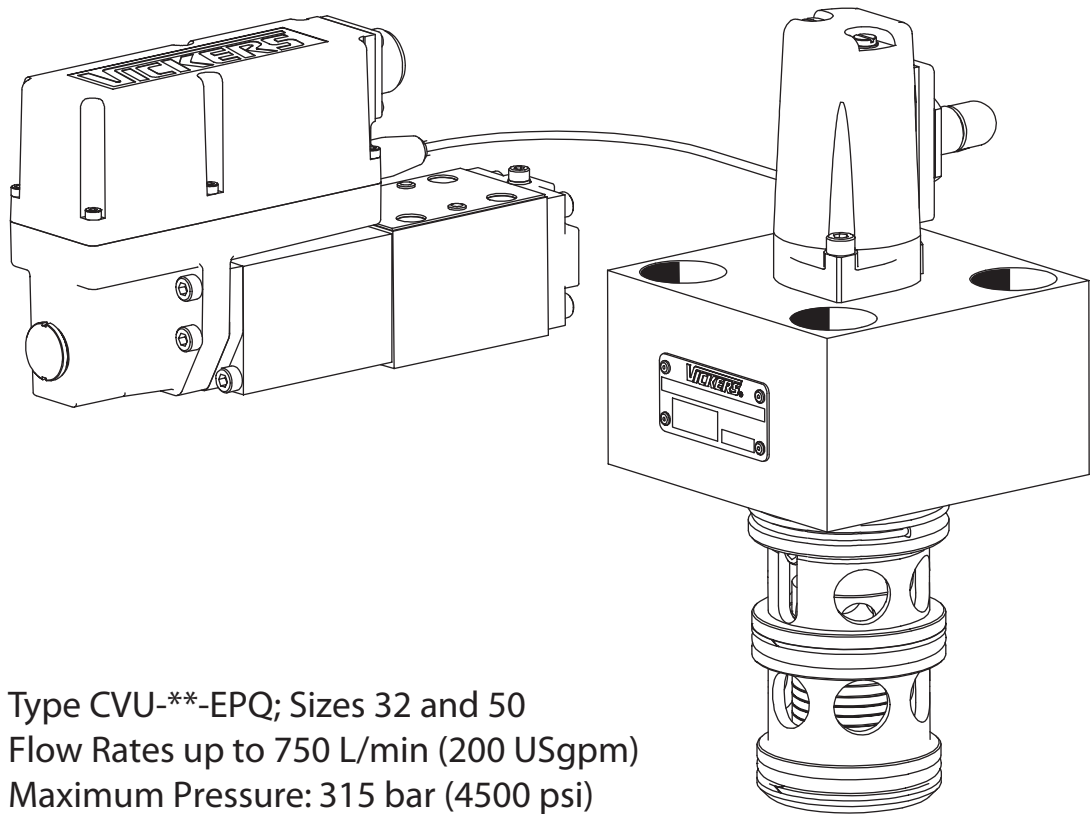



Vickers®

3-Way Cartridge Valves with Spool Position Feedback



Type CVU-**-EPQ; Sizes 32 and 50
Flow Rates up to 750 L/min (200 USgpm)
Maximum Pressure: 315 bar (4500 psi)



This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive, 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to additional devices, 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).



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General Description

CVU-**-EPQ

This catalog presents the 3-port cartridge valve, type CVU-**-EPQ, as the primary functional element in two types of system:

1. Flow control and
2. p/Q, pressure and flow control.

The hydraulically operated CVU-**-EPQ valve must be controlled by a separate proportional-solenoid-operated pilot valve, for which recommendations are included in the catalog. The size 3 pilot valve is available with integral control electronics, valve type KBSDG4V-3, allowing direct connection with the user's control system.

The 3-way function provides fully controllable throttling action between service port "A" and either inlet port "P" or outlet port "T" according to spool position, with a closed transient. In the normal condition (i.e. no hydraulic pilot pressure) the spool is biased by the integral spring to give the flow path "A" to "T": this may be referred to as the "failsafe" condition.

These valves are intended for use in open and closed-loop control systems, and the published performance data herein is applicable only when they are used in such systems with the appropriate Vickers® pilot valve and associated electronics.

Closed-Loop Pressure Control

The zero overlap condition of the main spool enables the EPQ valve to be used in a pressure control mode, with the control loop being closed by a pressure transducer sensing pressure in the outlet port "A".

Single/Double Pilot Control

Model Type EPQ1

The controlling hydraulic pressure from port "A" of the remote pilot valve is connected to the full area at the top of the spool via connection "X" in the mounting interface. Spool position is then determined by the relationship between the input (demand) signal and the LVDT feedback position.

Model Type EPQ2

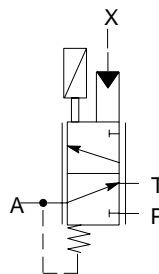
In addition to the pilot connection via port "X", port "B" of the pilot valve is connected to the spool annulus area via a second pilot port, "B", in the 3-way cartridge. Thus the spool is actively controlled in both directions of travel by pilot pressure.

Mounting Face and Pocket Dimensions

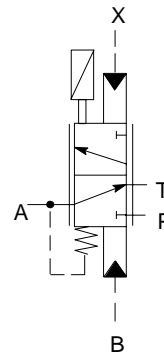
The EPQ series 3-port cartridge valves are based on the general design concepts of 2-port cartridge valves to ISO 7368 (DIN 24342). That is, they have the same manifold surface mounting interface, but differ in having deeper pocket recesses to accommodate the longer, 3-way spool. Furthermore, these pockets vary according to whether the selected model is single or double-pilot operated, see "Single/Double Pilot Control" below. Full details of pocket machining dimensions are given in this catalogue.

Functional Symbols

CVU-**-EPQ1
Single pilot operation



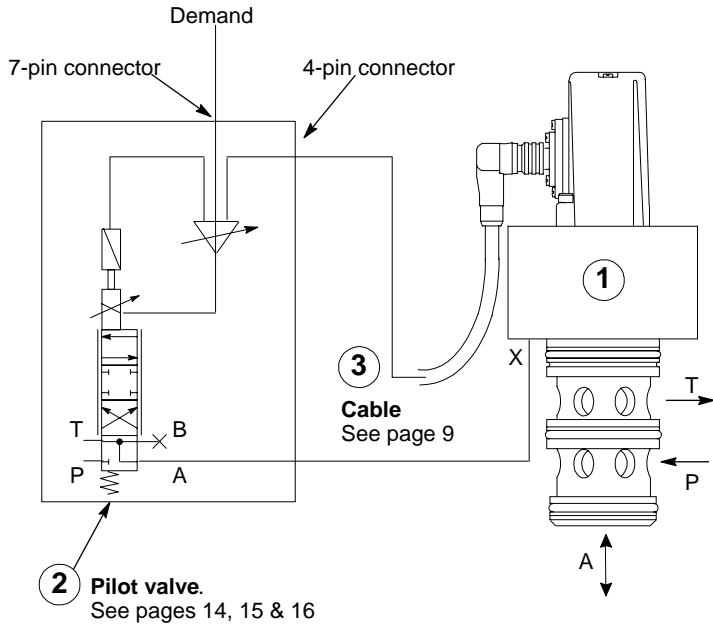
CVU-**-EPQ2
Double pilot operation



System Components

Flow Control Mode

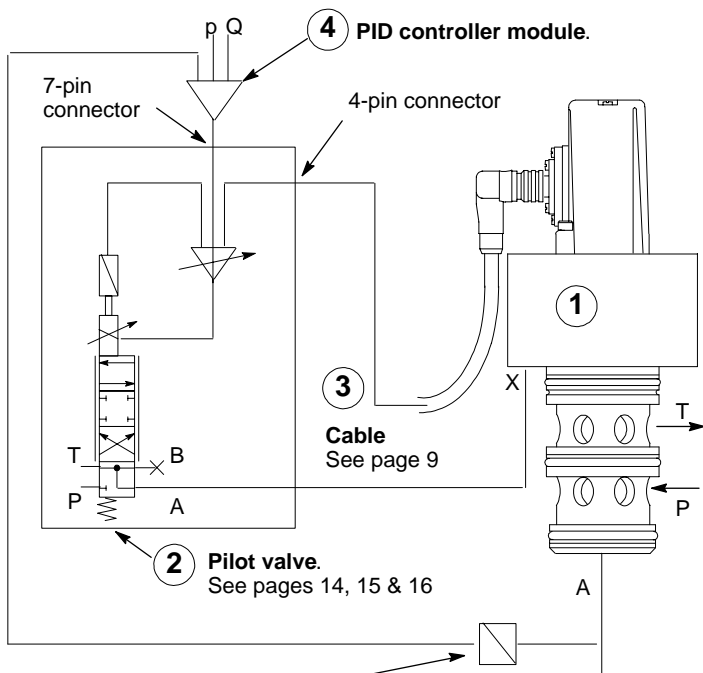
The single pilot version, -EPQ1- is shown. The pilot and control recommendations apply equally to the double piloted version, -EPQ2-.



Vickers® units/components required for this arrangement. Each item should be separately specified when ordering. (The "Quantity required" is for one assembly.)

Item no.	Specification	Qty required per assembly
For size 32		
1	CVU-32-EPQ1-9-38-10	1
2	KBSDG4V-3-96L-24-***-1*-EN83	1
For size 50		
1	CVU-50-EPQ2-9-75-10	1
2	KBSDG4V-3-96L-40-***-1*-EN83	1
For all sizes		
3	02-331572	1

For p/Q Mode



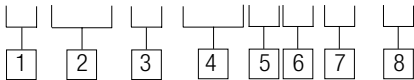
Vickers® units/components required for this arrangement. Each item should be separately specified when ordering. (The "Quantity required" is for one assembly.)

Item no.	Specification	Qty required per assembly
For size 32		
1	CVU-32-EPQ1-9-38-10	1
2	KBSDG4V-3-96L-24-***-1*-EN83	1
For size 50		
1	CVU-50-EPQ2-9-75-10	1
2	KBSDG4V-3-96L-40-***-1*-EN83	1
For all sizes		
3	02-331572	1
4	EHA-PID-201-A-20 ▼	1

▼ See separate catalog no. GB2427A.

Model Codes

(F3-)CVU--EPQ*-9-**-1***



1 Seal Material

F3 - Viton
Omit for Nitrile rubber

2 Cartridge Valve Unit

3 Nominal Size

Mounting face (i.e. not pocket) identified as for 2-port cartridge to ISO 7368 (DIN 24342).

32 - 09 (NG32)
50 - 11 (NG50)

4 Servo Controlled 3-Way Valve

5 Pilot Operation

Applicable to size 32 only:
1 - Single pilot operation
Applicable to size 50 only:
2 - Double pilot operation

6 Mounting Bolts

9 - Metric mounting bolts supplied.

7 Flow Rating

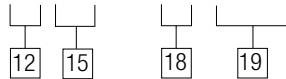
Code EPQ Size	Flow rating:	
	L/min	USgpm
38 - 32	380	100
75 - 50	750	200

8 Design Number

Installation dimensions unchanged for design numbers 10 to 19 inclusive.

Pilot Valve (with Integral Electronics)

KBSDG4V-3-96L--***-H7-1*-EN83**



The specification of these valves is fixed except for the customer's choice of the 7-pin plug connection as set out below. See **15**

A full description of the model code features can be found in catalog 5071.02/EN/0797/A, (positions 15 and 18 conform to this catalog).

12 Rated flow at 70 bar (1000 psi) loop Δp pressure drop (for precise details of ratings refer to catalog 5071.02/EN/0797/A)

24 - Specify for use with CVU-32-EPQ*
40 - Specify for use with CVU-50-EPQ*

15 Electrical connection

PC7 - 7-pin connector without plug
PE7 - 7-pin electrical plug with mating half
PH7 - As PE7 but with pin "C" used for enable signal
PR7 - As PC7 but with pin "C" used for enable signal

18 Design number, 10 series

Installation dimensions unchanged for design numbers 10 to 19 inclusive.

19 Special Features

EN83 - 1. The integral electronics are optimized for use with the -EPQ*- valve, and
2. The addition and location of a 4-pin socket for the primary feedback connection.

Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. To ensure that the EMC rating and IP67 rating are achieved:

1. The Vickers® plug, part no. 934939, must be correctly fitted. The plug retaining nut must be tightened with a torque of 2,0 Nm (1.5 lbf ft) to effect a proper seal.
2. The securing nuts of the co-axial 4-pin connector cable must be correctly fitted and tightened with a torque of 0,5 Nm (0.4 lbf ft).

Operating Data

CVU-**-EPQ*

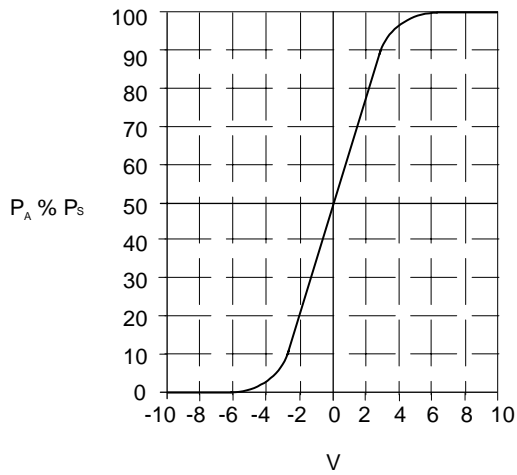
Characteristics		
Maximum pressure, all ports	315 bar (4500 psi)	
Pilot control pressure (applied to port B and/or port X)	Minimum 4 bar (60 psi) above maximum pressure at main port "A"	
Ambient temperature range	-20° to 50°C (-4° to 122°F)	
Hydraulic fluid: With Nitrile rubber seals With Viton seals	Anti-wear hydraulic oil. Non-alkyl-based phosphate ester, or chlorinated hydrocarbon	
Fluid viscosity range	Recommended running range is from 54 to 13 cSt (245 to 70 SUS) Extreme range is from 500 to 13 cSt (2270 to 70 SUS)	
Fluid temperature range	-20° to 70°C (-4° to 158°F)	
Filtration	Up to 70 bar (1000 psi): 18/16/13 Above 70 bar (1000 psi): 17/15/12[(See publication 561 or 9132 "Guide to Systemic Contamination Control" for further information on fluid treatment and conditioning)	
	CVU-32-EPQ1	CVU-50-EPQ2
Nominal flow rating at $\Delta p = 5$ bar (75 psi)	380 L/min (100 USgpm)	750 L/min (200 USgpm)
Maximum flow	1000 L/min (263 USgpm)	2250 L/min (594 USgpm)
Pilot flow rate for maximum dynamic response	16 L/min (4.2 USgpm)	28 L/min (7.4 USgpm)
Response time ■ for: Signal change 0 to 100%: $P_s = 100$ bar (1450 psi) $P_p = 105$ bar (1525 psi)	28 msec	50 msec
Hysteresis ■	<0.2%	
Reversal error ■	<0.1%	
Recommended Vickers® pilot valve and electronics	KBSDG4V-3-96L-**-***-H7-1*-EN83 (with integral amplifier)	

■ These characteristics are valid only when the CVU**-EPQ* unit is controlled by the specified Vickers® pilot valve with integral amplifier.

Performance Data

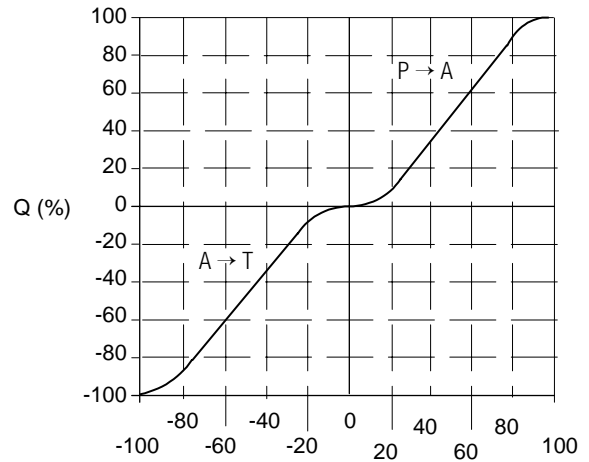
CVU-**-EPQ

Pressure Gain

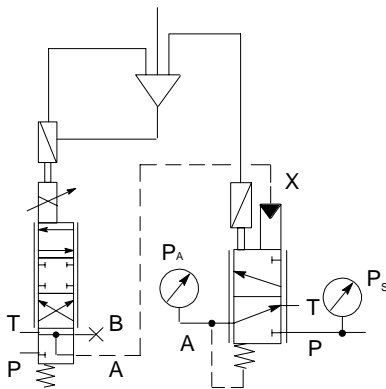


Spool Stroke from Null (% of max.)

Flow Rate/Signal Function



Command Signal (% of max.)



Performance Data, cont'd

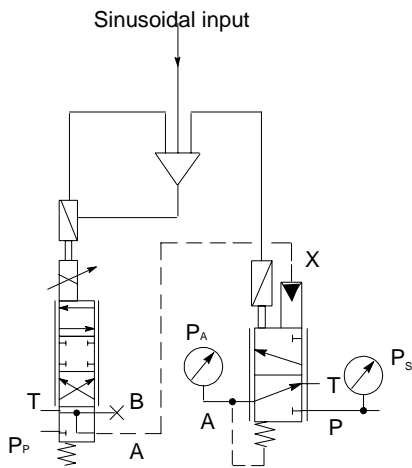
CVU-**-EPQ

Frequency Response

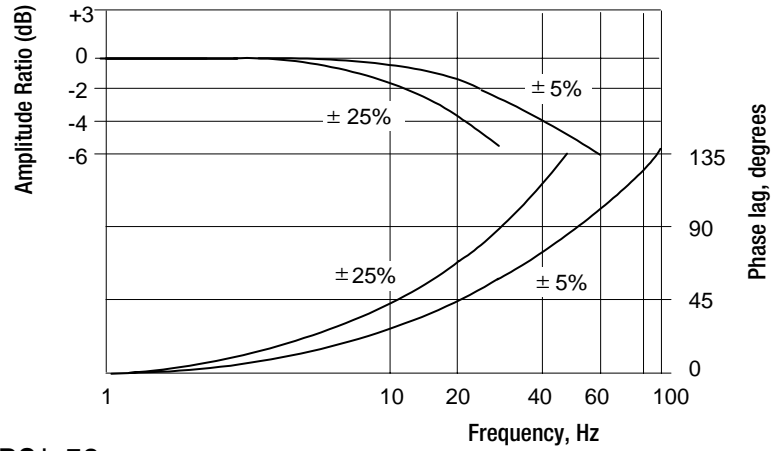
$P_p = 105 \text{ bar (1525 psi)}$

$P_A = 50 \text{ bar (725 psi)}$

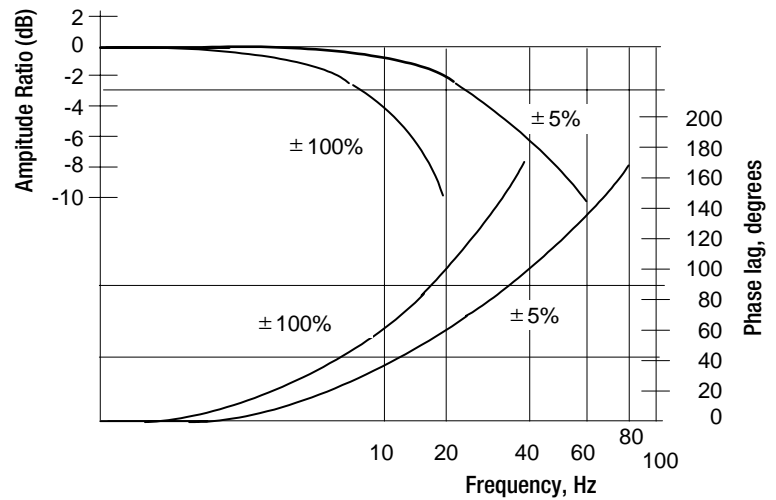
$P_s = 100 \text{ bar (1450 psi)}$



CVU-EPQ*-32



CVU-EPQ*-50



3-Way Cartridge Valves with Spool Position Feedback

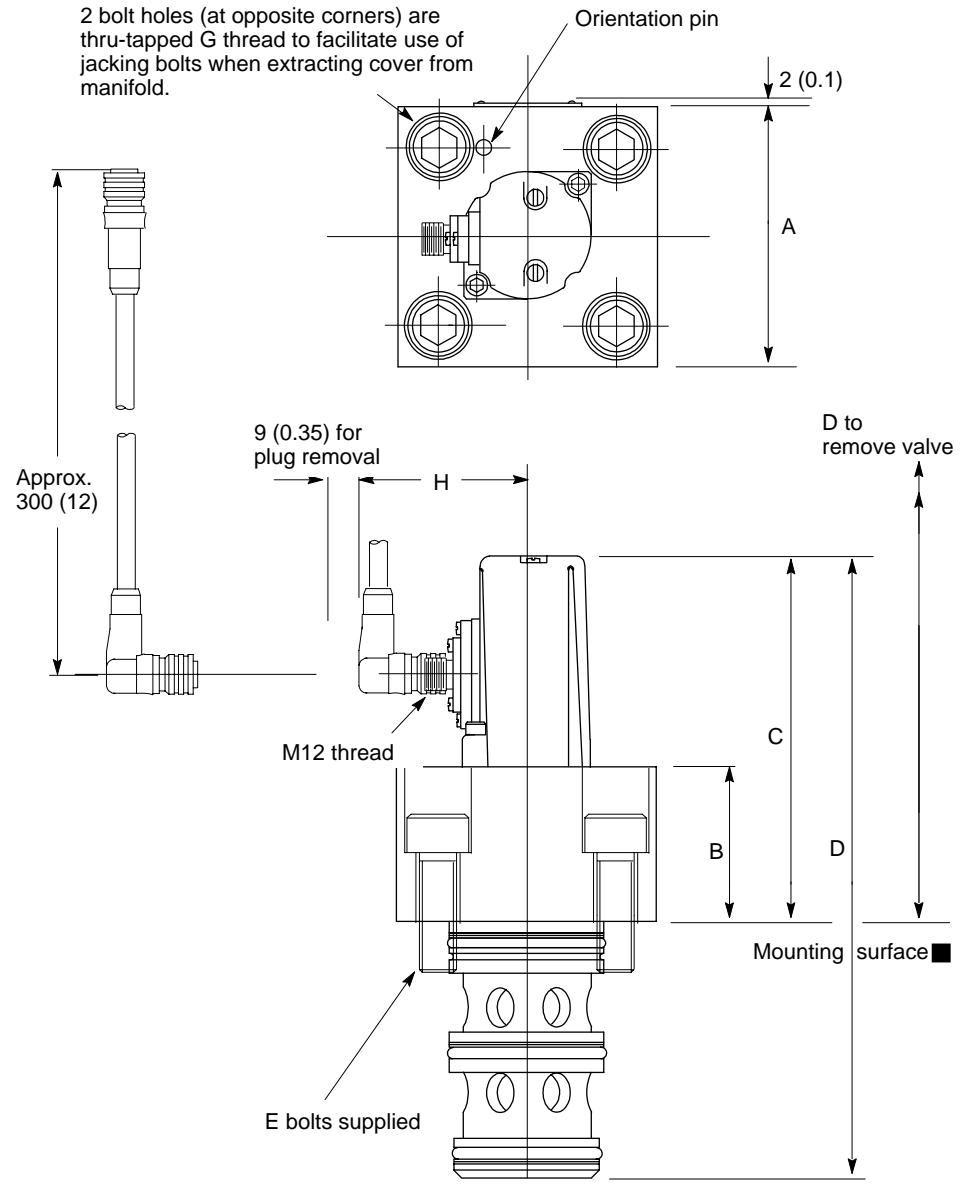


Installation Dimensions in mm (inches)

CVU-32/50-EPQ*

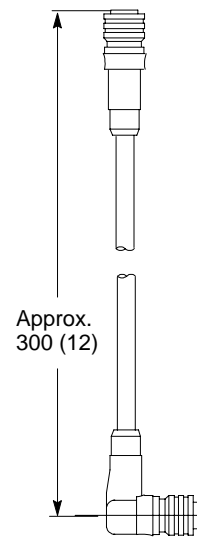


2 bolt holes (at opposite corners) are thru-tapped G thread to facilitate use of jacking bolts when extracting cover from manifold.



Required to connect KBSDG4V-3 pilot valve (with integrated electronics):

Connector Cable, 300mm (12")
 Part no. 02-331572; (plug molded on each end), to be ordered separately.



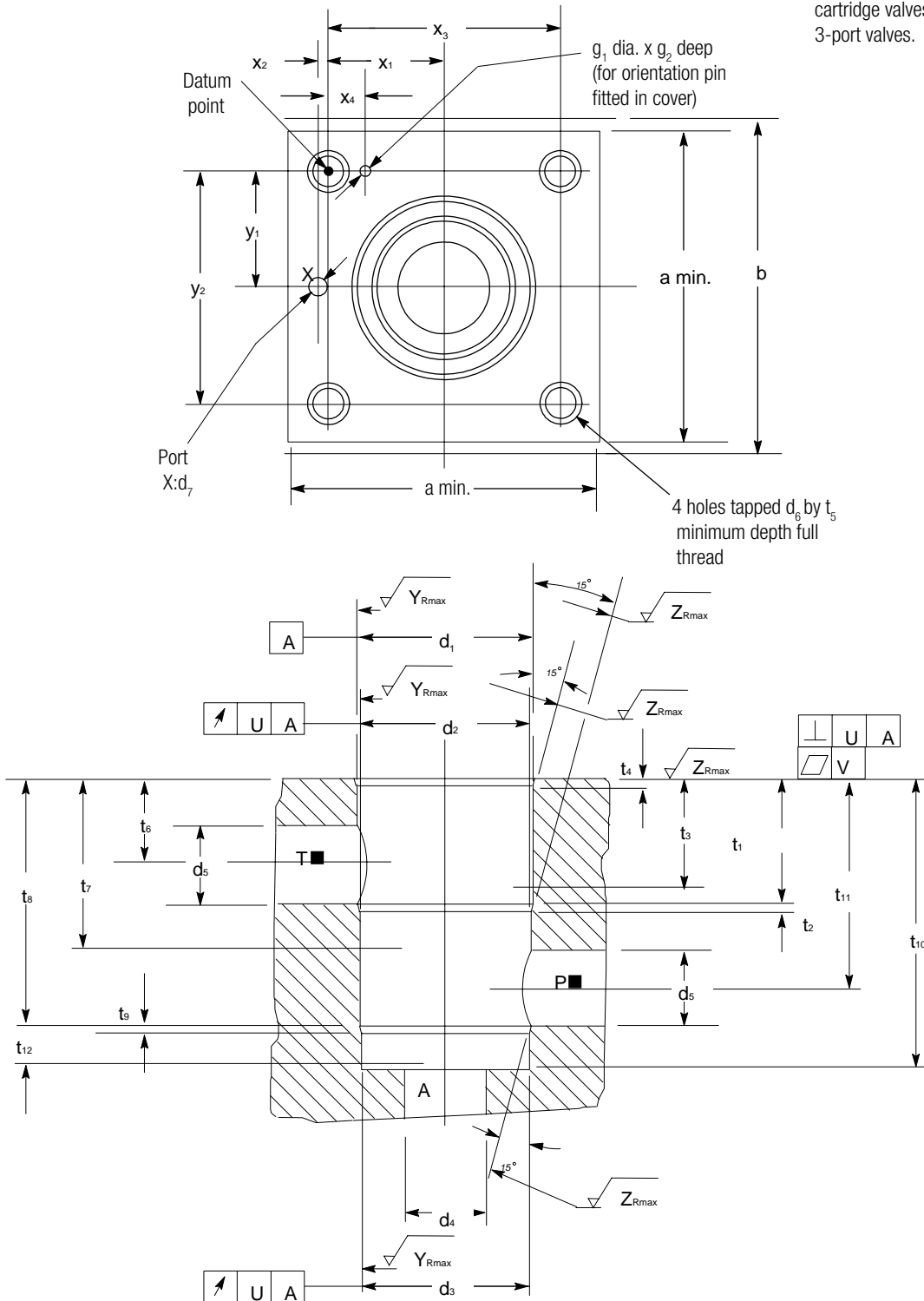
Dimension	Size 32	Size 50
A	102 (4.0)	140 (5.5)
B	60 (2.4)	60 (2.4)
C	139 (5.47)	165,6 (6.52)
D	239 (9.41)	330,5 (13.0)
E bolts ●	4 x M16 x 50	4 x M20 x 70
Bolt torque Nm (lbf ft)	285 (210)	580 (429)
G thread	M20	M24
H	65 (2.6)	66,5 (2.62)

■ Cartridge dimensions below this face conform to dimensional requirements of pockets as shown on pages 10, 11, 12 and 13.

● For details of equivalent inch/UNC bolts see pages 11 and 13.

Insert Cavity Dimensions CVU-32-EPQ1, mm (inches)

Note that top mounting face, including location and sizing of mounting bolts and port X, conforms to ISO 7368 and DIN 24342 (standards for 2-port cartridge valves). The pocket geometry is unique to 3-port valves.



■ The radial orientation of ports "P" and "T" about the center line of the pocket is not critical to the performance of CVU-**-EPQ* valves.

Dimension	CVU-32-EPQ*
a	102 (4.02)
b ▲	112 (4.41)
d ₁ dia.	60,030/60,000 (2.3640/2.3622)
d ₂ dia.	58,030/58,000 (2.285/2.283)
d ₃ dia.	58,030/55,000 (2.166/2.165)
d ₄ dia. max.	28 (1.10)
d ₅ dia. max.	26 (1.02)
d ₆ thread ▼	M16
d ₇ dia. max.	8 (0.315)
g ₁ dia. nominal	6 (0.236)
g ₂ min.	8 (0.315)
t ₁	43,8/43,2 (1.724/1.700)
t ₂	3 (0.118)
t ₃ min. (Y _{Rmax})	33 (1.3)
t ₄	2,5 (0.098)
t ₅ min. depth ▼	24 (0.94)
t ₆	30 (1.18)
t ₇ min. (Y _{Rmax})	58,5 (2.3)
t ₈	85,3/84,7 (3.358/3.335)
t ₉	2,5 (0.1)
t ₁₀	100,1/99,9 (3.941/3.933)
t ₁₁	71,5 (2.81)
t ₁₂	13 (0.51)
U	0,05 (0.0012)
V	0,01 (0.004)
x ₁ ◆	35 (1.378)
x ₂ ◆	6 (0.236)
x ₃ ◆	70 (2.756)
x ₄ ◆	18 (0.709)
y ₁ ◆	35 (1.38)
y ₂ ◆	70 (2.756)
Y _{Rmax}	8 micron (320 microinches)
Z _{Rmax}	12,5 micron (500 microinches)

▲ Minimum space required for slip-in valve (insert) & cover. Also minimum centerline to centerline distance for two identical cavities in a manifold block.

▼ For customers wishing to use UNC mounting bolts, recommendations for thread size and tapping depths are given in the following table.

◆ Dimensional tolerance is $\pm 0,2$ (0.008).

Recommendations for Alternative Tappings for UNC Mounting Bolts

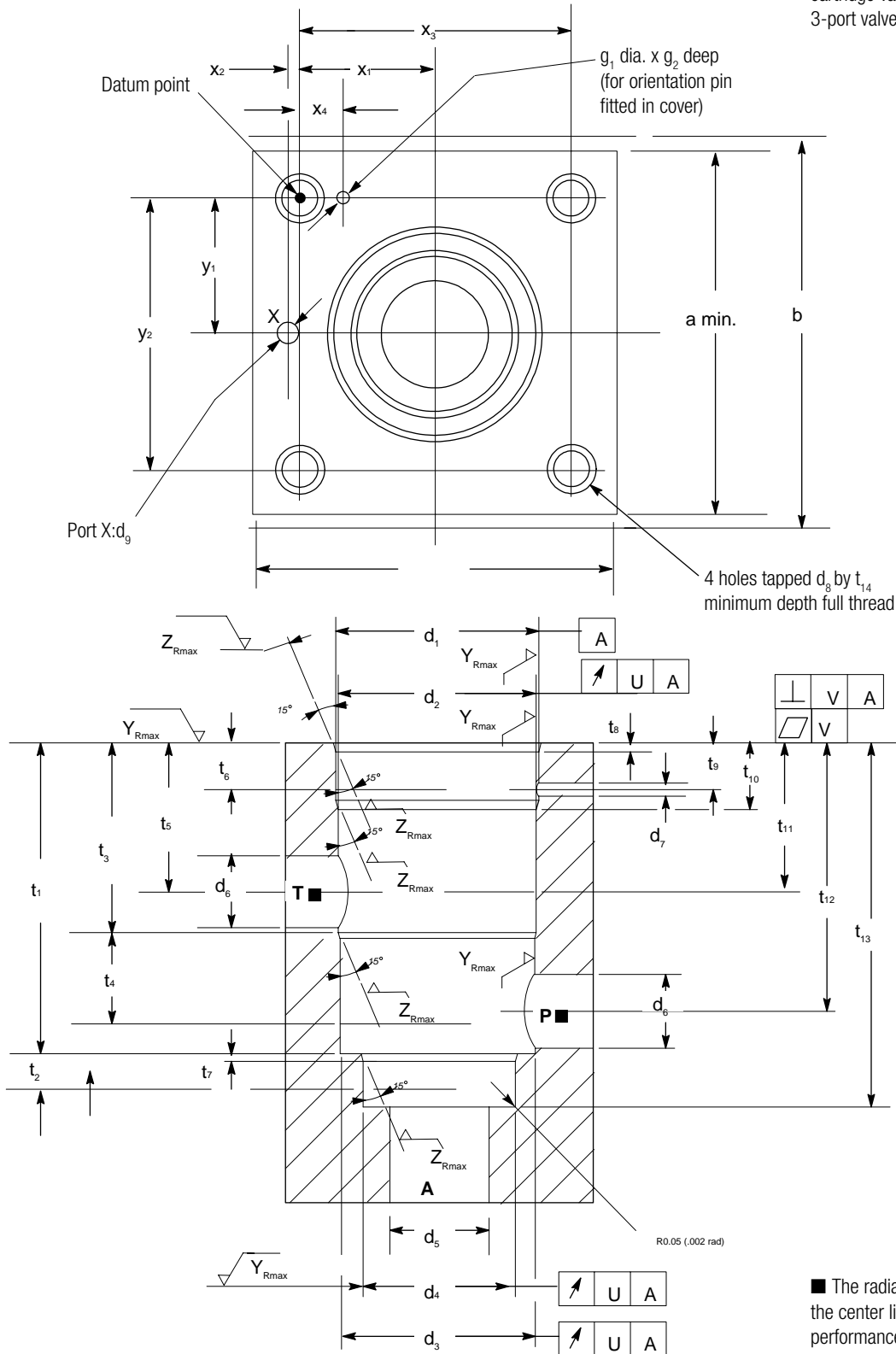
Dimension	Model
d ₆ thread	5/8"-11
t ₅ min. depth	35 (1.38)

3-Way Cartridge Valves with Spool Position Feedback



Insert Cavity Dimensions; CVU-50-EPQ2, mm (inches)

Note that top mounting face, including location and sizing of mounting bolts and port X, conforms to ISO 7368 and DIN 24342 (standards for 2-port cartridge valves). The pocket geometry is unique to 3-port valves.



Dimension	CVU-50-EPQ*
a	140 (5.51)
b ▲	150 (5.91)
d ₁ dia.	90,035/90,000 (3.545/3.5433)
d ₂	88,535/88,500 (3.486/3.484)
d ₃ dia.	87,035/87,000 (3.427/3.425)
d ₄ dia.	68,030/68,000 (2.678/2.677)
d ₅ dia. max	44 (1.73)
d ₆ dia. max.	39 (1.53)
d ₇ dia. max.	6,10 (0.240)
d ₈ thread ▼	M20
d ₉ dia. max.	10 (0.394)
g ₁ dia. nominal	8 (0.315)
g ₂ min.	8 (0.315)
t ₁	143,3/142,7 (5.641/5.618)
t ₂ min. (Y _{Rmax} :d ₄)	18 (0.71)
t ₃	87,3/86,7 (3.473/3.413)
t ₄ min. (Y _{Rmax} :d ₃)	40 (1.157)
t ₅	66 (2.6)
t ₆ min. (Y _{Rmax} :d ₁)	21 (0.83)
t ₇	2,5 (0.098)
t ₈	4 (0.157)
t ₉	21 (0.83)
t ₁₀	29 (1.142)
t ₁₁ min. (Y _{Rmax} :d ₂)	66 (2.6)
t ₁₂	122 (4.8)
t ₁₃	165,0/164,9 (6.500/6.492)
t ₁₄	30 (1.18)
U	0,05 (0.002)
V	0,01 (0.0004)
x ₁ ◆	50 (1.969)
x ₂ ◆	8 (0.315)
x ₃ ◆	100 (3.937)
x ₄ ◆	20 (0.787)
y ₁ ◆	50 (1.969)
y ₂ ◆	100 (3.937)
Y _{Rmax}	8 micron (320 microinches)
Z _{Rmax}	12,5 micron (500 microinches)

▲ Minimum space required for slip-in valve (insert) & cover. Also minimum centerline to centerline distance for two identical cavities in a manifold block.

▼ For customers wishing to use UNC mounting bolts, recommendations for thread size and tapping depths are given in the following table.

◆ Dimensional tolerance is ± 0,2 (.008).

Recommendations for Alternative Tappings for UNC Mounting Bolts

Dimension	Model
d ₆ thread	3/4"-10
t ₅ min. depth	40 (1.57)

3-Way Cartridge Valves with Spool Position Feedback

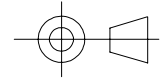


Installation Dimensions in mm (inches)

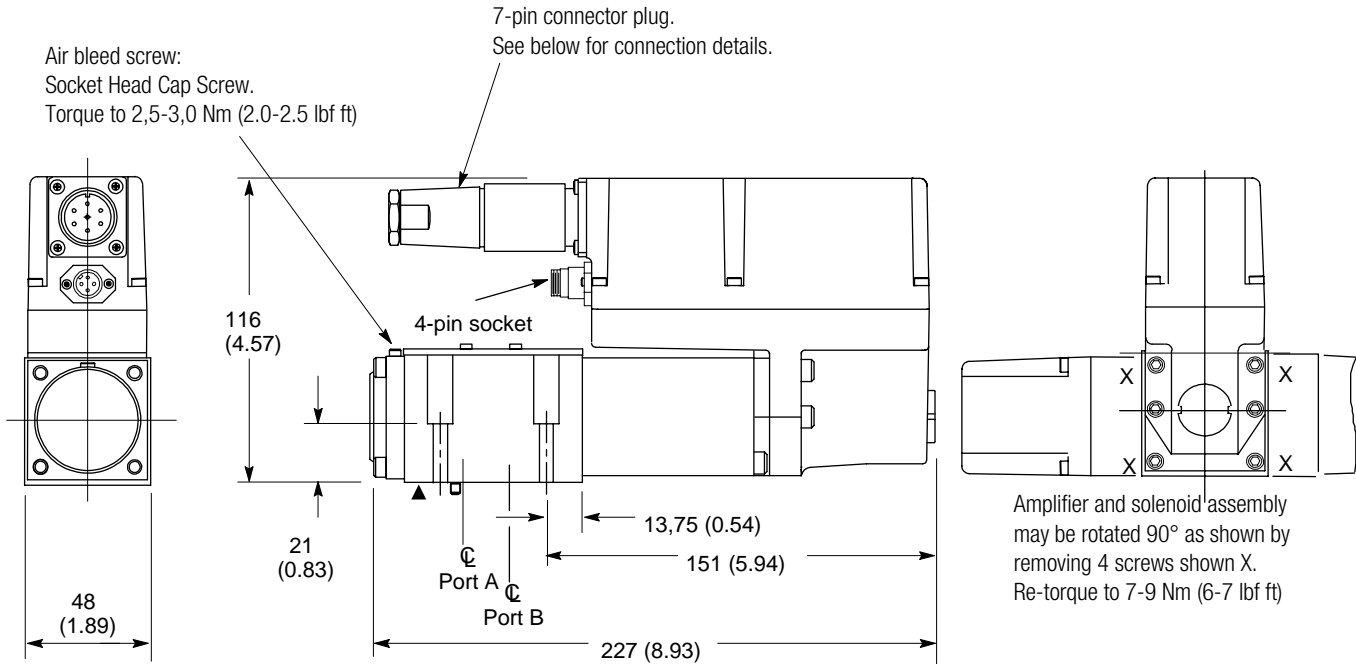
Pilot Valve with Integral Electronics

KBSDG4V-3...EN83

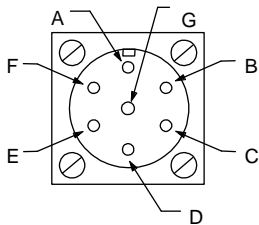
3rd angle projection



This drawing provides dimensions and information necessary to install this valve.
For full comprehensive data on the valve refer to catalog 5071.02/EN/1197/A.



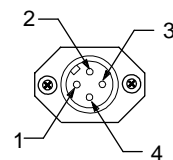
7-pin plug connections



View of pins of fixed half.

Pin	Description
A	Power supply positive (+)
B	Power 0V
C	Command/Monitor 0V (PC7 & PE7)
C	Valve enable (PH7 & PR7)
D	Command signal (+) - non-inverting input
E	Command signal (-) - inverting input
F	Monitor output
G	Protective ground

4-pin plug connections



View on LVDT

Pin 1	Signal
Pin 2	+15 V
Pin 3	0 V
Pin 4	Not used



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).

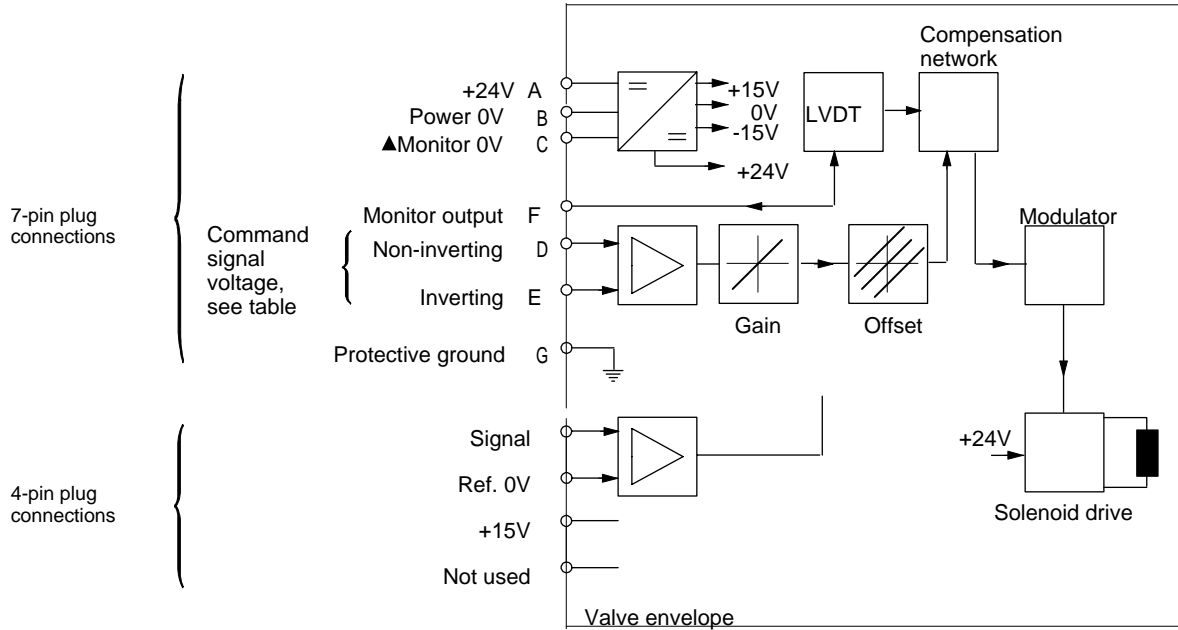
Electrical Data Pilot Valve with Integral Electronics KBSDG4V-3...EN83



Warning

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

Electrical Block Diagram



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

Command Signals and Outputs		
7-pin plug		Flow direction: CVU-**-EPQ
Pin D	Pin E	
Positive	0V	P to A
0V	Negative	
$U_D - U_E = \text{Positive}$		A to T
Negative	0V	
0V	Positive	
$U_D - U_E = \text{Negative}$		

KBSDG4V-3...EN83 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See next page and Installation Wiring Practices for Vickers® Electronic Products, leaflet 2468.

Recommended cable sizes

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)

Signal cables:

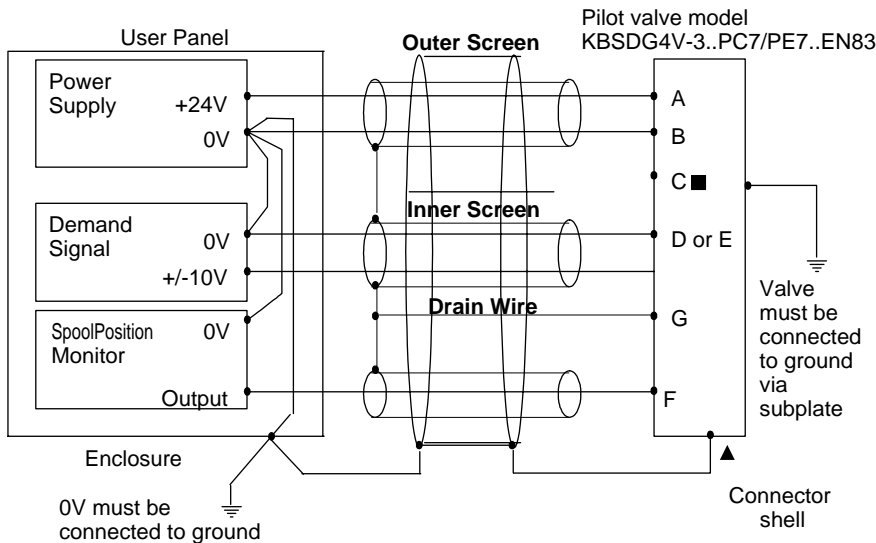
0,50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 6 cores and an overall screen.
Cable outside diameter 8,0-10,5 mm
(0.31-0.41 inches)

Electrical Data Pilot Valve with Integral Electronics KBSDG4V-3...EN83

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.

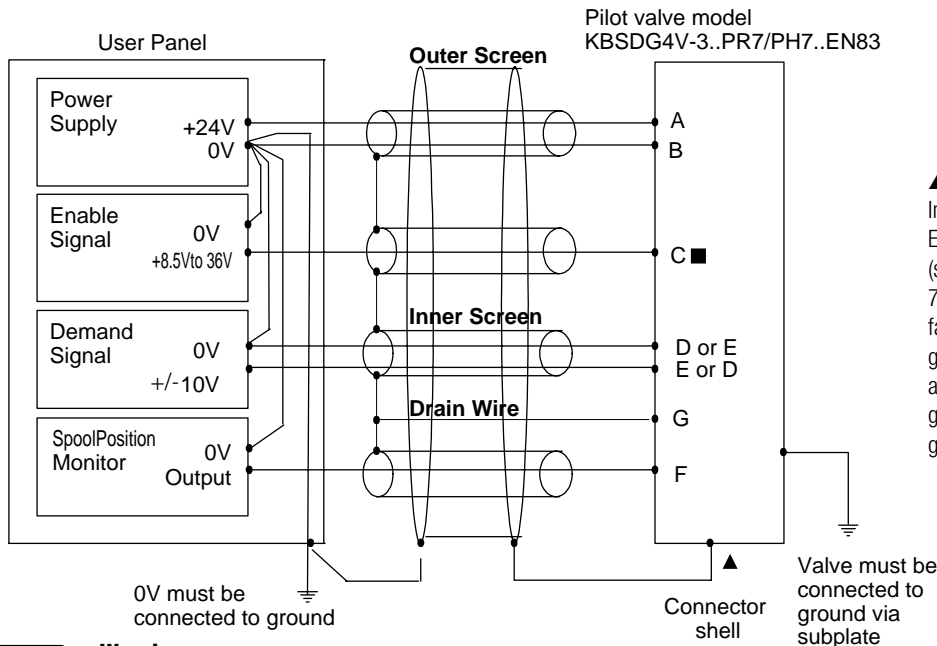


Warning

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 publication 9132 or 561, "Guide to Systemic Contamination Control". The book also includes information on the concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

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 the K(B)SDG4V-3 valves are compatible with antiwear hydraulic oils, and with non-alkyl-based phosphate esters.

Standard (nitrile rubber) seals in the CVU-**-EPQ cartridge valves are suitable for use only with antiwear hydraulic oils. When fitted with Viton seals (specify "F3-" in Model Code 1), these valves are suitable for use with non-alkyl-based phosphate esters.

The fluid 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). For further technical information about fluids see "Technical Information" leaflet B-920 or I-286S.

Installation

The proportional valves in this catalog can be mounted in any attitude.

For the K(B)SDG4V-3 pilot valve it may be necessary in certain demanding applications, to ensure that the solenoid is 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 CVU-**-EPQ

Metric bolts are supplied with all models.

For K(B)SDG4V-3

BK02-156493M (metric)
BK590716 (inch)

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

Seal Kits

For CVU-**-EPQ:

Standard nitrile rubber seals:
CVU-32-EPQ1 02-350905
CVU-50-EPQ2 02-358138
Viton seals:
F3-CVU-32-EPQ1 02-350906
F3-CVU-50-EPQ2 02-358139

For pilot valve:

K(B)SDG4V-3-1* 02-332693

Plugs

7-pin plug:K(B)SDG4V-3....EN83;

7-pin plug (metal) 934939*
(Recommended plug for EMC and IP67 protection)
7-pin plug (plastic) 694534
(For use only where EMC and IP67 protection is not required)

Note: An alternative metal connector which gives EMC protection rating is available from ITT-Cannon, part number CA02-COM-E-14S-A7-S. For IP rating consult the manufacturer.

* Plug 934939 is fitted to the pilot valve when "PE7" or "PR7" is specified at Model Code position 15.

4-pin plug, K(B)SDG4V-3...EN83 and CVU-**-EPQ:

The molded-on plug(s) of the connecting cable correctly fitted and tightened gives EMC and IP67 protection.

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: Customers are strongly advised not to attempt to disassemble any of the electronics, feedback devices or solenoid assemblies installed in these valves.

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